Volkswagen Jetta, Golf, GTI

1999, 2000, 2001, 2002, 2003, 2004, 2005

Service Manual

1.8L turbo, 1.9L TDI and PD diesel, 2.0L gasoline, 2.8L VR6

A4 Platform

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`http://www.BentleyPublishers.com/errata/`

WARNING—Important Safety Notice

Do not use this manual unless you are familiar with basic automotive repair procedures and safe workshop practices. This manual illustrates the workshop procedures required for most service work; it is not a substitute for full and up-to-date information from the vehicle manufacturer or for proper training as an automotive technician. Note that it is not possible for us to anticipate all of the ways or conditions under which vehicles may be serviced or to provide cautions as to all of the possible hazards that may result.

The vehicle manufacturer will continue to issue service information updates and parts retrofits after the editorial closing of this manual. Some of these updates and retrofits will apply to procedures and specifications in this manual. We regret that we cannot supply updates to purchasers of this manual.

We have endeavored to ensure the accuracy of the information in this manual. Please note, however, that considering the vast quantity and the complexity of the service information involved, we cannot warrant the accuracy or completeness of the information contained in this manual.

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Your common sense and good judgment are crucial to safe and successful service work. Read procedures through before starting them. Think about whether the condition of your car, your level of mechanical skill, or your level of reading comprehension might result in or contribute in some way to an occurrence which might cause you injury, damage your car, or result in an unsafe repair. If you have doubts for these or other reasons about your ability to perform safe repair work on your car, have the work done at an authorized Volkswagen dealer or other qualified shop.

Part numbers listed in this manual are for identification purposes only, not for ordering. Always check with your authorized Volkswagen dealer to verify part numbers and availability before beginning service work that may require new parts.

Before attempting any work on your Volkswagen, read the **WARNINGS** and **CAUTIONS** on page vii, and any **WARNING** or **CAUTION** that accompanies a procedure in the service manual. Review the **WARNINGS** and **CAUTIONS** on page vii each time you prepare to work on your Volkswagen.

Special tools required to perform certain service operations are identified in the manual and are recommended for use. Use of tools other than those recommended in this service manual may be detrimental to the car's safe operation as well as the safety of the person servicing the car.

Copies of this manual may be purchased from authorized Volkswagen dealers, from selected booksellers and automotive accessories and parts dealers, or directly from the publisher by mail.

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Foreword and Disclaimer

Service to Volkswagen owners is a top priority of the Volkswagen organization and has always included the continuing development and introduction of new and expanded services. In line with this purpose, Robert Bentley, Inc., in cooperation with Volkswagen of America, Inc., has introduced this Volkswagen Jetta, Golf, GTI Service Manual.

This manual covers Volkswagen Jettas, Golfs, and GTIs for the model years 1999 through mid-2005 based on Volkswagen's A4 platform. Please see the Vehicle Identification & VIN decoder remarks on the following page for more information. This manual was created specifically to cover only those models built for sale in the United States and Canada.

For the Volkswagen owner with basic mechanical skills and for independent auto service professionals, this manual includes the specifications and procedures that were available in an authorized Volkswagen dealer service department as this manual went to press. The Volkswagen owner with no intention of working on his or her car will find that owning and referring to this manual will make it possible to be better informed and to more knowledgeably discuss repairs with a professional automotive technician.

The Volkswagen owner intending to do maintenance and repair should have screwdrivers, a set of metric wrenches and sockets, and metric hex wrenches, since these basic hand tools are needed for most of the work described in this manual. Most procedures will also require a torque wrench to ensure that fasteners are tightened properly and in accordance with specifications. In some cases, the text refers to special tools that are recommended or required to accomplish adjustments or repairs. These tools are usually identified by their Volkswagen special tool number and illustrated.

Disclaimer

We have endeavored to insure the accuracy of the information in this manual. When the vast array of data presented in the manual is taken into account, however, no claim to infallibility can be made. We therefore cannot be responsible for the result of any errors that may have crept into the text. Please also read the **Important Safety Notice** on the copyright page at the beginning of this book.

A thorough pre-reading of each procedure, and the **WARNINGS** and **CAUTIONS** at the front of the book and those that accompany the procedure is essential. Reading a procedure before beginning work will help you determine in advance the need for specific skills, identify hazards, prepare for appropriate capture and handling of hazardous materials, and the need for particular tools and replacement parts such as gaskets.

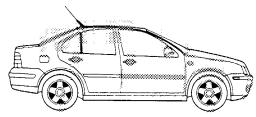
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`http://www.BentleyPublishers.com/errata/`

Volkswagen offers extensive warranties, especially on components of the fuel delivery and emission control systems. Therefore, before deciding to repair a Volkswagen that may be covered wholly or in part by any warranties issued by Volkswagen of America, Inc., consult your authorized Volkswagen dealer. You may find that the dealer can make the repair either free or at minimum cost. Regardless of its age, or whether it is under warranty, your Volkswagen is both an easy car to service and an easy car to get serviced. So if at any time a repair is needed that you feel is too difficult to do yourself, a trained Volkswagen technician is ready to do the job for you.

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Vehicle Identification & VIN Decoder



Some of the information in this manual applies only to cars of a particular model year or range of years. For example, "1999 m.y." refers to the 1999 model year. The model year does not necessarily match the calendar year in which the car was manufactured or sold. To be sure of the model year of a particular car, check the vehicle identification number (VIN) on the car. Technical changes made in production within a model year are identified in this manual by listing the VIN for the first car produced with this change.

The VIN is a unique sequence of 17 characters assigned by Volkswagen to identify each individual car. WVWDE21JXYW671801 is an example. Each of the 17 letters and numbers indicates certain facts about the car and its manufacture. VINs used to distinguish information in this manual may refer only to the last eleven digits—the characters 1JXYW671801 in the example above.

Your Volkswagen's VIN can be found on a plate mounted on the top of the instrument panel, on the driver's side where the number can be seen through the windshield. The 10th character is the model year code. The letters "I", "O", "Q" and "U" are not used for model year designation, for example, "X" for 1999 m.y., "Y" for 2000 m.y., "1" for 2001, "2" for 2002 m.y., etc. This manual covers Volkswagen Jettas, Golfs, and GTIs for the model years 1999 through mid-2005. The table below explains some of the various codes in the VIN numbers of models covered by this manual.

position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Jetta:							9	M				0	0	0	0	0	1	to							9	M				9	9	9	9	9	9
Golf:							1	J				0	0	0	0	0	1	to							1	J				9	9	9	9	9	9

Position	Description	Decoding Information
1	Country of origin	3 Mexico W Germany 9 Brazil
2	Manufacturer	V Volkswagen
3	Vehicle Type	W Passenger Car
4	Series	Varies with model year See BentleyPublishers.com for more information
5	Engine	
6	Restraint system	
7	Model	9M Jetta sedan 1J Golf, GTI, Jetta Wagon, R32
8		
9	Check Digit	0-9 or X, calculated by NHTSA
10	Model Year	X 1999 Y 2000 1 2001 2 2002 3 2003 4 2004 5 2005
11	Assembly Plant	4 Curitiba, Brazil H Hannover, Germany 8 Dresden, Germany M Puebla, Mexico D Bratislava, Slovakia P Mosel, Germany E Emden, Germany W Wolfsburg, Germany
12-17	Serial Number	Sequential production number of the specific vehicle

Please read these WARNINGS and CAUTIONS before proceeding with maintenance and repair work.

WARNING—

● Read the **Important Safety Notice** on the copyright page at the beginning of the book.

● Some repairs may be beyond your capability. If you lack the skills, tools and equipment, or a suitable workplace for any procedure described in this manual, we suggest you leave such repairs to an authorized Volkswagen dealer service department, or other qualified shop.

● A thorough pre-reading of each procedure, and the **WARNINGS** and **CAUTIONS** that accompany the procedure is essential. Posted corrections (errata) should also be reviewed before beginning work. Please see **www.BentleyPublishers.com/errata/**.

● Volkswagen is constantly improving its cars. Sometimes these changes, both in parts and specifications, are made applicable to earlier models. Therefore, before starting any major jobs or repairs to components on which passenger safety may depend, consult your authorized Volkswagen dealer about Technical Bulletins that may have been issued.

● Do not re-use any fasteners that are worn or deformed in normal use. Many fasteners are designed to be used only once and become unreliable and may fail when used a second time. This includes, but is not limited to, nuts, bolts, washers, self-locking nuts or bolts, circlips and cotter pins. Always replace these fasteners with new parts.

● Never work under a lifted car unless it is solidly supported on stands designed for the purpose. Do not support a car on cinder blocks, hollow tiles or other props that may crumble under continuous load. Never work under a car that is supported solely by a jack. Never work under the car while the engine is running.

● If you are going to work under a car on the ground, make sure that the ground is level. Block the wheels to keep the car from rolling. Disconnect the battery negative (–) terminal (Ground strap) to prevent others from starting the car while you are under it.

● Never run the engine unless the work area is well ventilated. Carbon monoxide kills.

● Finger rings, bracelets and other jewelry should be removed so that they cannot cause electrical shorts, get caught in running machinery, or be crushed by heavy parts.

● Tie long hair behind your head. Do not wear a necktie, a scarf, loose clothing, or a necklace when you work near machine tools or running engines. If your hair, clothing, or jewelry were to get caught in the machinery, severe injury could result.

● Do not attempt to work on your car if you do not feel well. You increase the danger of injury to yourself and others if you are tired, upset or have taken medication or any other substance that may keep you from being fully alert.

● Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the car. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

● Catch draining fuel, oil, or brake fluid in suitable containers. Do not use food or beverage containers that might mislead someone into drinking from them. Store flammable fluids away from fire hazards. Wipe up spills at once, but do not store the oily rags, which can ignite and burn spontaneously.

● Always observe good workshop practices. Wear goggles when you operate machine tools or work with battery acid. Gloves or other protective clothing should be worn whenever the job requires working with harmful substances.

● Friction materials such as brake or clutch discs may contain asbestos fibers. Do not create dust by grinding, sanding, or by cleaning with compressed air. Avoid breathing asbestos fibers and asbestos dust. Breathing asbestos can cause serious diseases such as asbestosis or cancer, and may result in death.

● Disconnect the battery negative (–) terminal (ground strap) whenever you work on the fuel system or the electrical system. Do not smoke or work near heaters or other fire hazards. Keep an approved fire extinguisher handy.

● Batteries give off explosive hydrogen gas during charging. Keep sparks, lighted matches and open flame away from the top of the battery. If hydrogen gas escaping from the cap vents is ignited, it will ignite gas trapped in the cells and cause the battery to explode.

● Connect and disconnect battery cables, jumper cables or a battery charger only with the ignition switched off, to prevent sparks. Do not disconnect the battery while the engine is running.

● Do not quick-charge the battery (for boost starting) for longer than one minute. Wait at least one minute before boosting the battery a second time.

● Do not allow battery charging voltage to exceed 16.5 volts. If the battery begins producing gas or boiling violently, reduce the charging rate. Boosting a sulfated battery at a high charging rate can cause an explosion.

● The air-conditioning system is filled with chemical refrigerant, which is hazardous. The A/C system should be serviced only by trained technicians using approved refrigerant recovery/recycling equipment, trained in related safety precautions, and familiar with regulations governing the discharging and disposal of automotive chemical refrigerants.

● Do not expose any part of the A/C system to high temperatures such as open flame. Excessive heat will increase system pressure and may cause the system to burst.

● Some aerosol tire inflators are highly flammable. Be extremely cautious when repairing a tire that may have been inflated using an aerosol tire inflator. Keep sparks, open flame or other sources of ignition away from the tire repair area. Inflate and deflate the tire at least four times before breaking the bead from the rim. Completely remove the tire from the rim before attempting any repair.

● Most cars covered by this manual are equipped with a supplemental restraint system (SRS), that automatically deploys an airbag in the event of a frontal impact. The airbag is inflated by an explosive device. Handled improperly or without adequate safeguards, it can be accidently activated and cause serious injury.

● To prevent personal injury or airbag system failure, **only factory trained Volkswagen service technicians** should test, disassemble or service the airbag system.

continued on next page

Please read these WARNINGS and CAUTIONS before proceeding with maintenance and repair work.

WARNING (continued) —

● Disconnect the power supply before working on the airbag system, or when doing repairs that require removing airbag system components. Disconnect the battery negative (–) terminal and cover the battery.

● On airbag-equipped cars, never apply stickers or any other type of covering on the steering wheel. Do not let chemical cleaners, oil or grease come into contact with vinyl covering of the airbag unit.

● Never open or otherwise attempt to repair airbag system parts. Always use new parts. Never leave airbag parts or the partially disassembled airbag system unattended.

● Never use a test light to conduct electrical tests on the airbag system. The system must only be tested by trained Volkswagen Service technicians using the Volkswagen VAG 1551/1552 Scan Tool (ST) or an approved equivalent. The airbag unit must never be electrically tested while it is not installed in the car.

● Do not expose the airbag unit to temperatures above 194°F (90°C), even for brief periods. Keep clear of heat sources such as hot plates, soldering irons, heat lamps and welding equipment.

● When driving or riding in an airbag-equipped vehicle, never hold test equipment in your hands or lap while the vehicle is in motion. Objects between you and the airbag can increase the risk of injury in an accident.

● Greases, lubricants and other automotive chemicals contain toxic substances, many of which are absorbed directly through the skin. Read manufacturer's instructions and warnings carefully. Use hand and eye protection. Avoid direct skin contact.

CAUTION—

● If you lack the skills, tools and equipment, or a suitable workshop for any procedure described in this manual, we suggest you leave such repairs to an authorized Volkswagen dealer or other qualified shop. We especially urge you to consult an authorized Volkswagen dealer before beginning repairs on any car that may still be covered wholly or in part by any of the extensive warranties issued by Volkswagen of America.

● Volkswagen offers extensive warranties, especially on components of fuel delivery and emission control systems. Therefore, before deciding to repair a Volkswagen that may still be covered wholly or in part by any warranties issued by Volkswagen United States, Inc., consult your authorized Volkswagen dealer. You may find that he can make the repair for free, or at minimal cost.

● Volkswagen part numbers listed in this manual are for identification purposes only, not for ordering. Always check with your authorized Volkswagen dealer to verify part numbers and availability before beginning service work that may require new parts.

● Before starting a job, make certain that you have all the necessary tools and parts on hand. Read all the instructions thoroughly, do not attempt shortcuts. Use tools appropriate to the work and use only replacement parts meeting Volkswagen specifications. Makeshift tools, parts and procedures will not make good repairs.

● Use pneumatic and electric tools only to loosen threaded parts and fasteners. Never use these tools to tighten fasteners, especially on light alloy parts. Always use a torque wrench to tighten fasteners to the tightening torque specification listed.

● Be mindful of the environment and ecology. Before you drain the crankcase, find out the proper way to dispose of the oil. Do not pour oil onto the ground, down a drain, or into a stream, pond or lake. Consult local ordinances that govern the disposal of wastes.

● On cars equipped with anti-theft radios, make sure you know the correct radio activation code before disconnecting the battery or removing the radio. If the wrong code is entered into the radio when power is restored, that radio may lock up and be rendered inoperable, even if the correct code is then entered.

● Connect and disconnect a battery charger only with the battery charger switched off.

● Do not quick-charge the battery (for boost starting) for longer than one minute. Wait at least one minute before boosting the battery a second time.

● Sealed or "maintenance free" batteries should be slow-charged only, at an amperage rate that is approximately 10% of the battery's ampere-hour (Ah) rating.

● Do not allow battery charging voltage to exceed 16.5 volts. If the battery begins producing gas or boiling violently, reduce the charging rate. Boosting a sulfated battery at a high charging rate can cause an explosion.

Golf, GTI and Jetta Product Familiarization

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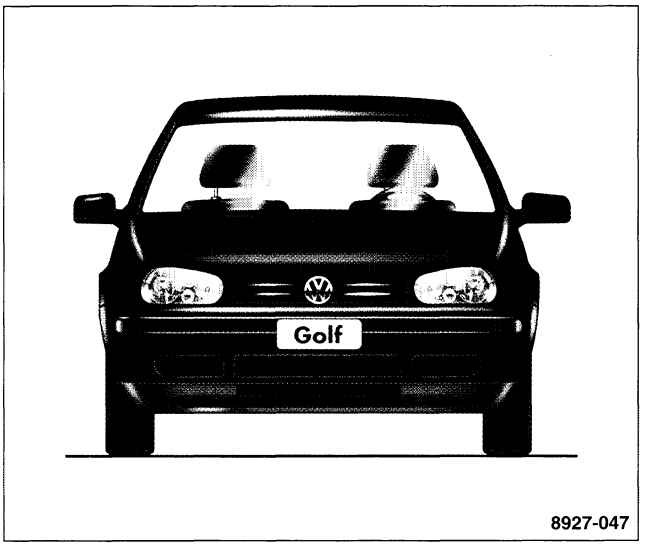
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INTRODUCTION

The information included in this appendix is based on introductory and preliminary sales information for A4 Golf, GTI, and Jetta vehicles sold in the USA/Canada. The content provided is intended to serve a product familiarization guide. Note that the information given here is subject to change and should be used as a general reference only.

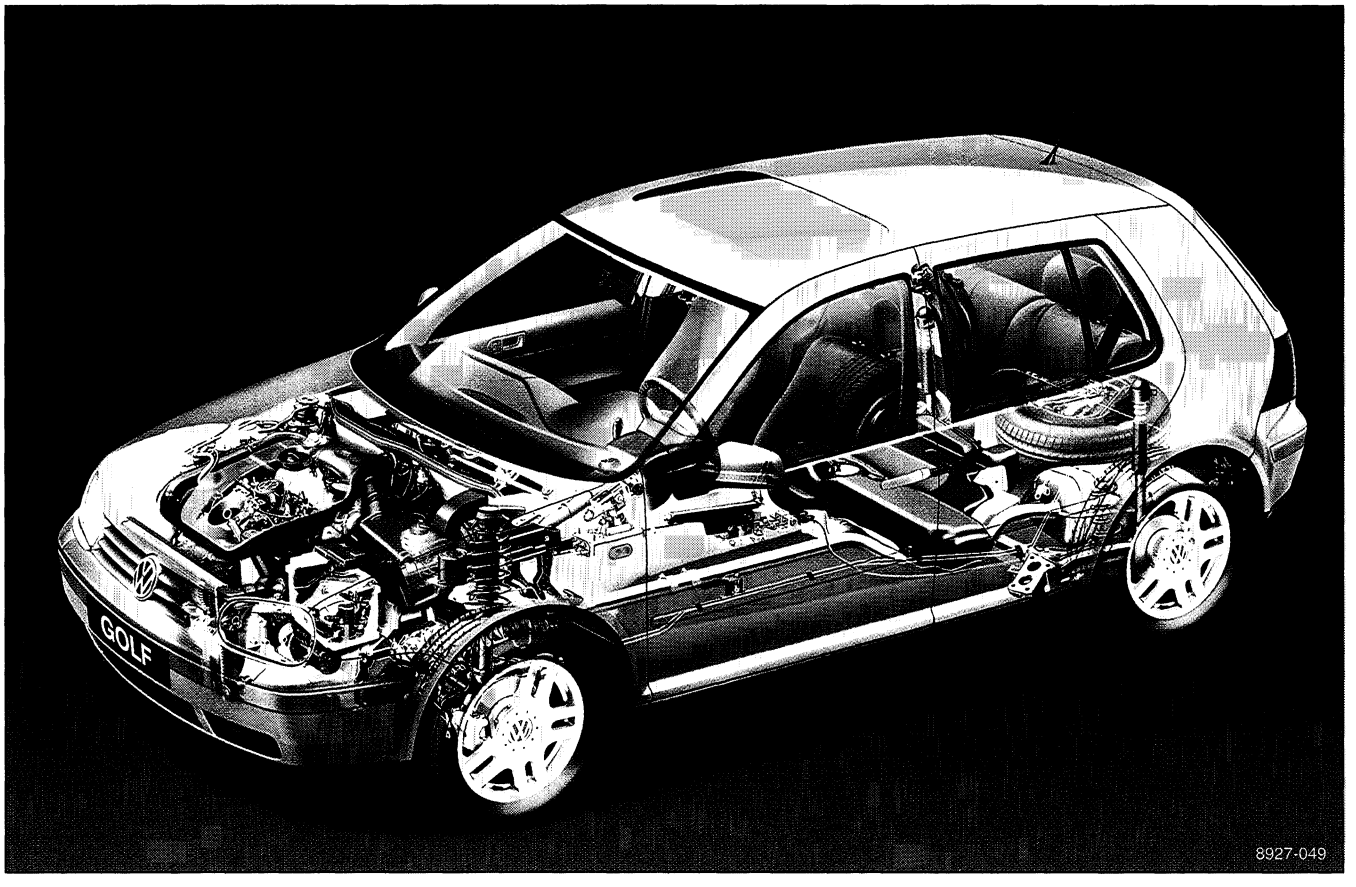
WARNING —
Always check the Volkswagen Worldwide Repair Information System or the publisher's website at www.bentleypublishers.com for information that may supersede any information included in this section.

PRODUCT OVERVIEW

The fourth generation of the Golf and Jetta, known as the A4 platform, was introduced in 1999. When introduced, three trim levels were offered (GL, GLS, and GLX). The Jetta was available in GL, GLS, and GLX trim levels, first as a 4-door sedan, and beginning in the 2001, as a wagon. The Golf was available as both 2- and 4-door hatchbacks, in GL and GLS trim levels. GTI models were only available as 2-door hatchbacks (GLS, GLX models).

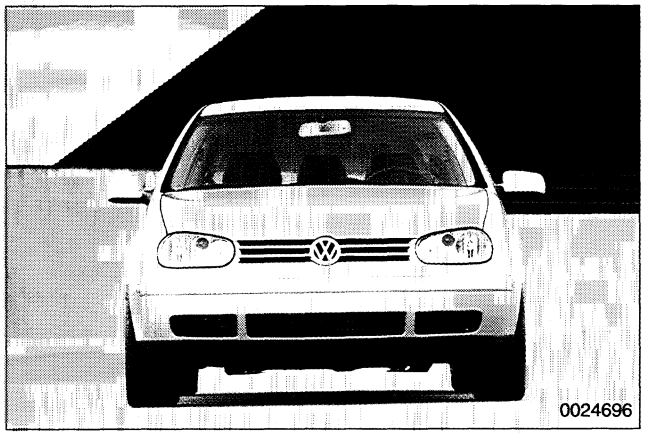
External badging was not used to identify the different models. The engine versions were however displayed on the rear of the vehicles. Available engines are listed below.

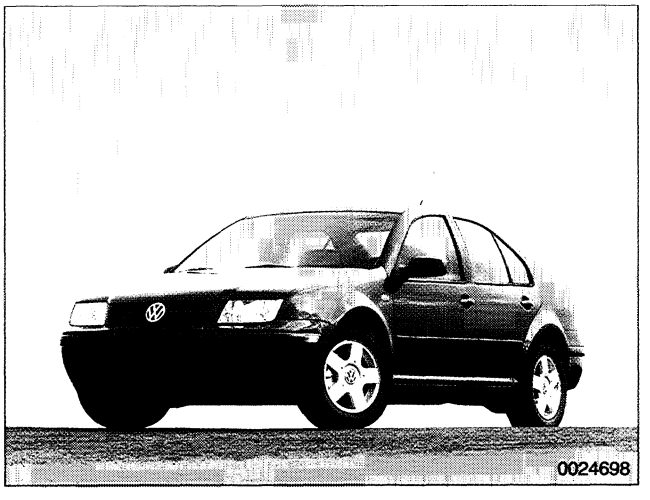
All models feature chrome accents and soft-textured painted surfaces. The rear seat has a one third/two third split with a center seat head rest and shoulder belt. Side airbags for the front seats are also standard equipment for all models.



The only individual option available during the model's introduction was the CD changer. All models are pre-wired for dealer installation.

Additional optional equipment became available throughout the production span of the A4 vehicles. Late model high-tech options included ESP (Electronic Stabilization Program), Tiptronic 5-speed automatic transmission, 6-speed manual transmission, ASR (Anti Slip Regulation), Volkswagen





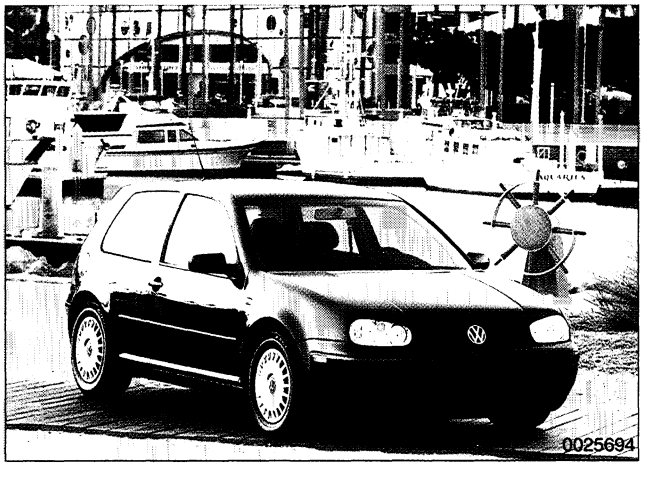
GTI and Jetta GLX models standard equipment (1999 model introduction)

- All GLS level equipment
- 2.8 liter VR6 engine
- 16 inch 5 spoke alloy wheels
- Anti-theft wheel locks
- Partial leather interior trim
- 3-spoke leather wrapped steering wheel
- Power sunroof
- Cold weather package
- Rear sunshade (Jetta only)
- Climatronic (automatic climate control system)
- Rain sensor for windshield wipers
- Trip computer
- Foglights
- Sport suspension
- Auto-dimming rear view mirror
- Traction control

Telematics by OnStar, and Sport suspension with 18-inch alloy wheel and 225/40R18Y tires.

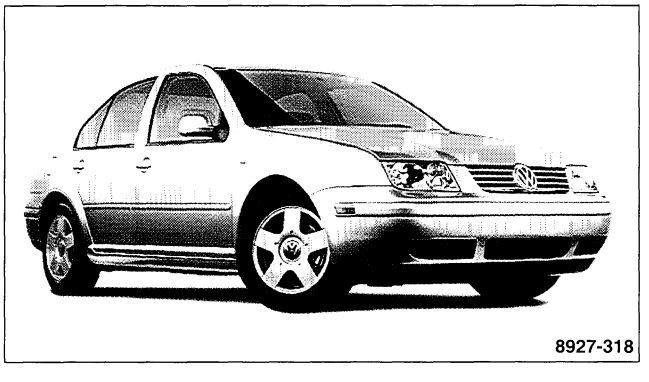
For 1999, a Luxury Package was available on the GLS models, which included a sunroof and 15" alloy wheels. A Leather Package was also available which contained partial leather interior trim, leather wrapped steering wheel, shift knob and parking brake handle. Heated seats and windshield washer nozzles were included with the Leather Package. Vehicles pictured represent several different model years.





Golf and Jetta GL standard equipment (1999 model introduction)

- 2.0L 4-cylinder 115hp (gasoline)
- Optional 1.9L 4-cylinder 90hp (TDI) (diesel)
- Blue/red instrumentation
- Side turn signal lights
- Soft-texture painted interior panels
- Chrome interior accents
- Dual front and side airbags
- ABS with 4-wheel disc brakes
- 3 rear shoulder belts and 3 head rests
- Remote side mirrors
- Stereo/radio cassette
- Air conditioning
- Anti-theft alarm
- Remote power locks
- Power windows
- Tilt/telescopic adjustable steering wheel
- 15" steel wheels
- Full size spare tire on steel rim
- Roof antenna (amplified)

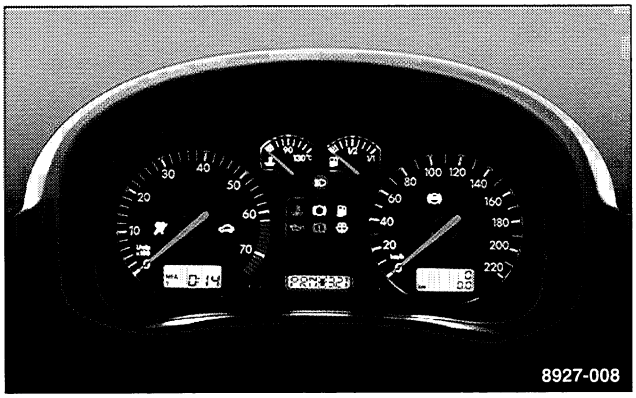


Golf, GTI and Jetta GLS models standard equipment (1999 model introduction)

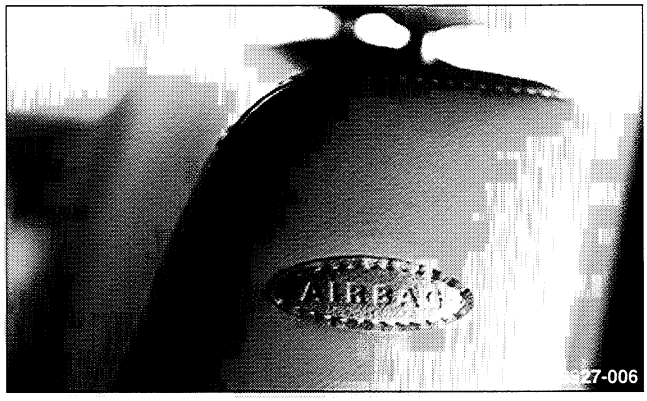
- All GL level equipment
- Optional 2.8L VR6 engine (Jetta only)
- Cruise control
- Heated power side mirrors
- Front center arm rest

Feature Overview

Instrument cluster illumination



Front seat side airbags



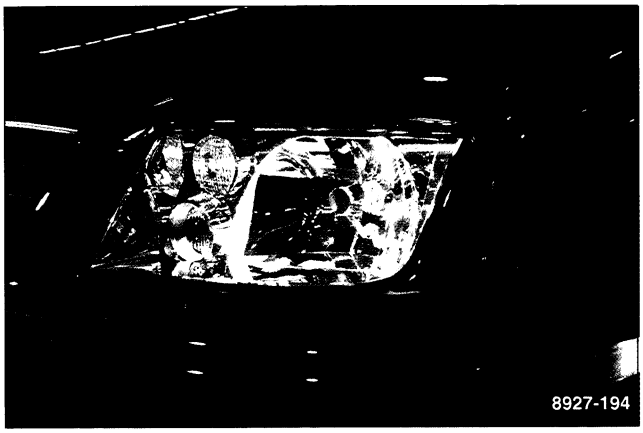
New headlight design, Golf



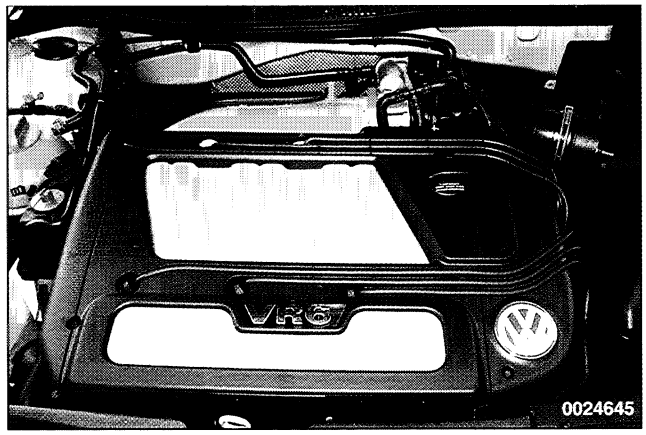
Power windows



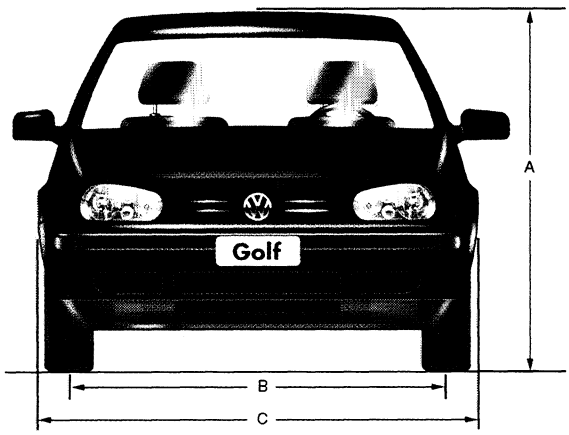
New headlight design, Jetta



VR6 engine



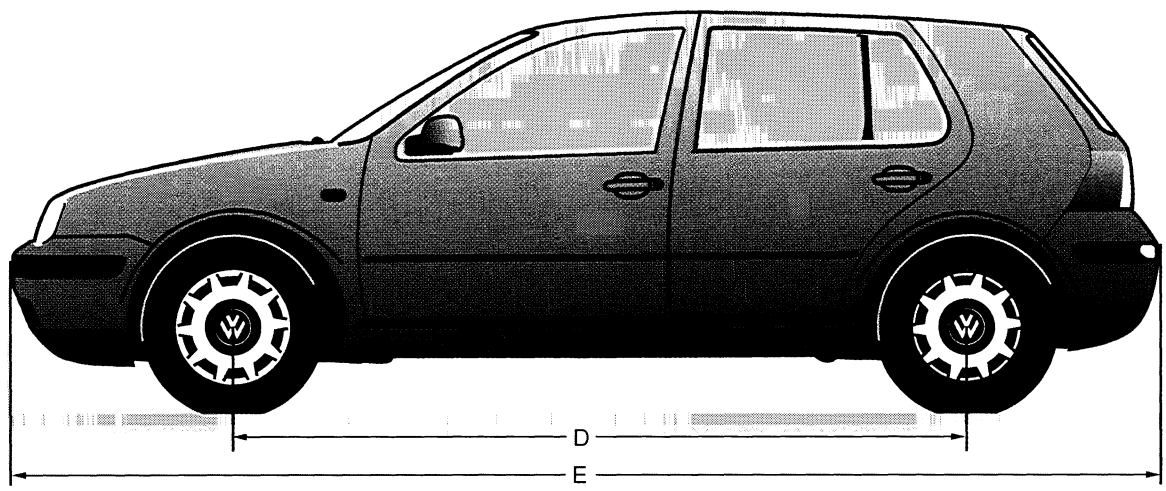
Golf Dimensions



8927-047a

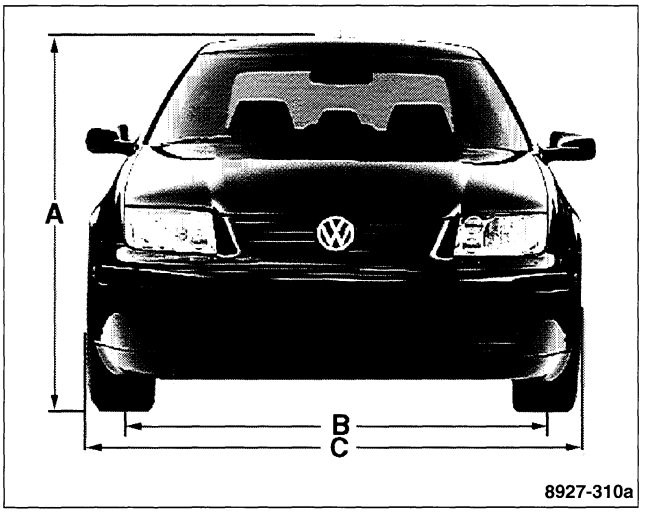
Golf (1999)

- Overall height (**A**) . . . . . 56.7 in. (1439 mm)
- Track (**B**)
  - Front . . . . . 59.6 in. (1513 mm)
  - Rear . . . . . 58.8 in. (1494 mm)
- Overall width (**C**) . . . . . 68.3 in. (1735 mm)
- Wheelbase (**D**) . . . . . 98.9 in. (2513 mm)
- Overall length (**E**) . . . . . 163.3 in. (4149 mm)
- Ground clearance . . . . . 4.8 in. (122 mm)
- Turning circle. . . . . .35.8 in. (10.9 mm)
- Curb weight
  - 5-speed manual . . . . . NA
  - 4-speed automatic . . . . . NA
- Passenger volume . . . . . 87.0 ft^3 (2.5 m^3)
- Trunk volume. . . . . .17.6 ft^3 (0.5 m^3)
- Seating capacity . . . . . Five

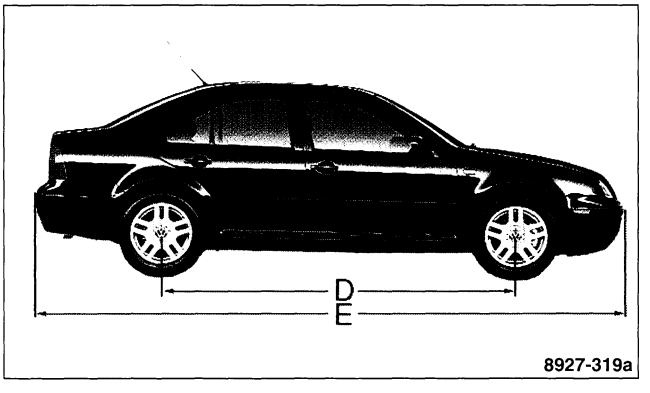


8927-046a

Jetta Dimensions



8927-310a



8927-319a

Jetta, sedan (1999)

- Overall height (**A**) . . . . . 56.9 in. (1446 mm)
- Track (**B**)
  - Front . . . . . 59.6 in. (1513 mm)
  - Rear . . . . . 58.8 in. (1494 mm)
- Overall width (**C**) . . . . . 68.3 in. (1735 mm)
- Wheelbase (**D**) . . . . . 98.9 in. (2513 mm)
- Overall length (**E**) . . . . . 172.3 in. (4376 mm)
- Ground clearance . . . . . 4.8 in. (122 mm)
- Turning circle. . . . . 35.8 in. (10.9 mm)
- Curb weight
  - 5-speed manual . . . . . 2853 (1279 kg)
  - 4-speed automatic . . . . . 2902 (1301 kg)
- Passenger volume . . . . . 88.0 ft^3 (2.5 m^3)
- Trunk volume. . . . . 13 ft^3 (0.4 m^3)
- Seating capacity . . . . . Five

ENGINE AND TRANSAXLE

Multiple engine and transaxle configurations were used in the 1999 through 2005 A4 cars.

Engines ranged from the economical 90 hp 1.9 liter TDI engine to the high-performance 240 hp 3.2 liter R32 engine.

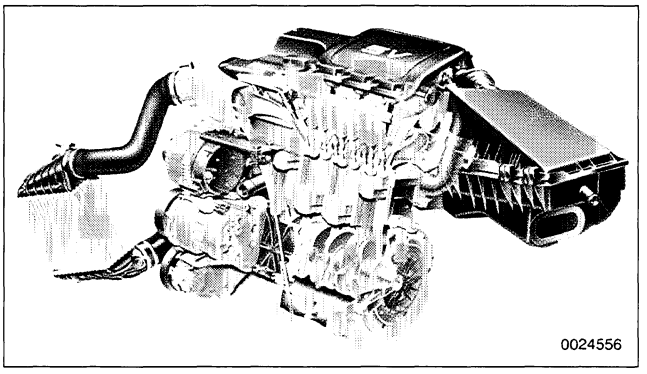
Manual transaxles were offered in 5 and 6-speed versions. Electronically-controlled automatics were available in 4-speed and 5-speed with Tiptronic.

Engines

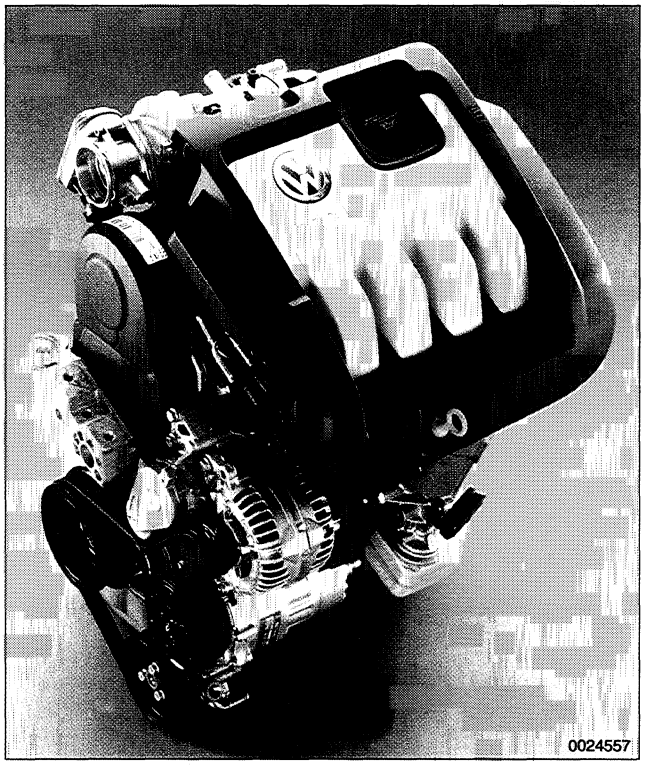
Five engine displacements with a total of 13 engine code variants were used throughout the platform's production span.

Engine Applications

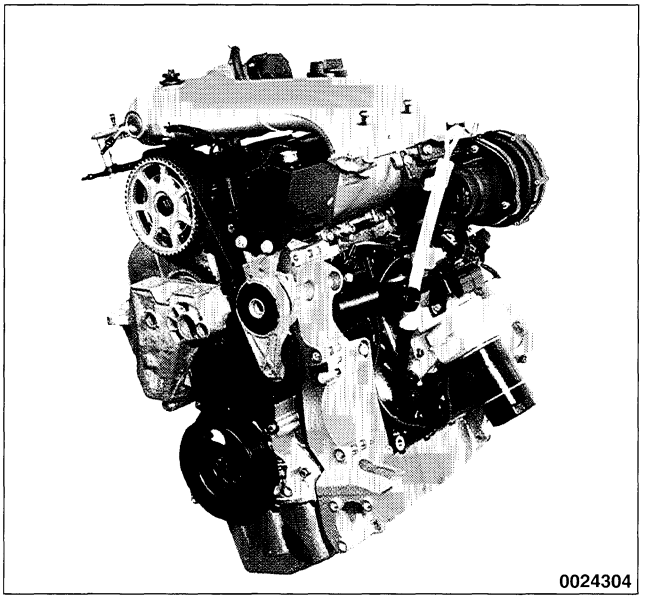
- 1.8L 4-cylinder turbo gasoline (AWD, AWW, AWP)
- 1.9L 4-cylinder turbo diesel (ALH)
- 1.9L 4-cylinder PD turbo diesel (BEW)
- 2.0L 4-cylinder gasoline (AEG, AVH, AZG, BBW, BEV)
- 2.8L 6-cylinder gasoline (AFP, BDF)
- 3.2L 6-cylinder gasoline (BJS)



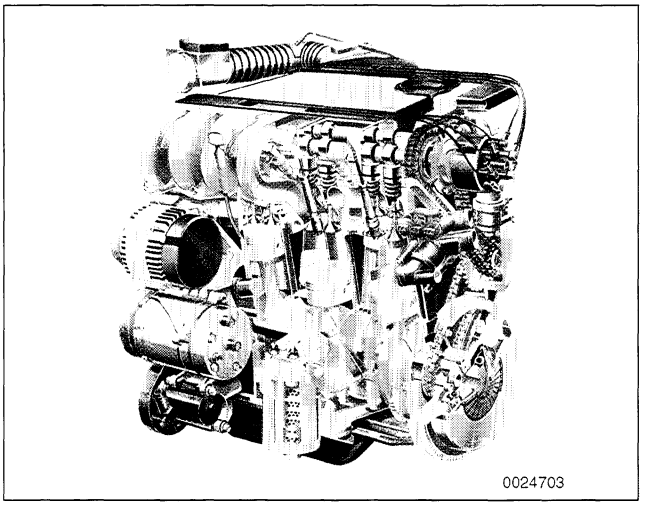
- 1.8L 4-cylinder turbo gasoline engine was introduced in 2000 with 150 hp and later increased to 180hp for 2004. It was first available in GLS models.



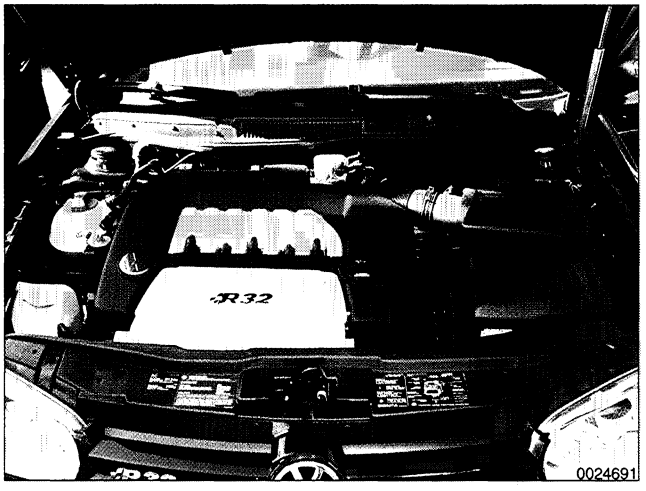
- 1.9L TDI Diesel engine (PD TDI engine shown). New TDI PD engine ("pumpe düse" or pump injector) was introduced in 2004.



- 2.0L gasoline engine was the base 4-cylinder engine, producing 115 hp.

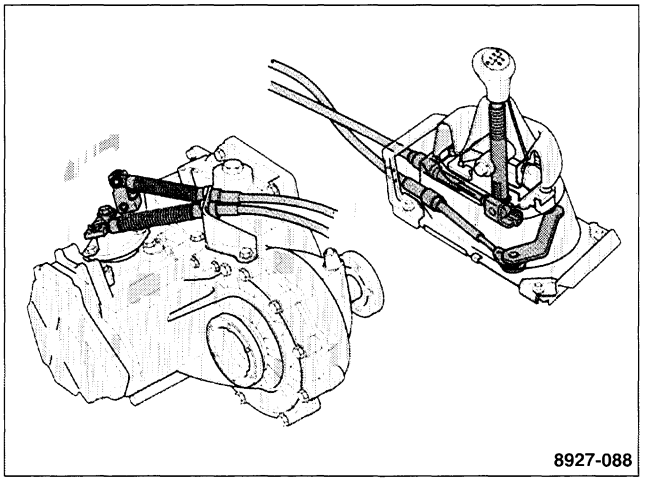


- A 2.8L 6-cylinder (VR6) engine is used in the 6-cylinder GTI GLX and in Jetta GLS and GLX models. It was produced in 12-valve and 24-valve versions. The 200 hp 24-valve VR6 was available from model year 2001 (engine code BDF). The VR6 was discontinued in the Jetta for 2005.

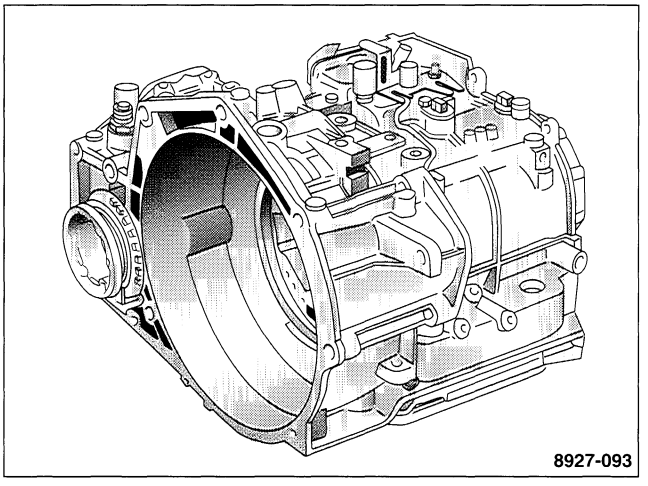


- 3.2L 15-degree V6 four-valve 240 hp engine was only available in the Golf R32 model.

Transaxles



- Two cable-shifted manual transmissions were offered, a 5-speed and a 6-speed. The six speed was introduced in 2002 as an available option on some models and standard on the some of the higher performance models. See **34 Manual Transmission** for additional information.


8927-093

Two automatic transmissions were offered. On early cars the 4-speed was the only available choice. In 2002, the 5-speed Tiptronic automatic transmission with manual-shift mode was offered as an option on 1.8T models. Both the 4-speed and the 5-speed units are electro-hydraulically controlled and feature adaptive programming and On-Board Diagnostic (OBD) capabilities. See **37 Automatic Transmission** for additional information.

Transaxle Applications

- Automatic transaxles
  - 01M . . . . . 4-speed automatic
  - 09A . . . . . 5-speed automatic with Tiptronic
- Manual transaxles
  - 02J . . . . . 5-speed manual
  - 02M . . . . . 6-speed manual
  - 02Y . . . . . 6-speed manual (4MOTION)

SUSPENSION AND BRAKES

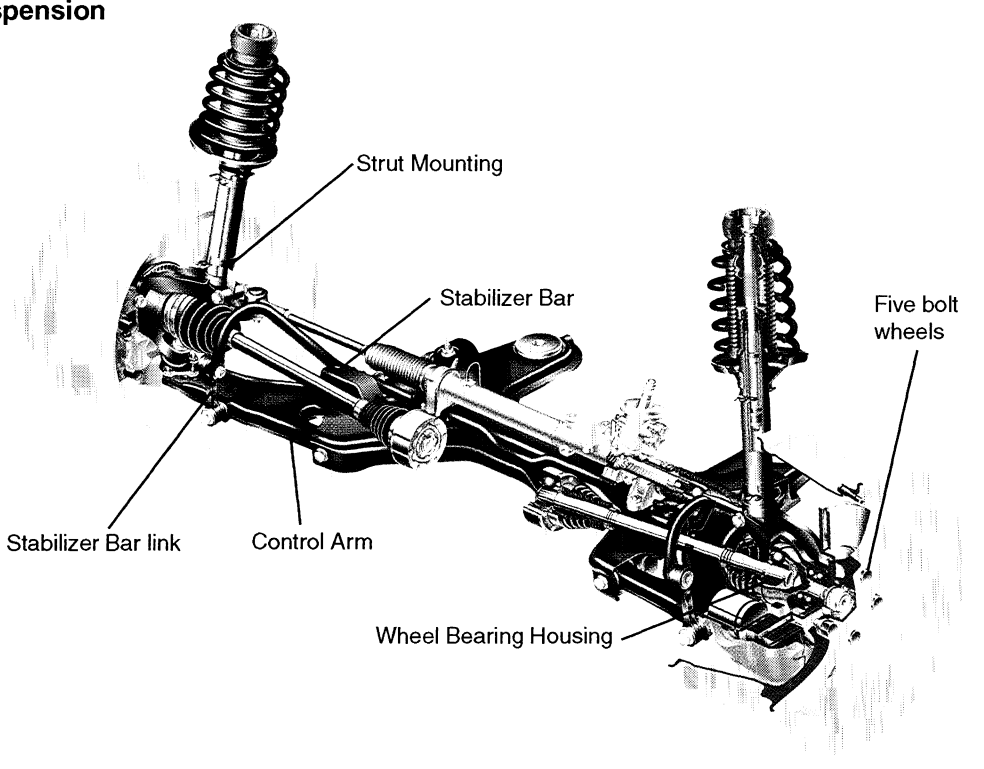
The layout of the A4's running gear has influenced generations of compact class cars since the series was launched in1999.

Its MacPherson struts and lower wishbones on the front axle make it one of the most highly regarded axle systems on the market. The rear suspension is a torsion beam and trailing arm design with built in stabilizer bar. It is designed to maximize available interior room.

This suspension package results in maximum steering precision and clearly defined handling with excellent cornering stability.

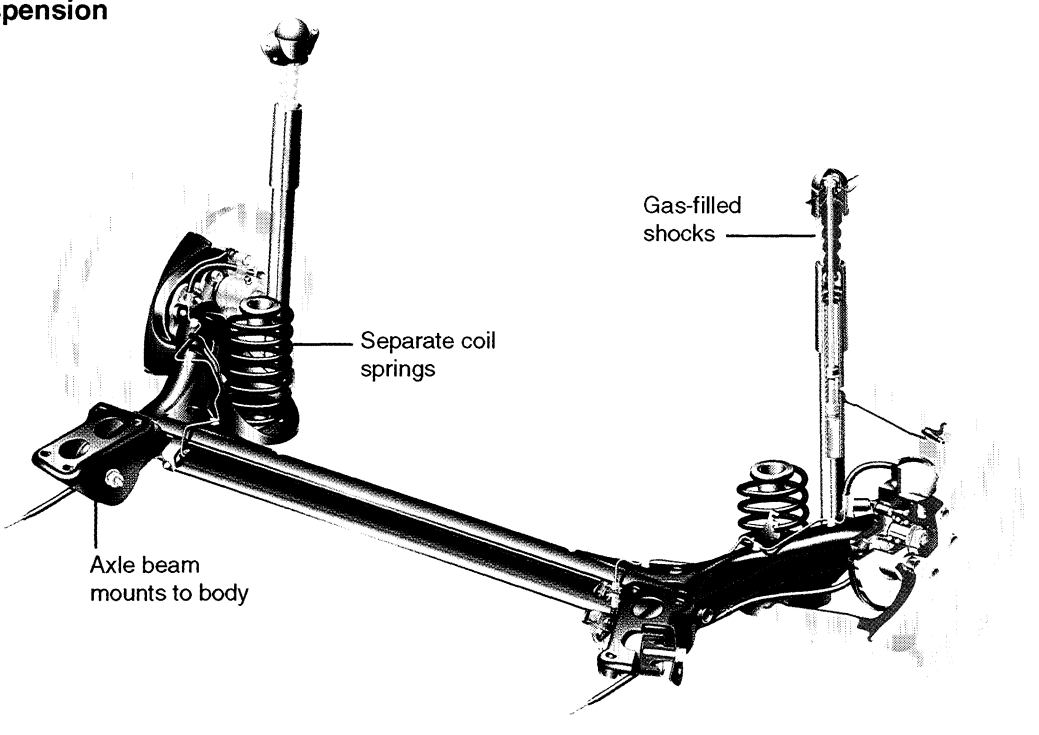
Front and rear suspension

Front Suspension



8927-098

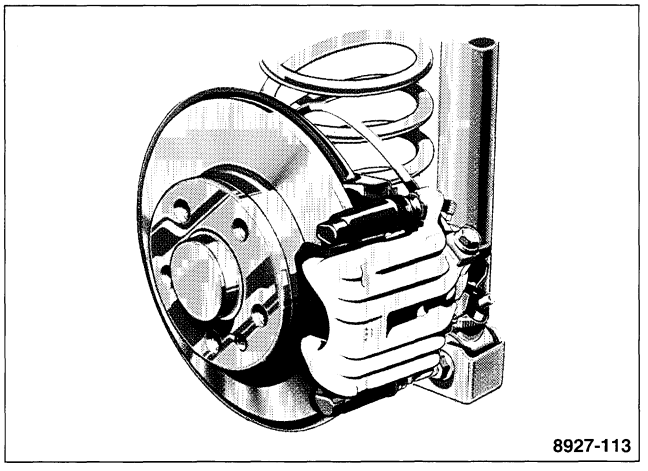
Rear Suspension



8927-105

Brakes, mechanical

Golf, Jetta, and GTI models are equipped with 4-wheel disc brakes.

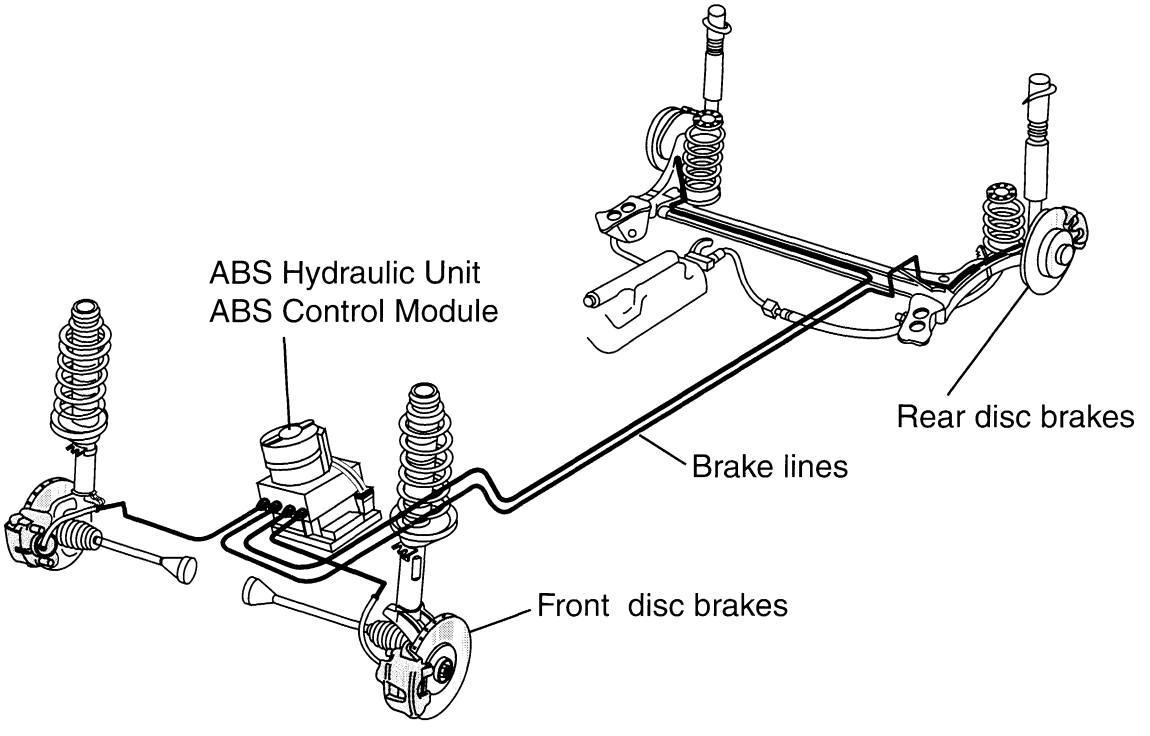


- The rear brake caliper housing are made of aluminum for reduced unsprung weight.

ABS (Anti-lock Brake System)

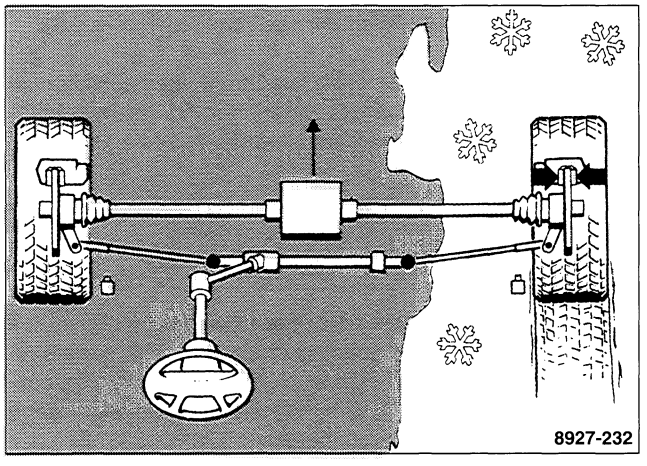
ABS is standard equipment on all Jetta, Golf, and GTIs.

ABS (Anti-lock braking)



EDL (Electronic Differential Lock)

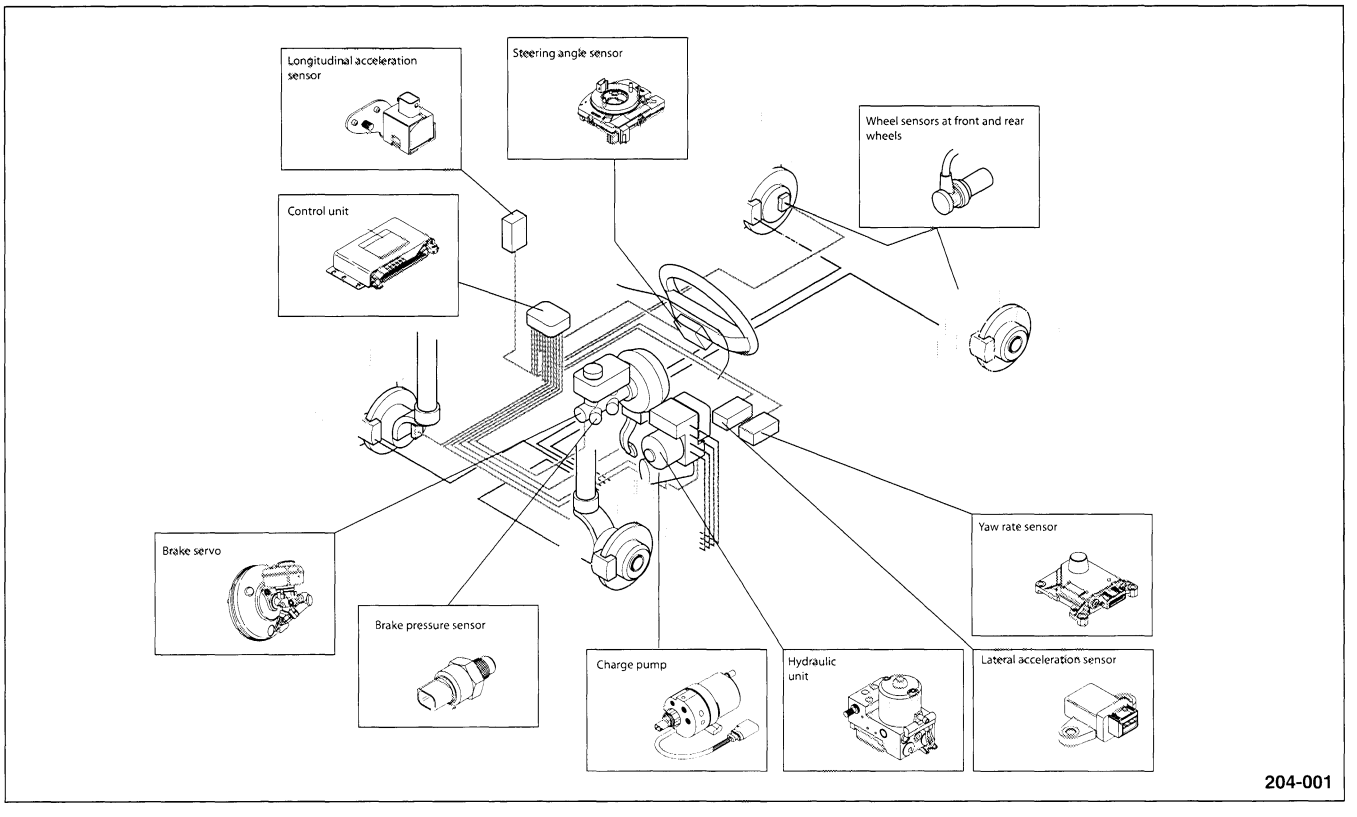
EDL is a low speed traction control system that utilizes the ABS to apply brake pressure to a slipping wheel during acceleration. EDL is enabled at speeds of up to 24 miles per hour. EDL was standard equipment on models equipped with high output engines.



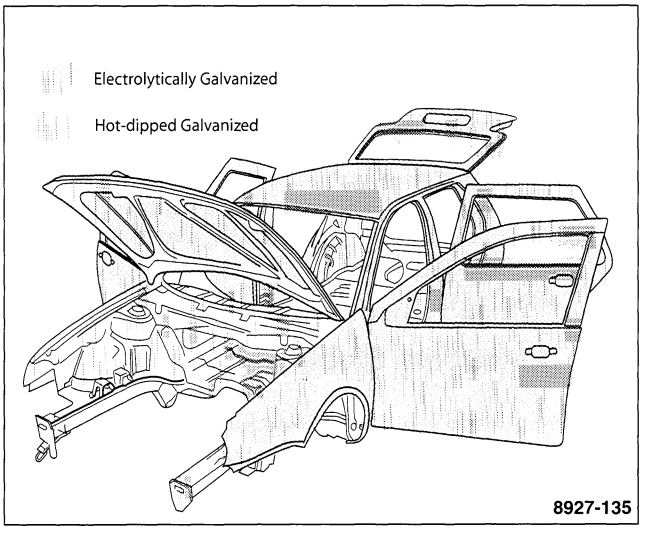
When the driving wheels experience unequal traction and the wheel with the least amount of traction spins, the ABS wheel speed sensor *picks up the difference in wheel speed.* The ABS control module responds by applying brake pressure to the spinning wheel which transfers the driving torque to the opposite wheel.

ESP (Electronic Stability Program)

The ESP (Electronic Stability Program) is one of the vehicle's active safety features. It is also known as a "driving dynamic control system". In simple terms, ESP is a dynamic anti-skid program. Utilizing a variety of sensors and controls to monitor steering angle, road wheel angle, yaw rate and lateral acceleration, the EDL system recognizes when the vehicle is in danger of skidding. By counteracting any tendency towards understeer or oversteer, ESP stabilizes the dynamic handling response of the car. It constantly compares the actual movement of the vehicle with predetermined values and, according to the situation, reacts by braking the outer front or inner rear wheel and automatically adjusting the engine's output.The system works in conjunction with the existing ABS system.



BODY – EXTERIOR



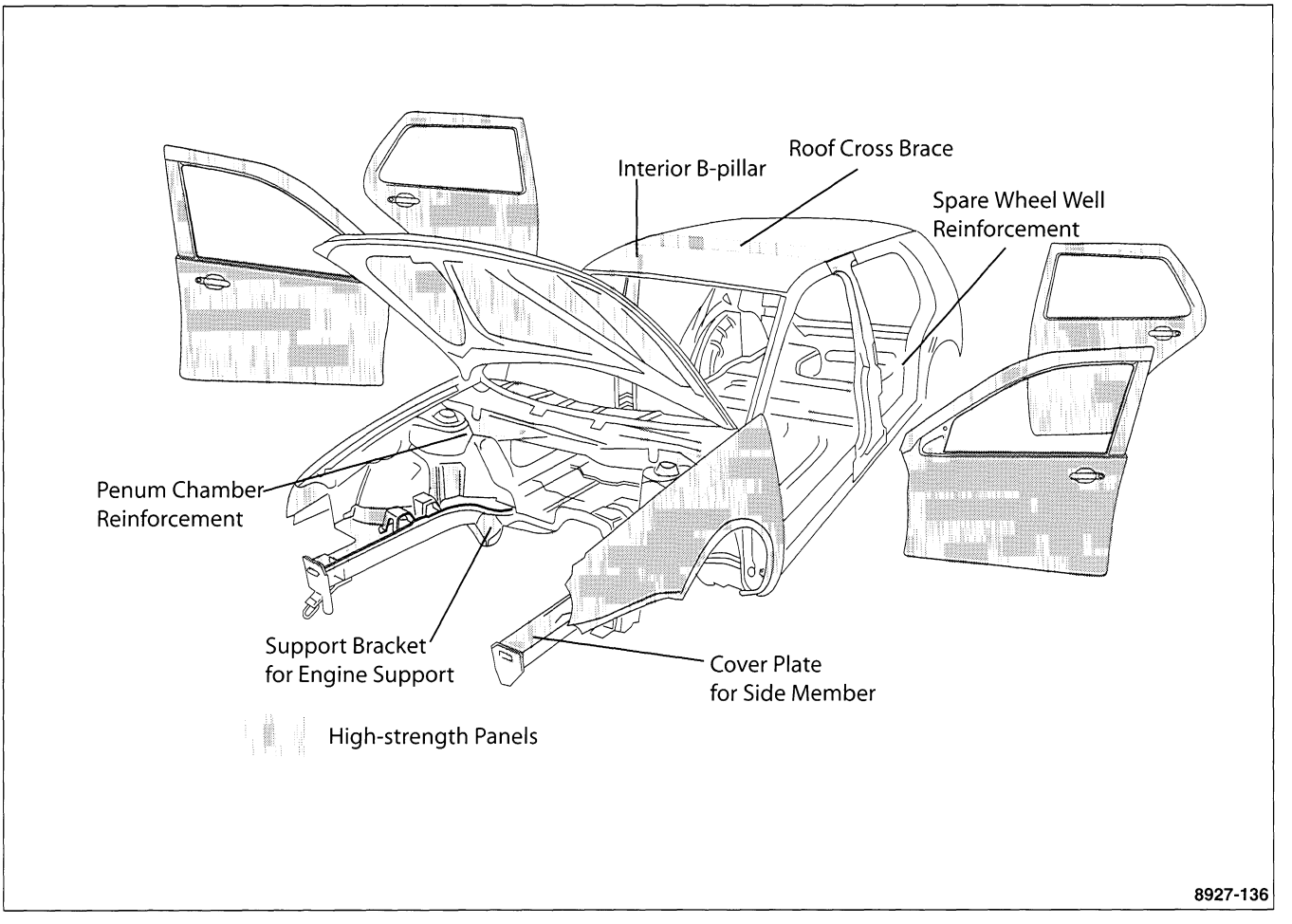
Fully galvanized body

The Golf and Jetta models have fully galvanized steel bodies for greater protection against corrosion. Body panels that are not visible are hot dipped galvanized. External panels that require a smooth finish are electrolytically galvanized.

Some body panels are constructed from special alloy high strength steel. These panels are thinner than the steel normally used for body panels and therefore save a great deal of weight.

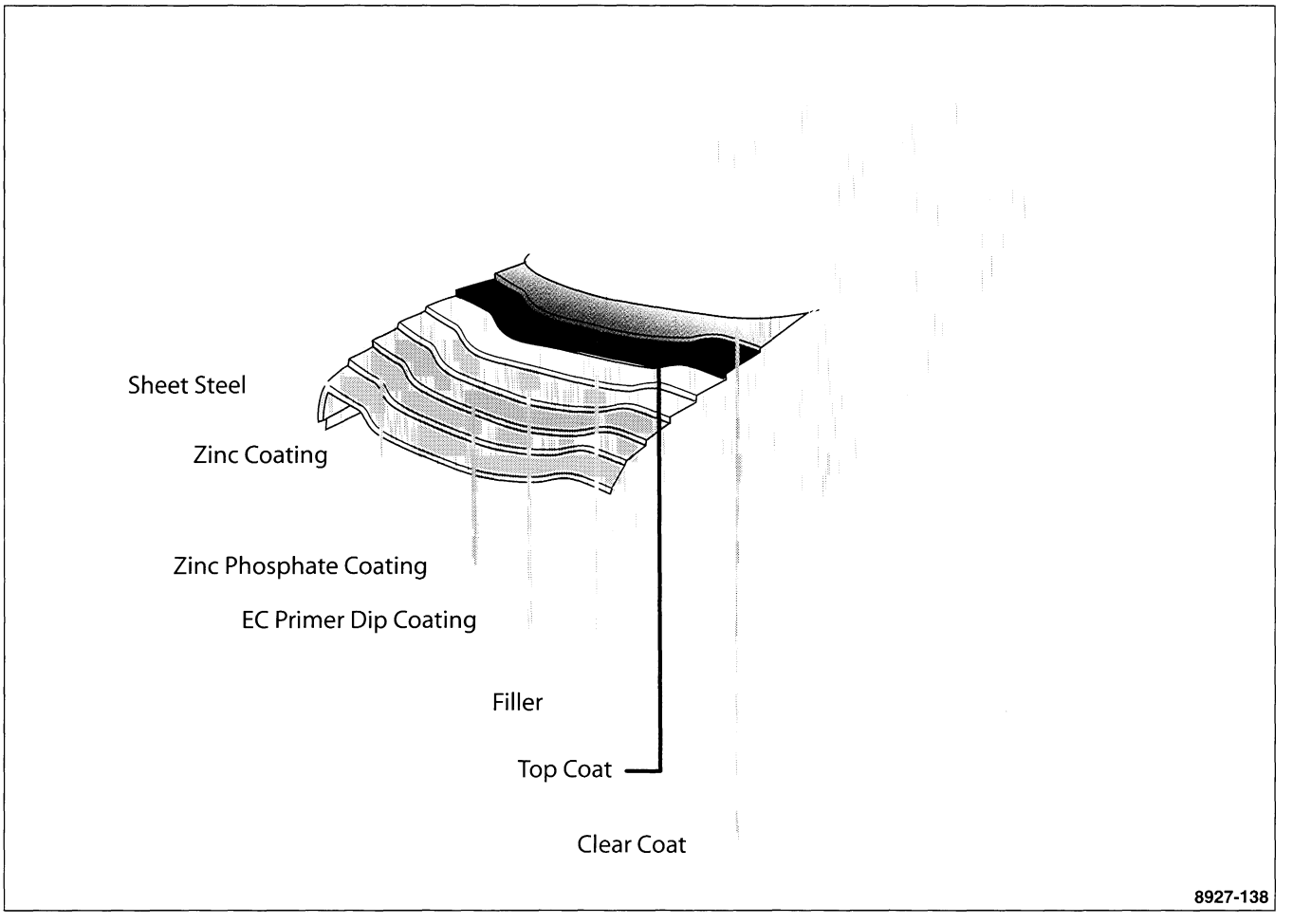
High-strength steel body panels

The high strength steel used for these panels is relatively soft during the forming and welding processes. The panels require heat treatment to become as strong as the thicker, conventional body panels. This happens during the paint curing process when the bodies are heated to 170° C (338° F).

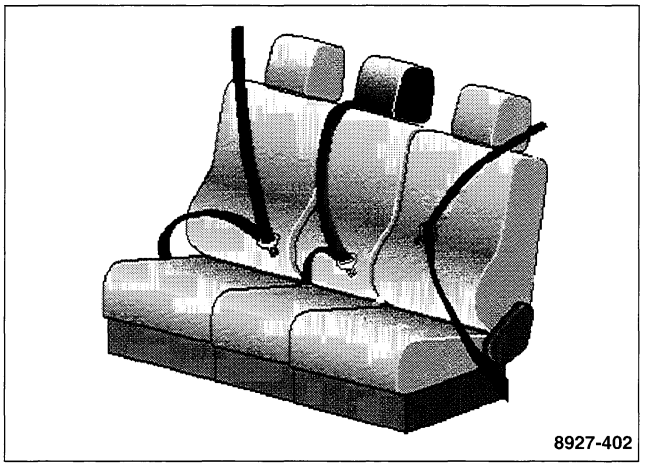


Five step paint process

Electrolytic galvanizing provides a good base for the five-step paint process. A zinc phosphate coating is followed by an electro-chemical primer dip coating. A filler is applied, and then the top color coat. A clear coat is then applied. The filler and top coats have elastic properties that make them chip resistant.




8927-145


8927-402

BODY – INTERIOR

The interior trim and upholstery is finished in a soft texture. Chrome accents highlight the interior trim. All models have heated remote mirrors and remote power door locks.

Two door models have an easy entry system built into the front seats. When the front seat is tilted forward, the seat slides forward on the track to provide easier entry to the rear seat area. All models have split folding rear seats.

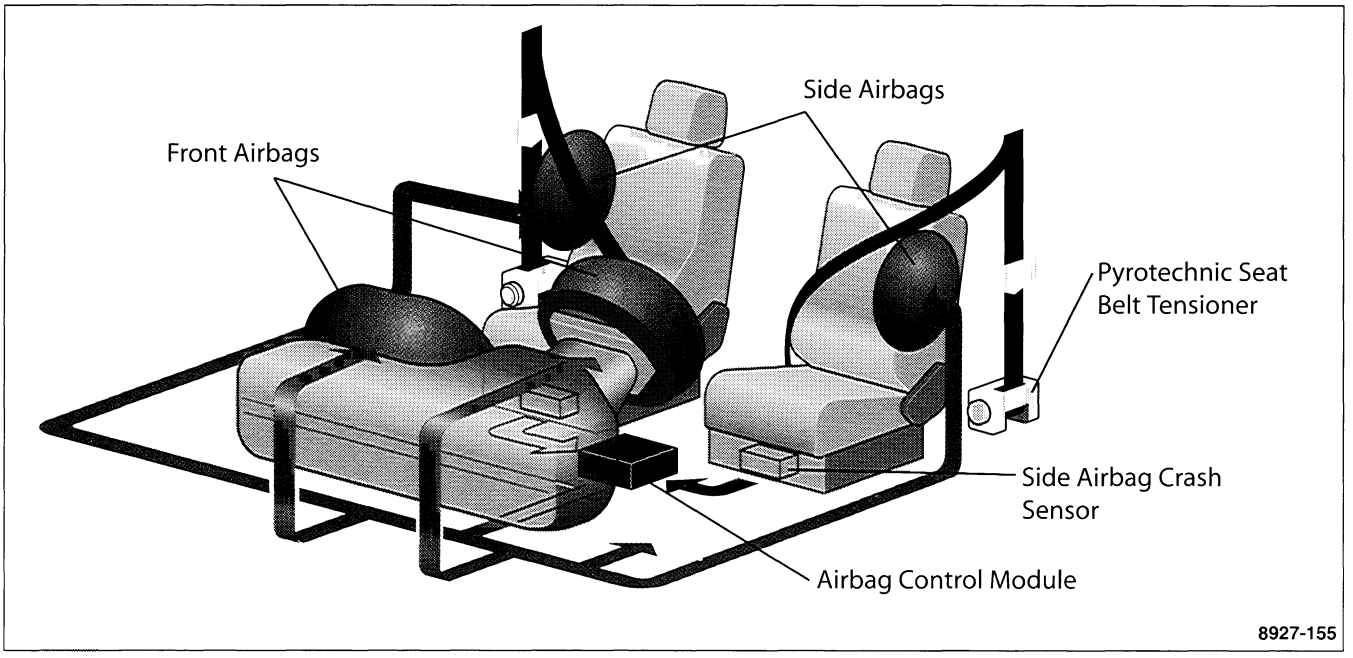
A power sunroof was standard on all GTIs, the Jetta GLX, and optional on other models. The Jetta GLX also got a rear window sun shade.

Airbags

Dual front airbags and side airbags were built into the front seat back rest and were installed as standard equipment on all models as of 1999. Pyrotechnic seat belt tensioners are used on the front seats.

In addition to deploying the airbags, the Airbag Control Module sends a signal to the Central Control Module to unlock the doors an switch on the interior light if the airbags are deployed.

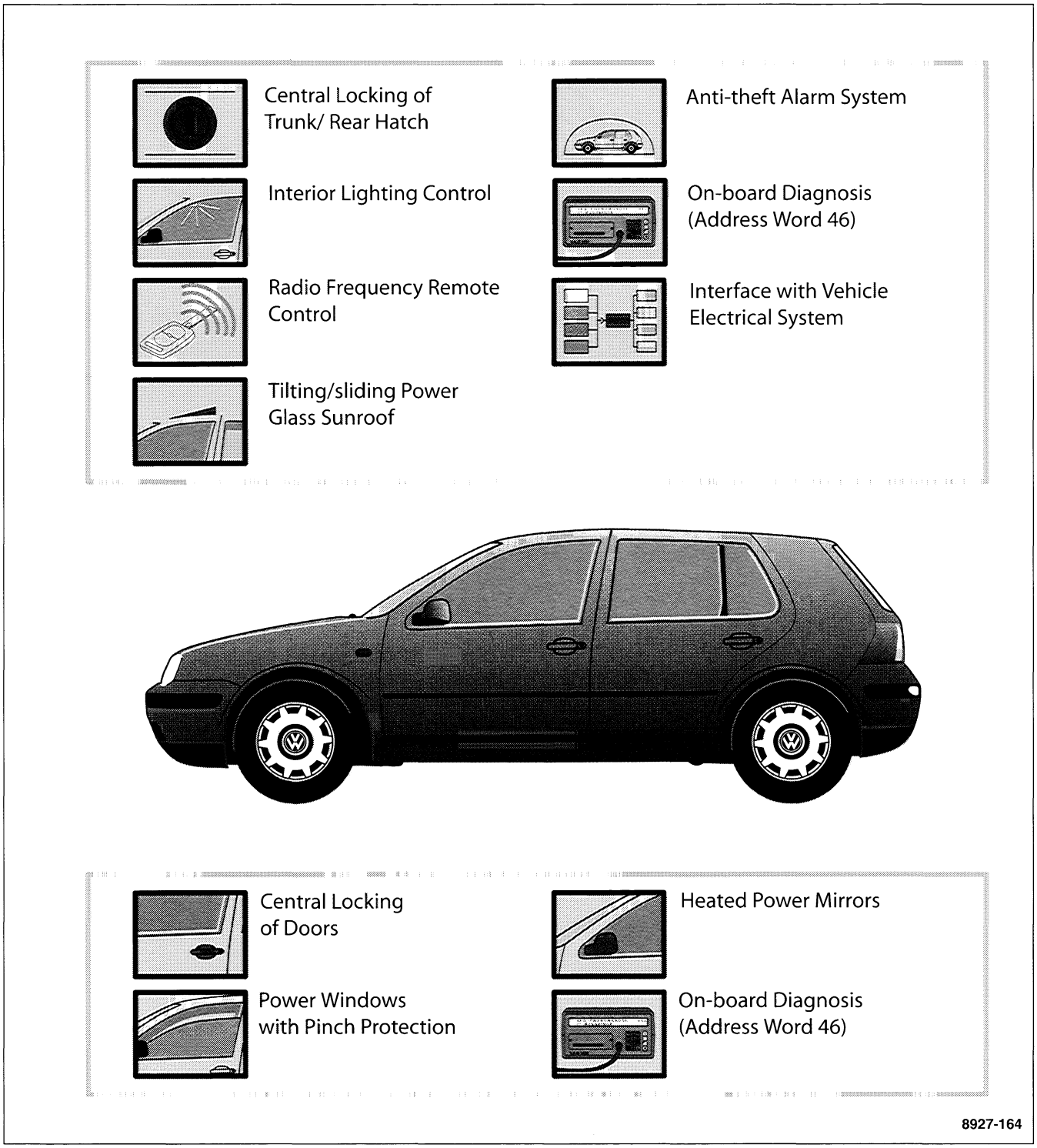
Rear headrest and shoulder belts are used in the rear.



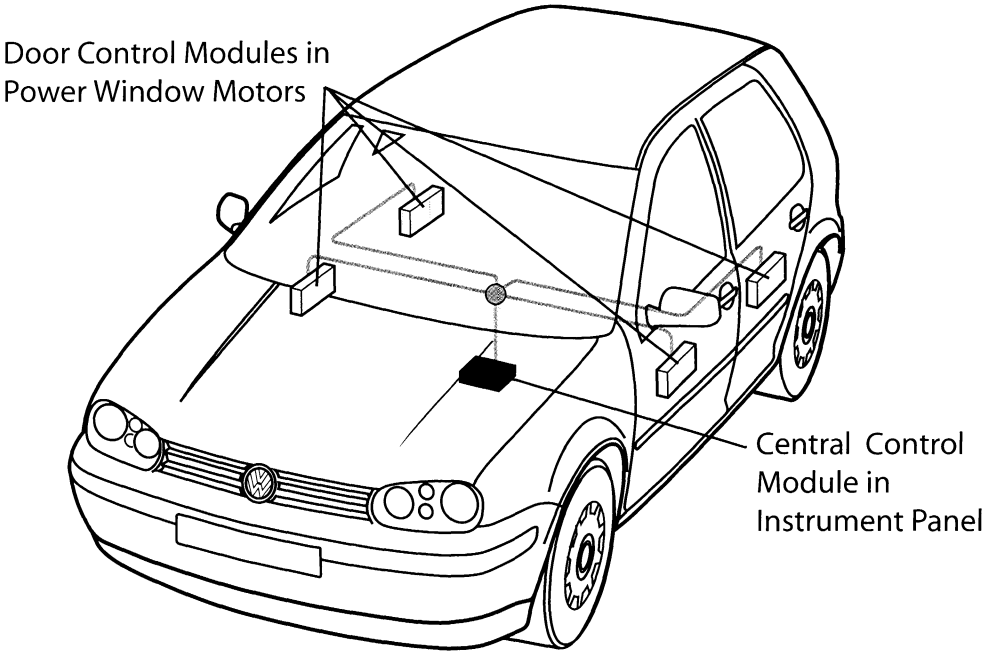
8927-155

Comfort electronics

A4 models had an integrated system of comfort options. It is a decentralized system utilizing a central control module and control modules in each door.



Comfort System with Central Control Module and 4-door Control Modules



CAN-bus

To reduce the amount of wiring used in the vehicle and to increase reliability, many electrical functions are accomplished using serial data transfer via a Controller Area Network bus. (CAN-bus). Similar to a telegraph, this process converts information into a series of pulses representing coded data messages that can be understood by other components.

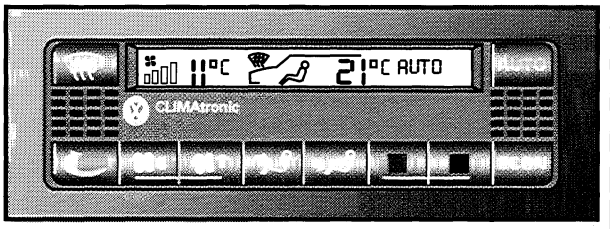
Wiring is simplified. Only ten wires pass between the door and the A-pillar, where up to 30 wires were used to control these components on previous Golf/Jetta models.

HEATING AND AIR CONDITIONING

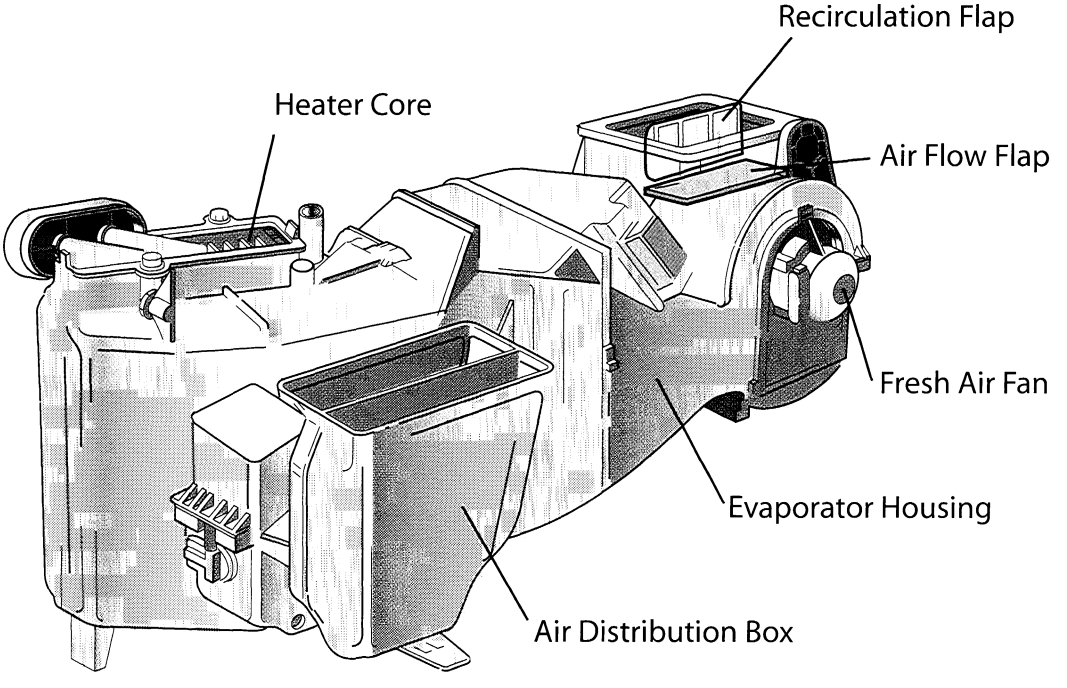
Air conditioning is standard on Golfs, GTIs and Jettas. The cable-actuated manual system uses a blend door for temperature regulation. Air flow controls feature a recirculation function.

The fully automatic Climatronic control system uses electric motors and feedback potentiometers in place of the cable controls on the manual heating and A/C system. Temperature and sunlight photo sensors are used to determine the degree of heating or cooling necessary to keep the interior of the vehicle at the digitally selected temperature.

A replaceable activated charcoal dust and pollen filter is used in the system to filter out odors and air pollutants.



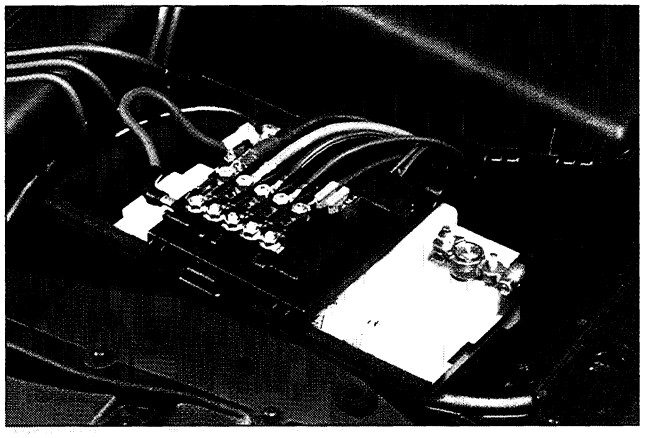
8927-185



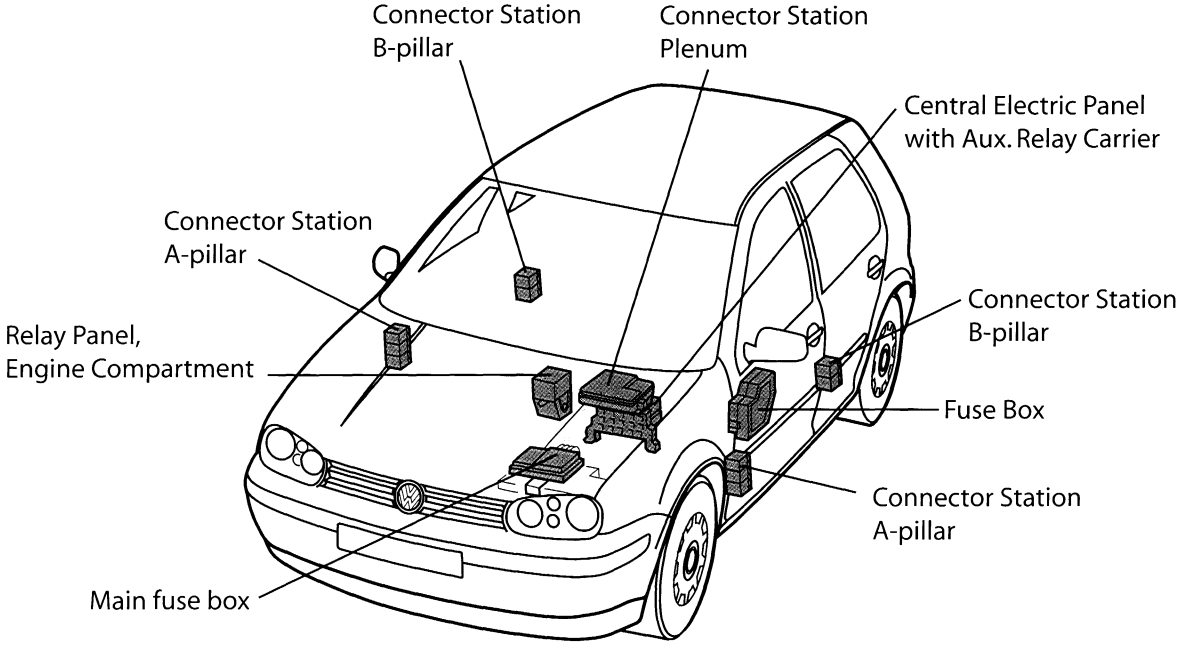
8927-184

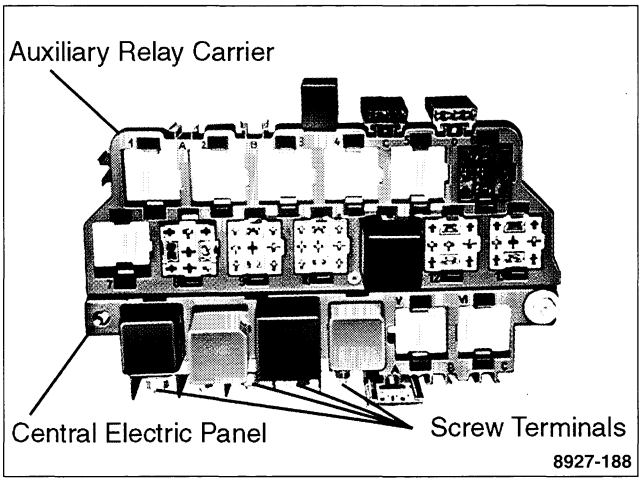
ELECTRICAL SYSTEM

A decentralized electrical system is used on the Golf, GTI and Jetta vehicles. In other words, the electrical system is subdivided into separate connector stations, relay carriers, and fuse boxes. The system provides the technician with easier access to test points when troubleshooting electrical problems.

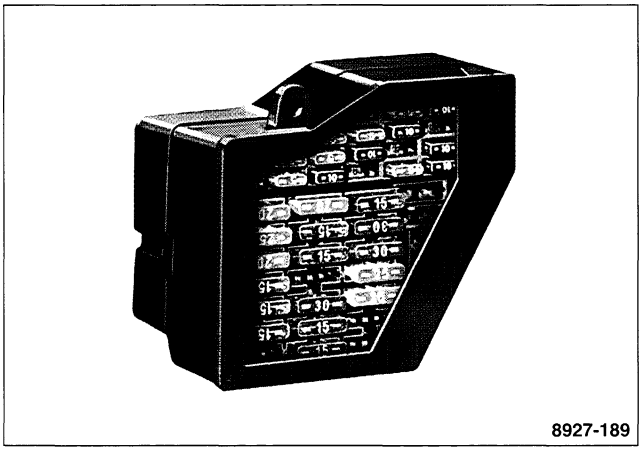


➤ The main fuse box is located at the battery. It contains high-current fuses for applications such as the charging system, engine management, and radiator cooling fans. This design protects the main wiring harness in the event of a short circuit.

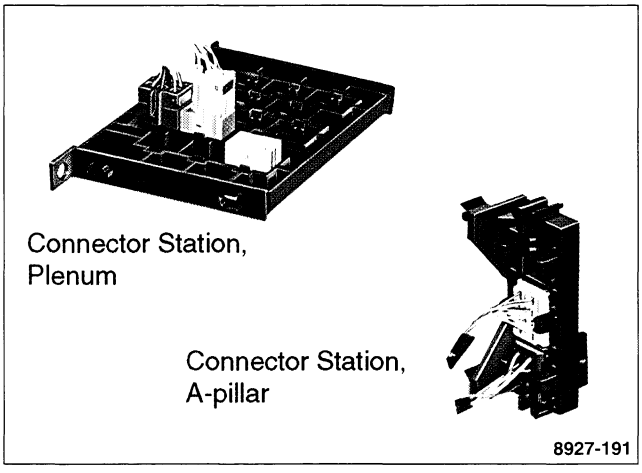




The central electric panel has sockets for six relays. Below the relay sockets are several screw terminals for battery (terminal 30), ignition (terminal 15), and load reduction (terminal 75 or X)



The fuse box is located on the left end of the instrument panel behind a cover. It contains both standard size fuses and mini fuses. The use of mini fuses allows protection of individual circuits.



The decentralized electrical system requires less wiring and reduces vehicle weight. The connector stations are located in the plenum and at the A- and B-pillars.

TECHNICAL SPECIFICATIONS

1999 Golf GL and GLS, 2.0 Liter Gas or 1.9 Liter TDI Engine — USA
1999 GTI GLS, 2.0 Liter Gas Engine — USA

Engine				
	Gasoline		Diesel	
Type	4-cylinder, in-line		4-cyl. inline, turbo-charged, direct injection	
Bore	3.25 in	82.6 mm	3.13 in	79.5 mm
Stroke	3.65 in	92.7 mm	3.76 in	95.5 mm
Displacement	121.1 in^3	1984cm^3	115.7 in^3	1896cm^3
Compression Ratio	10.0 : 1		19.5 : 1	
Power @ RPM	115 HP @ 5200 (85 kW @ 5200)		90 HP @ 33750 (66 kW @ 3750)	
Max. Torque @ RPM	122 lb-ft @ 2600 (165 Nm @ 2600)		149 lb-ft @ 1900 (202 Nm @ 1900)	
Fuel Requirement	Regular Unleaded		Diesel	

Engine Design		
	Gasoline	Diesel
Arrangement	Front mounted, transverse	
Cylinder Block	Cast Iron	
Crankshaft	Cast iron. 5 main bearings	Forged steel. 5 main bearings
Cylinder Head	Aluminum alloy, cross flow	Aluminum alloy, cross flow
Valve train	Single over head camshaft, spur belt driven w/ semi-aut. belt tensioner, 2 valves per cylinder, maintenance free hydraulic lifters, single coil valve springs	Single over head camshaft, spur belt driven, 2 valves per cylinder, maintenance free hydraulic lifters, single coil valve springs
Lubrication	Rotary internal gear pump, crankshaft chain driven, oil cooler	Rotary gear pump, oil cooler
Cooling System	Water cooled, water pump, cross flow radiator, double thermostatically controlled electric 2-speed radiator fans	Water cooled, water pump, cross flow radiator, thermostatically controlled electric 3-speed radiator fan
Fuel/Air Supply	Sequential multi port fuel injection (Motronic)	Electronically controlled direct injection (EDC), turbocharger
Emissions System	OBD II, 3-way catalytic converter with 2 oxygen sensors (upstream and downstream), enhanced evaporation system (California cars with secondary air injection pump) ORVR onboard refill vapor recovery system	OBD D, catalytic converter, water-cooled EGR system

Electrical System		
	Gasoline	Diesel
Alternator, Volts/Amps	14 / 70 (90 with A/C)	
Battery, Volts (Ampere-Hours)	12 (63)	12 (80)
Ignition	Digital electronic with knock sensor	Compression ignition
Firing Order	1-3-4-2	

1999 Golf GL and GLS, 2.0 Liter Gas or 1.9 Liter TDI Engine — USA
1999 GTI GLS, 2.0 Liter Gas Engine — USA

Drive Train				
Configuration	Front-wheel drive			
Transmission Gear Ratios	**5-Speed Manual**		**4-Speed Automatic**	
	Gasoline	**Diesel**	**Gasoline**	**Diesel**
1st	3.78 : 1	3.78 : 1	2.71 : 1	N/A
2nd	2.12 : 1	2.12 : 1	1.55 : 1	N/A
3rd	1.36 : 1	1.36 : 1	1.00 : 1	N/A
4th	1.03 : 1	0.97 : 1	0.68 : 1	N/A
5th	0.84 : 1	0.76 : 1		N/A
Reverse	3.60 : 1	3.80 : 1	2.11 : 1	N/A
Final drive	4.24 : 1	3.39 : 1	4.88 : 1	N/A

Capacities	
Engine Oil (w/filter)	4.8 qt (4.5L)
Fuel Tank	14.5 gal (54.9 L)

Steering	
Type	Rack and pinion, power assisted
Turns (lock to lock)	3.2
Turning circle (curb to curb)	35.8 ft (10.9 m)

Interior Volume - SAE	**Golf GL & GLS**		**GTI GLS**	
EPA Class	Compact		Compact	
		EPA		**EPA**
Passenger Volume	87.0 ft^3 (2.5 m^3)	88 ft^3 (2.5 m^3)	84.7 ft^3 (2.4 m^3)	85 ft^3 (2.4 m^3)
Trunk Volume	17.6 ft^3 (0.5 m^3)	18 ft^3 (0.5 m^3)	17.9 ft^3 (0.5 m^3)	18 ft^3 (0.5 m^3)
Seating Capacity	Five		Five	
	Front	**Rear**	**Front**	**Rear**
Volume	49.4 ft^3 (1.4 $m)^3$	37.9 ft^3 (1.1 m^3)	47.6 ft^3 (1.3 m^3)	37.1 ft^3 (1.1 m^3)
Head Room	38.5 in (979 mm)	37.7 in (958 mm)	37.1 in (943 mm)	36.5 in (926 mm)
Shoulder Room	53.7 in (1365 mm)	51.7 in (1313 mm)	53.7 in (1365 mm)	52.7 in (1339 mm)
Leg Room	41.3 in (1050 mm)	33.3 in (846 mm)	41.3 in (1050 mm)	33.3 in (846 mm)

1999 Golf GL and GLS, 2.0 Liter Gas or 1.9 Liter TDI Engine — USA
1999 GTI GLS, 2.0 Liter Gas Engine — USA

Body, Chassis and Suspension		
Type	Unitized construction, bolt-on front fenders	
Front Suspension	Independent MacPherson struts, coil springs, telescopic shock absorbers, integrated stabilizer bar	
Rear Suspension	Independent torsion beam axle, coil springs, telescopic shock absorbers, integrated stabilizer bar	
Service Brakes	Power assisted, dual diagonal circuits, 280 mm vented front discs and 232 mm rear discs	
Anti-lock Braking System	Standard, all 4 wheels	
Parking Brake	Mechanical, effective on rear wheels	
	Golf GL, GLS 2.0L & TDI &	**GTI GLS 2.0L**
Wheels	6 J x 15, steel, with full wheel covers, 5 bolts	6 J x 15, light alloy, 5-spoke, 5 bolts
Tires	195/65 R 15 H all season	195/65 R 15 H all season

Dimensions		
Wheelbase, in	98.9 in	(2511 mm)
Track: Front	59.6 in	(1513 mm)
Track: Rear	58.8 in	(1494 mm)
Overall Length	163.3 in	(4149 mm)
Overall Width	68.3 in	(1735 mm)
Overall Height	56.7 in	(1439 mm)

	5-speed manual		4-speed automatic	
	Gasoline	**Diesel**	**Gasoline**	**Diesel**
Curb Weight, lb	NA	NA	NA	NA
Payload, lb	NA	NA	NA	NA

Fuel Consumption (EPA Estimates)				
	5-speed manual		4-speed automatic	
	Gasoline	**Diesel**	**Gasoline**	**Diesel**
City	24 mpg (10.0 L/100 km)	42 mpg (5.6 L/100km)	22 mpg (10.5 L/100 km)	34 mpg (6.9 L/100 km)
Highway	31 mpg 7.1 L/100 km)	49 mpg (4.4 L/100 km)	28 mpg (7.7 L/100 km)	45 mpg (4.8 L/100 km)

1999 Jetta GL and GLS, 2.0 Liter Gas or 1.9 Liter TDI Engine — USA

Engine				
	Gasoline		Diesel	
Type	4-cylinder, in-line		4-cyl. inline, turbo-charged, direct injection	
Bore	3.25 in	82.6 mm	3.13 in	79.5 mm
Stroke	3.65 in	92.7 mm	3.76 in	95.5 mm
Displacement	121.1 in^3	1984cm^3	115.7 in^3	1896cm^3
Compression Ratio	10.5 : 1		19.5 : 1	
Power @ RPM	115 HP @ 5200 (85 kW @ 5200)		90 HP @ 3750 (66 kW @ 4000)	
Max. Torque @ RPM	122 lb-ft @ 2600 (165 Nm @ 2600)		149 lb-ft @ 1900 (202 Nm @ 1900)	
Fuel Requirement	Regular Unleaded		Diesel	

Engine Design		
	Gasoline	Diesel
Arrangement	Front mounted, transverse	
Cylinder Block	Cast Iron	
Crankshaft	Cast iron. 5 main bearings	Forged steel. 5 main bearings
Cylinder Head	Aluminum alloy, cross flow	
Valve train	Single over head camshaft, spur belt driven w/ semi-aut. belt tensioner, 2 valves per cylinder, maintenance free hydraulic lifters, single coil valve springs	Single over head camshaft, spur belt driven, 2 valves per cylinder, maintenance free hydraulic lifters, single coil valve springs
Lubrication	Rotary internal gear pump, crankshaft chain driven, oil cooler	Rotary gear pump, oil cooler
Cooling System	Water cooled, water pump, cross flow radiator, double thermostatically controlled electric 2-speed radiator fans	Water cooled, water pump, cross flow radiator, thermostatically controlled electric 3-speed radiator fan
Fuel/Air Supply	Sequential multi port fuel injection (Motronic)	Electronicallycontrolleddirectinjection (EDC), turbocharger
Emissions System	OBD II, 3-way catalytic converter with 2 oxygen sensors (upstream and downstream), enhanced evaporation system (California cars with secondary air injection pump) ORVR onboard refill vapor recovery system	OBD D, catalytic converter, water-cooled EGR system

Electrical System		
	Gasoline	Diesel
Alternator, Volts/Amps	14 / 70 (90 with A/C)	
Battery, Volts (Ampere-Hours)	12 (63)	12 (80)
Ignition	Digital electronic with knock sensor	Compression ignition
Firing Order	1-3-4-2	

1999 Jetta GL and GLS, 2.0 Liter Gas or 1.9 Liter TDI Engine — USA

Drive Train				
Configuration	Front-wheel drive			
Transmission Gear Ratios	**5-Speed Manual**		**4-Speed Automatic**	
	Gasoline	**Diesel**	**Gasoline**	**Diesel**
1st	3.78 : 1	3.78 : 1	2.71 : 1	N/A
2nd	2.12 : 1	2.12 : 1	1.55 : 1	N/A
3rd	1.36 : 1	1.36 : 1	1.00 : 1	N/A
4th	1.03 : 1	0.97 : 1	0.68 : 1	N/A
5th	0.84 : 1	0.76 : 1		N/A
Reverse	3.60 : 1	3.80 : 1	2.11 : 1	N/A
Final drive	4.24 : 1	3.39 : 1	4.88 : 1	N/A

Capacities	
Engine Oil (w/filter)	4.8 qt (4.5L)
Fuel Tank	14.5 gal (54.9 L)

Steering	
Type	Rack and pinion, power assisted
Turns (lock to lock)	3.2
Turning circle (curb to curb)	35.8 ft (10.9 m)

Interior Volume - SAE				
EPA Class	Compact			
	EPA			
Passenger Volume	88.0 ft^3	(2.5 m^3)		
Trunk Volume	13 ft^3	(0.4 m^3)		
Seating Capacity	Five			
	Front		**Rear**	
Volume	49.7 ft^3	(1.4 m^3)	37.9 ft^3	(1.1 m^3)
Head Room	38.7 in	(982 mm)	37.2 in	(944 mm)
Shoulder Room	53.7 in	(1365 mm)	52.9 in	(1343 mm)
Leg Room	41.3 in	(1050 mm)	33.3 in	(846 mm)

1999 Jetta GL and GLS, 2.0 Liter Gas or 1.9 Liter TDI Engine — USA

Body, Chassis and Suspension	
Type	Unitized construction, bolt-on front fenders
Front Suspension	Independent MacPherson struts, coil springs, telescopic shock absorbers, integrated stabilizer bar
Rear Suspension	Independent torsion beam axle, coil springs, telescopic shock absorbers, integrated stabilizer bar
Service Brakes	Power assisted, dual diagonal circuits, 280 mm vented front discs and 232 mm rear discs
Anti-lock Braking System	Standard, all 4 wheels
Parking Brake	Mechanical, effective on rear wheels
Wheels	6 J x 15, steel, with full wheel covers, 5 bolts
Tires	195/65 R 15 H all season

Dimensions		
Wheelbase, in	98.9 in	(2513 mm)
Track: Front	59.6 in	(1513 mm)
Track: Rear	58.8 in	(1494 mm)
Overall Length	172.3 in	(4376 mm)
Overall Width	68.3 in	(1735 mm)
Overall Height	56.9 in	(1446 mm)

	5-speed manual		4-speed automatic	
	Gasoline	**Diesel**	**Gasoline**	**Diesel**
Curb Weight, Jetta GL	2853 lb (1279 kg)	2873 lb (1303 kg)	2902 lb (1301 kg)	NA
Payload, Jetta GL	1047 lb (475 kg)	1091 lb (495 kg)	1047 lb (475 kg)	NA
Curb Weight, Jetta GLS	2862 lb (1283 kg)	2891 lb (1311 kg)	2911 lb (1305 kg)	NA
Payload, Jetta GLS	1047 lb (475 kg)	1091 lb (495 kg)	1047 lb (475 kg)	NA

Fuel Consumption (EPA Estimates)

	5-speed manual		4-speed automatic	
	Gasoline	**Diesel**	**Gasoline**	**Diesel**
City	24 mpg (10.0 L/100 km)	42 mpg (5.6 L/100 km)	22 mpg (10.5 L/100 km)	34 mpg (6.9 L/100 km)
Highway	31 mpg 7.1 L/100 km)	49 mpg (4.4 L/100 km)	28 mpg (7.7 L/100 km)	45 mpg (4.8 L/100 km)

1999 GTI, GLX — USA
1999 Jetta GLS and GLX, 2.8 Liter VR6 Engine — USA

Engine	
Type	6-cylinder, 15 degree V, gasoline
Compression Ratio	10.5 : 1
Power @ RPM	174 HP @ 5800 (128 kW @ 5800)
Max. Torque @ RPM	181 lb-ft @ 3200 (245 Nm @ 3200)
Fuel Requirement	Regular Unleaded

Engine Design	
Arrangement	Front mounted, transverse
Cylinder Block	Cast Iron
Crankshaft	Forged steel. 7 main bearings
Cylinder Head	Aluminum alloy, cross flow
Valve train	Dual over head cam shaft, chain driven, 2 valves per cylinder, maintenance free hydraulic lifters
Lubrication	Rotary gear pump, oil cooler
Cooling System	Water cooled, water pump, cross flow radiator, thermostatically controlled electric 3-speed radiator fan
Fuel/Air Supply	Sequential multi port fuel injection (Motronic), electronic throttle, variable intake manifold
Emissions System	OBD II, 3-way catalytic converter with 2 oxygen sensors (upstream and downstream), enhanced evaporation system, secondary air injection pump, ORVR onboard refill vapor recovery system

Electrical System	
Alternator, Volts/Amps	14 / 70 (90 with A/C)
Battery, Volts (Ampere-Hours)	12 (63)
Ignition	Digital electronic with knock sensor
Firing Order	1-5-3-6-2-4

Drive Train		
Configuration	Front-wheel drive with EDL traction control	
Transmission Gear Ratios	**5-Speed Manual**	**4-Speed Automatic**
1st	3.62 : 1	2.71 : 1
2nd	2.07 : 1	1.44 : 1
3rd	1.47 : 1	1.00 : 1
4th	1.04 : 1	0.74 : 1
5th	0.84 : 1	
Reverse	3.17 : 1	2.88 : 1
Final drive	3.39 : 1	4.27 : 1

1999 GTI, GLX — USA
1999 Jetta GLS and GLX, 2.8 Liter VR6 Engine — USA

Capacities	
Fuel Tank	14.5 gal (54.9 L)

Steering	
Type	Rack and pinion, power assisted
Turning circle (curb to curb)	35.8 ft (10.9 m)

Interior Volume - SAE				
EPA Class	Compact			
			EPA	
Passenger Volume	84.7 ft^3	(2.4 m^3)	88 ft^3	(2.5 m^3)
Trunk Volume	13.2 ft^3	(0.4 m^3)	13 ft^3	(0.4 m^3)
Seating Capacity	Five			
	Front		Rear	
Volume	47.5 ft^3	(1.4 m^3)	37.2 ft^3	(1.1 m^3)
Head Room	37.0 in	(939 mm)	36.5 in	(926 mm)
Shoulder Room	53.7 in	(1365 mm)	52.9 in	(1343 mm)
Leg Room	41.3 in	(1050 mm)	33.3 in	(846 mm)

Body, Chassis and Suspension			
Type	Unitized construction, bolt-on front fenders		
Front Suspension	Independent MacPherson struts, coil springs, telescopic shock absorbers, integrated stabilizer bar		
Rear Suspension	Independent torsion beam axle, coil springs, telescopic shock absorbers, integrated stabilizer bar		
Service Brakes	Power assisted, dual diagonal circuits, 288 mm vented front discs and 232 mm rear discs		
Anti-lock Braking System	Standard, all 4 wheels		
Parking Brake	Mechanical, effective on rear wheels		
	GTI GLX	Jetta GLS	Jetta GLX
Wheels	6 1/2 J x 16, 6-spoke alloy (Montreal)	6 J x 15, steel, with full wheel covers, 5 bolts	6 J x 15, light alloy, 5-spoke, 5 bolts
Tires	205/55 R 16 H all season	195/65 R 15 H all season	195/65 R 15 H all season

1999 GTI, GLX — USA
1999 Jetta GLS and GLX, 2.8 Liter VR6 Engine — USA

Dimensions				
	GTI GLX		Jetta GLS, GLX	
Wheelbase	98.9 in	(2511 mm)	98.9 in	(2513 mm)
Track: Front	59.6 in	(1513 mm)	59.6 in	(1513 mm)
Track: Rear	58.8 in	(1494 mm)	58.8 in	(1494 mm)
Overall Length	163.3 in	(4149 mm)	172.3 in	(4376 mm)
Overall Width	68.3 in	(1735 mm)	68.3 in	(1735 mm)
Overall Height	56.7 in	(1439 mm)	56.9 in	(1446 mm)
	5-speed manual	4-speed auto	5-speed manual	4-speed auto
Curb Weight	NA	NA	2994 lb (1358 kg)	3043 lb (1380 kg)
Payload	NA	NA	1003 lb (455 kg)	992 lb (450 kg)

Fuel Consumption (EPA Estimates)						
	5-speed manual			4-speed automatic		
	GTI GLX	Jetta GLS	Jetta GLX	GTI GLX	Jetta GLS	Jetta GLX
City	20 mpg (11.7 L/ 100 km)	19 mpg (12.1 L/ 100 km)	19 mpg (12.1 L/ 100 km)	NA	19 mpg (12.6 L/ 100 km)	19 mpg (12.6 L/ 100 km)
Highway	28 mpg (7.6 L/100 km)	26 mpg (7.7 L/100 km)	26 mpg (7.7 L/100 km)	NA	28 mpg (8.4 L/ 100 km)	28 mpg (8.4 L/ 100 km)

0

0 Maintenance

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GENERAL

All of the maintenance work described in this repair group is important and should be carried out at the specified time or mileage interval. The Owner's Manual, the Maintenance Record, and the Warranty Booklet originally supplied with the car contain the maintenance schedules that apply to your Volkswagen. Following these schedules will ensure safe and dependable operation. In addition, many of the maintenance procedures are necessary to maintain warranty protection.

NOTE —

Volkswagen is constantly updating their recommended maintenance procedures and requirements. The information contained here may not include updates or revisions made by Volkswagen since publication of the Owner's Manual, the Maintenance Record, and the Warranty Booklet supplied with the car. If there is any doubt about what procedures apply to a specific model or model year, or what intervals should be followed, remember that an authorized Volkswagen dealer has the latest maintenance information.

CAUTION —

Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using a VAG 1551/1552 or equivalent scan tool.

HOW TO USE THIS MANUAL

The manual is divided into 10 main sections, or partitions:

0 Maintenance
1 Engine
2 Engine Management, Exhaust, and Engine Electrical
3 Clutch, Transmission, and Final Drive
4 Suspension, Brakes, and Steering
5 Body–Assembly
6 Body–Components and Accessories
7 Body–Interior Trim
8 Heating and Air Conditioning
9 Electrical System

0 Maintenance covers the recommended schedules and service procedures needed to do the Volkswagen-specified scheduled maintenance work.

The remaining nine partitions (1 through 9) are repair oriented and are broken down into individual repair groups.

Some main partitions begin with a general information group, e.g. **1 General Information.** These general groups are mostly descriptive in nature, covering topics such as theory of operation and troubleshooting. The remainder of the repair groups contain the more involved and more detailed system repair information.

A master listing of the 10 partitions and the corresponding specific repair groups can be found on the inside front cover of the manual.

At the end of the manual is a table that describes many of the various Diagnostic Trouble Codes (DTCs) that can be retrieved using a Volkswagen VAG 1551/1552 scan tool or VAS 5051 diagnostic tool. This table also lists the various scan tool codes for generic aftermarket scan tools (P-codes). See **Scan Tool** section at back of repair manual.

Thumb tabs are used on the first page of each repair group page to help locate the groups quickly. Page numbers throughout the manual are organized according to the repair group system. For example, you can expect to find information on engine removal and installation (Repair Group 10) beginning on page 10-1. A comprehensive **Index** can be found on the last pages of the manual.

Warnings, Cautions and Notes

Throughout this manual are many passages with the headings **WARNING**, **CAUTION**, or **NOTE**. These very important headings have different meanings.

> ***WARNING —***
> *The text under this heading warns of unsafe practices that are very likely to cause injury, either by direct threat to the person(s) doing the work or by increased risk of accident or mechanical failure while driving. Warnings are always contained in a box.*

> ***CAUTION —***
> *A caution calls attention to important precautions to be observed during the repair work that will help prevent accidentally damaging the car or its parts. Cautions are always contained in a box.*

NOTE —
A note contains helpful information, tips that will help in doing a better job and completing it more easily.

Please read every **WARNING**, **CAUTION**, and **NOTE** at the front of the manual and as they appear in repair procedures. They are very important. Read them before you begin any maintenance or repair job.

Some **WARNING**s and **CAUTION**s are repeated wherever they apply. Read them all. Do not skip any. They are important, even to the owner who never intends to work on the car.

Work Safety

Although an automobile presents many hazards, common sense and good equipment can help ensure safety. Many accidents happen because of carelessness. Pay attention and stick to these few important safety rules.

WARNING —

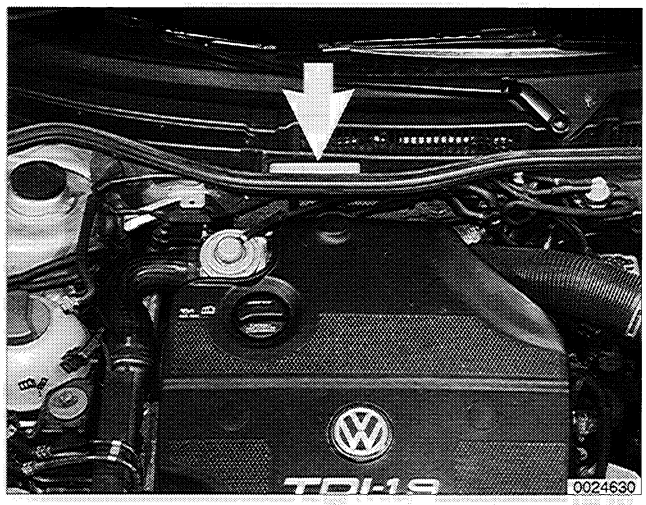
- *Never run the engine in the work area unless it is well-ventilated. The exhaust should be vented to the outside. Carbon Monoxide (CO) is an odorless and colorless gas that can kill.*
- *Remove all neckties, scarfs, loose clothing, and jewelry when working near running engines or power tools. Tuck in shirts. Tie long hair and secure it under a cap. Severe injury can result from these things being caught in rotating parts.*
- *Remove rings, watches, and bracelets. Metallic jewelry conducts electricity and may cause shorts, sparks, burns, or damage to the electrical system when accidentally contacting the battery or other electrical terminals.*
- *Disconnect the battery negative (–) (GND) cable whenever working on or near the fuel system, airbag system or anything that is electrically powered. Accidental electrical contact may damage the electrical system, cause fire, or result in serious personal injury.*
- *Never work under a lifted car unless it is solidly supported on jack stands that are intended for that purpose. Do not support a car on cinder blocks, bricks, or other objects that may shift or crumble under continuous load. Never work under a car that is supported only by a jack.*
- *The fuel system retains pressure even when the ignition is off. Loosen the fuel lines very slowly to allow the residual pressure to dissipate gradually. Cover fittings with a suitable shop cloth to avoid spraying fuel.*
- *Fuel is highly flammable. When working around fuel, do not smoke or work near fire hazards. Keep an approved fire extinguisher handy. Be aware that water and building heaters may have standing pilot lights.*
- *Illuminate the work area adequately and safely. Use a portable safety light for working inside or under the car. A fluorescent type light is best because it gives off less heat. If using a light with a normal incandescent bulb, use rough service bulbs to avoid breakage. The hot filament of a broken bulb can ignite spilled fuel or oil.*
- *Keep sparks, lighted matches, and open flame away from battery. Hydrogen gas emitted by the battery is highly flammable. Any nearby source of ignition may cause the battery to explode.*
- *Never lay tools or parts in the engine compartment or on top of the battery. They may fall and be difficult to retrieve, become caught in belts or other rotating parts, or cause electrical shorts and damage to the electrical system.*



IDENTIFICATION PLATES AND LABELS

Vehicle Identification Number (VIN)

The vehicle year and model can be determined from the VIN or the identification plate. The VIN (Chassis number) (**arrow**) is located on the instrument panel on the driver's side and is visible from the outside through the windshield. See **Foreword** in the front of this manual for detailed VIN information.



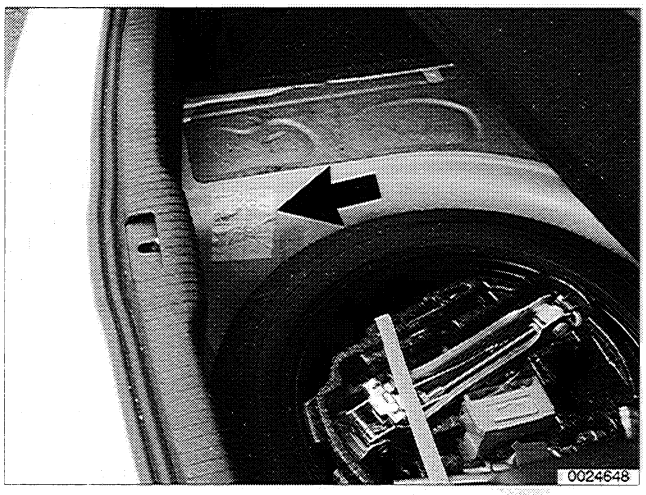
The VIN (**arrow**) is also located in the plenum chamber and is visible through an opening in the plenum cover.

NOTE —

Additional information on the 17 digit VIN is given in the Foreword on page vi, at the front of the manual.



The door pillar certification sticker (**arrow**) lists the full VIN, vehicle weight ratings, production date and emission compliance certification. Above this sticker is the airbag warning label.



The vehicle data (**arrow**) plate is located in the luggage compartment on the right side of the spare tire recess. The data plate contains the following vehicle information:

1. **Production control number**
2. **Vehicle identification number**
3. **Model identification number**
4. **Model explanation/engine output**
5. **Engine and transmission code letters**
6. **Paint number/interior equipment identification number**
7. **Optional equipment identification numbers**

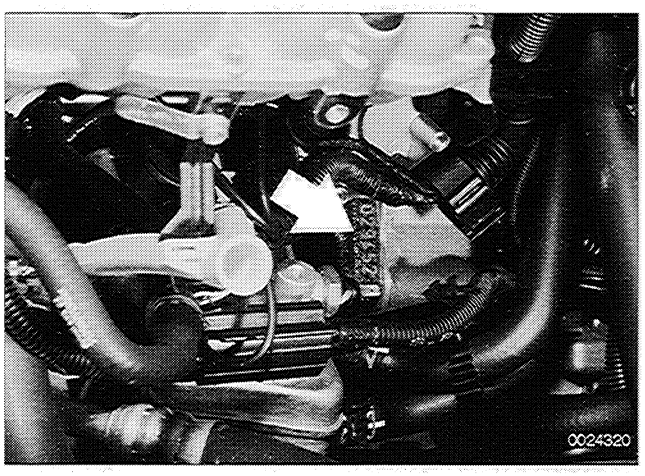
Additional vehicle identification information can also found on a sticker attached to the driver's side door post.

Engine identification

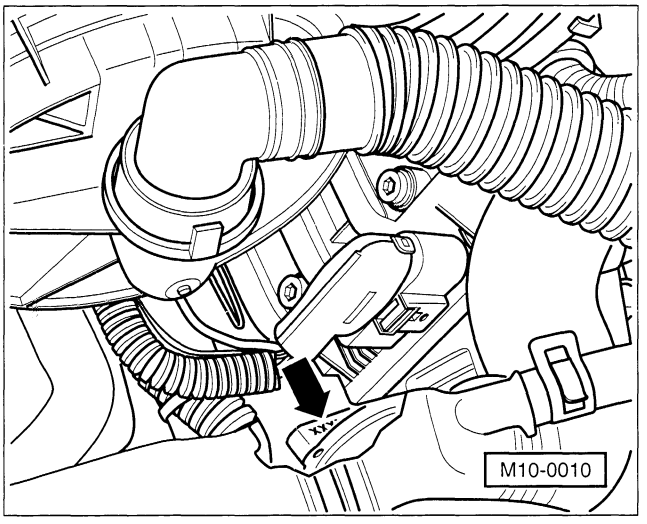
The engines used in vehicles covered by this manual are identified by a three letter code followed by a six digit number such as: AEG 029 452. The engine code and the engine number are located on the engine block.

Engine Codes

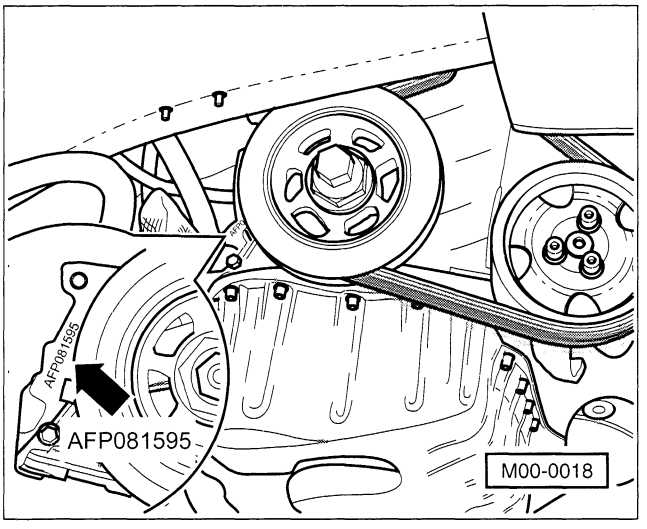
- AWD, AWW, AWP . . . 1.8L 4-cylinder turbo gasoline
- ALH . . . . . 1.9L 4-cylinder turbo diesel
- BEW. . . . . 1.9L 4-cylinder TDI-PD diesel
- AEG, AVH, AZG, BBW, BEV 2.0L 4-cylinder gasoline
- AFP, BDF . . . . . .2.8L 6-cylinder gasoline



4-cylinder engine code letters and numbers (**arrow**) are located at the rear of the cylinder block. This information is stamped into the cylinder block casting near the oil filter flange close to the joint between the engine and transmission.



6-cylinder (through 06.26.99 production) engine code is located on the left side of the engine block below the camshaft timing chain tensioner.

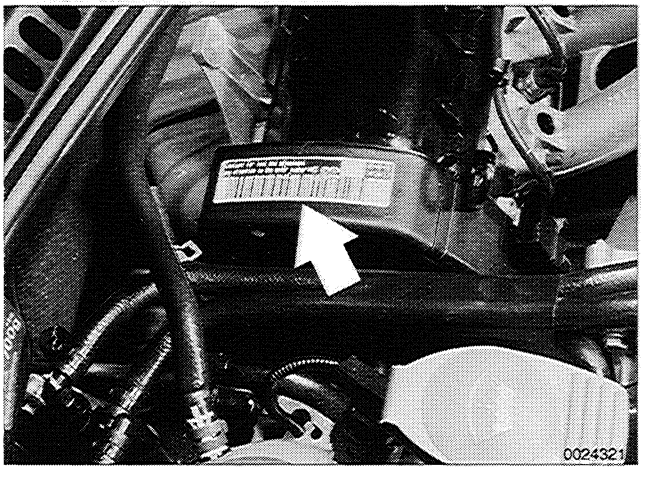


6-cylinder (from 06.27.99 production; from engine #AFP-019059) engine code is located on engine block next to vibration damper.

- **AFP** engine shown, **BDF** engine code is located in the same position as shown at left.

Engine code

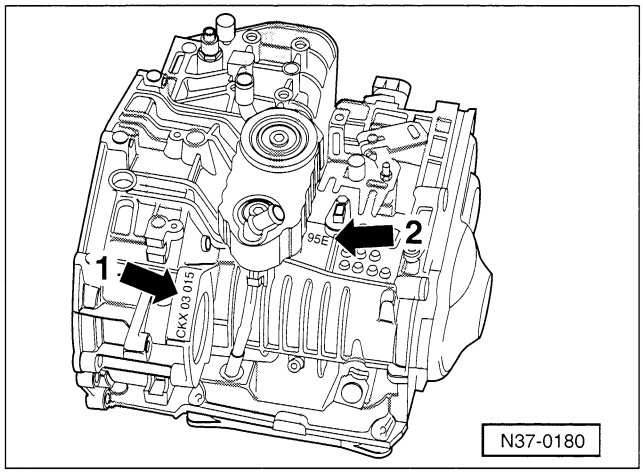
- AFP 12-valve VR6
- BDF 24-valve VR6



Additionally, in most cases, the engine codes can be found on a sticker (**arrow**) on the back of the intake manifold upper section or on the upper section of the toothed belt guard.

Transmission identification

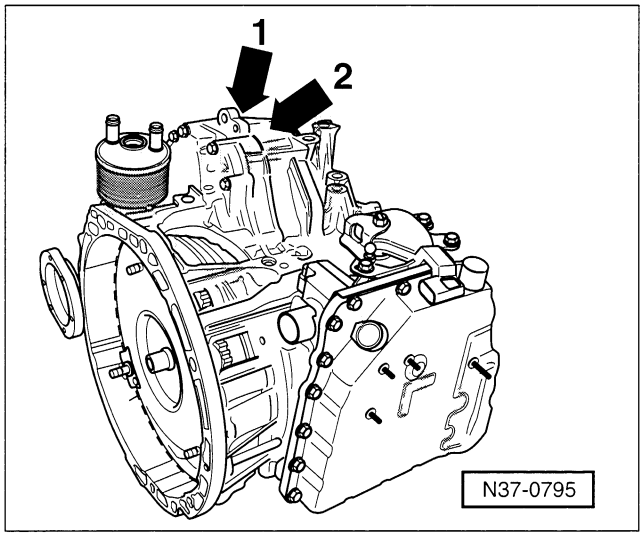
The transmissions used in vehicles covered by this manual are identified by a three letter code followed by a five digit number such as: DQY 17078. The digits indicate the transmission build date and all transmissions built on any given day will have the same number. Four transmissions types are available; a 4- or 5-speed automatic or a 5- or 6-speed manual. Each transmission type comes in numerous versions, depending on engine type. For a listing of the various transmission codes and specifications see **34 Manual Transmission** or **37 Automatic Transmission**.



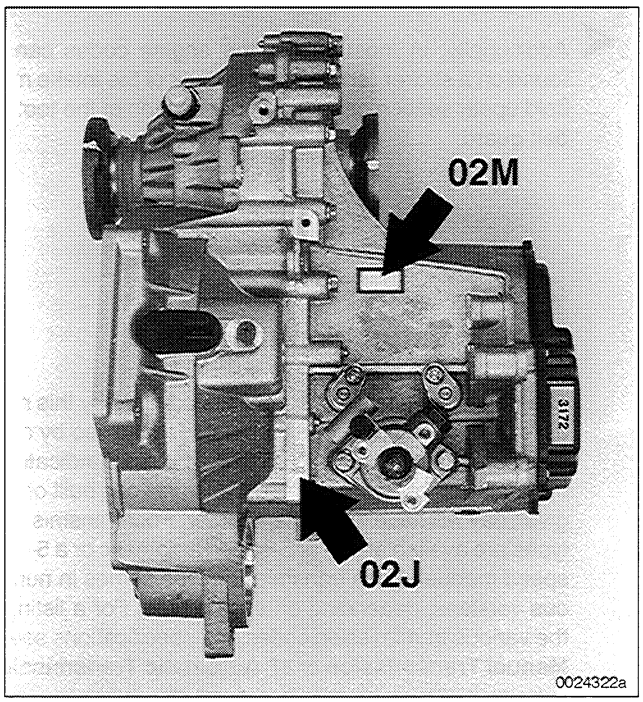
Transmission Codes

- 01M . . . . . 4-speed automatic
- 09A. . . . . 5-speed automatic
- 02J . . . . . 5-speed manual
- 02M . . . . . .5- or 6-speed manual

Transmission code (**arrow 1**) stamped into machined area of case for 4-speed automatic transmissions (01M). Other numbers (**arrow 2**) may be cast into the case but are not relevant to the code.



Transmission code (**arrow 1**) stamped into machined area of case for 5-speed automatic transmissions (09A). Other numbers (**arrow 2**) may be cast into the case but are not relevant to the code.



Transmission code for 5- and 6-speed manual transmissions (**arrows**) stamped into machined areas of case as indicated.

TOWING

Emergency towing with commercial equipment

The following information is to be used by commercial tow truck operators who know how to operate their equipment safely. To prevent damage to the vehicle, read and understand all of the following information before proceeding.

WARNING —

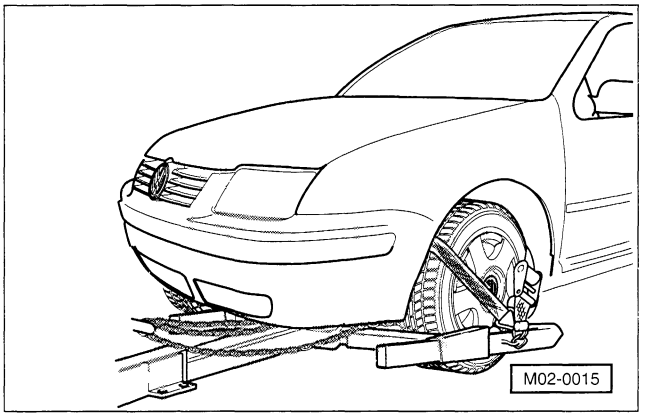
- *Never allow passengers to ride in a towed vehicle for any reason.*
- *The vehicles covered by this manual cannot be towed with conventional sling-type equipment or non-self-loading wheel dollies. Towing with this type of equipment will cause bumper and body panel damage.*
- *If an automatic transmission vehicle cannot be towed with wheel lift equipment in combination with self-loading wheel dollies, it must be transported with a car carrier (flatbed) to avoid damage to the transmission due to lack of lubrication.*
- *To reduce the risk of accident and serious personal injury, always stay within manufacturer's rated equipment capacities. Exceeding manufacturer's design specifications is dangerous.*

- Whenever possible, tow with the front wheels off the ground.
- The vehicle may be lifted at the rear and moved a short distance to a better position for front wheel lifting.
- If a vehicle with a manual transmission must be towed with the front wheels on the ground, make sure that the transmission oil has not leaked out or been drained.
- If a vehicle is to be towed on its drive wheels, the transmission and differential MUST be operable. Place the transmission in NEUTRAL.
- If any doubt exists about the condition of the transmission or differential, tow the vehicle with the drive wheels lifted, use self-loading wheel dollies or wheel lift equipment.
- Excessive towing speeds and distances may damage both manual and automatic transmissions.
- Move the vehicle only within the recommended speeds and distances.
- During any tow, the raised wheels can contact the road or other ground surfaces, so they need to rotate freely.
- The anti-theft steering column lock is not strong enough to withstand shocks transmitted from the wheels while towing. Before towing, always unlock the steering wheel with the ignition key and secure the steering wheel with a steering wheel clamp which has been specifically designed for towing service.

Emergency towing with commercial equipment (continued)

- To reduce the risk of serious personal injury and vehicle damage, never attempt to rock or pivot the vehicle on jack stands to allow positioning on the dolly.
- Always release the parking brake.
- When the ignition key is not available, DO NOT tow from the rear or serious damage to vehicle systems will result.
- The front of the vehicle must be lifted to prevent damage to the steering column anti-theft lock.
- To reduce the risk of accident and serious injury, never tow any vehicle at a speed in excess of 50 mph for any reason whenever towing with a conventional tow truck, with or without the use of a self-loading wheel dolly.
- Safe operating speeds always depend on weather, road, traffic, visibility; as well as condition of towed vehicle.
- A tow truck is an emergency vehicle to be used to move disabled vehicles to a suitable place of repair. It must not be used for transporting vehicles long distances.
- Towed vehicles should be raised until lifted wheels are a minimum of 6 inches from the ground and there is adequate clearance at opposite end of lifted vehicle.
- Always inspect points of attachment to the disabled vehicle. If they appear to be damaged or deteriorated, select other attachment points at a substantial structural member of the frame.
- Never allow the fuel tank to support any of the vehicle's weight during towing. Before moving the vehicle, carefully secure or remove any loose or protruding parts of damaged vehicles; such as hoods, fenders, trim, etc.
- To avoid serious vehicle damage, never lift or tow any vehicle by attaching towing chains or hooks to shock absorbers, stabilizer bars, or front strut rods.
- Never go under the vehicle while it is lifted by the towing equipment, unless the vehicle is adequately supported by safety stands.
- The safety of the operator and all others in the vicinity of the wrecker or the towed vehicle must be the first consideration at all times during a towing operation.

Vehicle hook-up, front



– Attach wheel lift equipment to wheels.

➤ Attach safety straps to wheels.

– Attach safety chains to lower control arms.

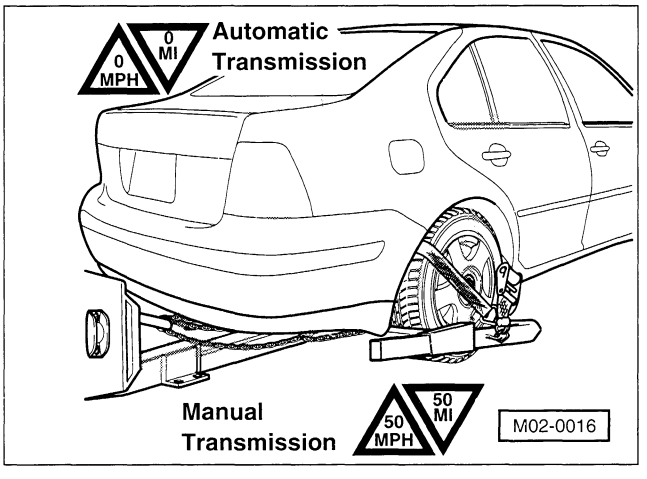
NOTE —

- *Always use a safety chain system which is completely independent of the primary lifting and towing attachments.*
- *During installation of safety chains, be careful not to damage lights, bumpers, or painted surfaces.*
- *To prevent damage to brake lines and front driveshaft boots, always position hooks and chains cautiously to prevent damage to these components.*
- *Prior to towing the vehicle, ensure that all attachment points are firmly secured.*
- *Towing clearance: 6-12 inches between tires and ground.*

Vehicle hook-up, rear

WARNING —

- *Do not tow cars with automatic transmission from the rear.*
- *Do not tow cars with manual transmission from the rear unless transmission is in neutral and ignition is unlocked. Secure steering wheel with a steering wheel clamp which has been specifically designed for towing service.*



– Attach wheel lift equipment to wheels.

➤ Attach safety straps to wheels.

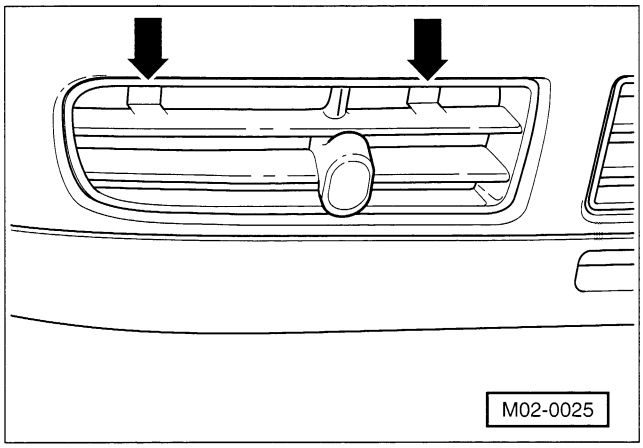
– Attach safety chains to axle beam.

NOTE —

Observe all notes associated with front vehicle hook-up.

Towing eyes

To be able to pull or be pulled, a towing eye must be threaded into the mount at right front of vehicle. The detachable towing eye is in the vehicle tool kit.



➤ Pry off towing eye cover at **arrows** from right front section of bumper with flat blade screwdriver.

– Thread towing eye fully into mount and tighten with wheel lug wrench.

– After use, unscrew towing eye and return to vehicle tool kit.

– Reinstall cover.

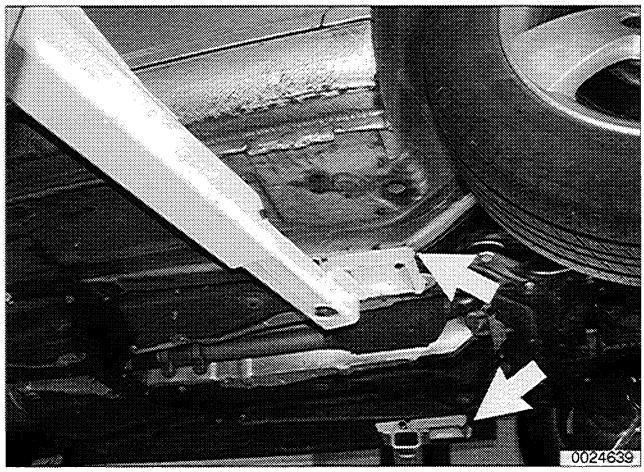
NOTE —
The rear towing eye is welded to the vehicle and is located under rear bumper on right side.

LIFTING VEHICLE

Lifting with hoist or floor jack

The vehicle may be raised for service and repairs by floor jacks and/or hoists. For repairs that require raising the vehicle, proper jacking points must be used. There are four jack points, two on each side of the car, marked by indentations in the lower panel sheet metal just behind the front fender or just in front of rear fender. If using a hoist, similar lift points are just inboard of the aforementioned indentations.

Lifting points



➤ To lift the front of vehicle, place floor jack or hoist under frame member (**arrows**) as shown.



➤ To lift the rear of vehicle, use appropriate rear lifting points (**arrow**).

> ***WARNING —***
> *Do not lift vehicle at engine oil pan, transmission, or on front or rear axle as serious damage may result.*

- Place car on a flat level area with a surface capable of supporting jacks and jackstands, e.g. concrete.
- Block the wheels to prevent the car from rolling.
- Place the jack or hoist at proper lifting points as shown previously.
- Operate the jack or hoist and raise the car slowly. If working under the car, support the weight of the car using jack stands.

> ***WARNING —***
> • *If work is to be performed under vehicle it must be supported by suitable jack stands.*
>
> • *Vehicle may only be lifted at points indicated in order to avoid damaging vehicle floor pan and to prevent the vehicle from tipping.*
>
> • *Never start engine and engage a gear with vehicle lifted if any drive wheel has contact with the floor! (There is danger of an accident if this is not observed).*
>
> • *Before driving on to a vehicle hoist, ensure there is sufficient clearance between low lying vehicle components and the hoist platform.*

Working under the vehicle

When working under any vehicle, the following points should be observed:

- Disconnect the negative (GND) battery cable so that no one else can start the car. Let others know that you will be under the vehicle.
- Place at least two jack stands under the car. A jack is a temporary lifting device and should not be used alone to support the car while you are under it. Use positively locking jack stands that are designed for the purpose of supporting a car.
- If you are using a hoist, be sure that the safety locks are engaged and that the weight of the vehicle is resting on the locks, not the hydraulic system.

– Lower the car slowly until its weight is fully supported by the jack stands or hoist. Watch to make sure that jack stands do not tip or lean as the car settles on them, and that jack stands and hoist arms are placed solidly and will not move.

> ***WARNING —***
> *Check to make sure vehicle is stable before working under car.*

– Observe all jacking precautions again when raising the car to remove the jack stands.

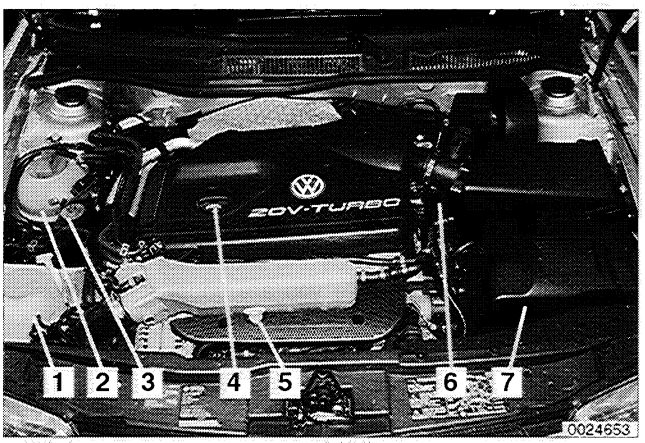
ENGINE COMPARTMENT MAINTENANCE

The jobs listed under this heading are the engine compartment maintenance items from the maintenance tables. Use the under-hood illustrations as references.

Visually inspect engine and engine compartment for leaks and damage. Also inspect lines, hoses, and the connections for the fuel system, brake system, cooling system, heating and air conditioning system for leaks, worn areas, porosity, and deterioration.

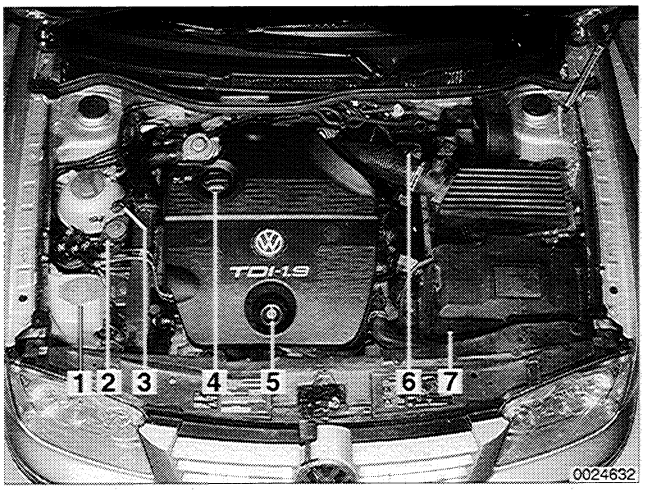
Fluid levels must also be between specified MIN and MAX marks on the appropriate reservoirs and tanks.

The following illustrations show representative engine compartment layouts for the major engine types. There are minor differences between model years, such as engine sound absorber configuration, but these slight variations will be readily apparent and understood.



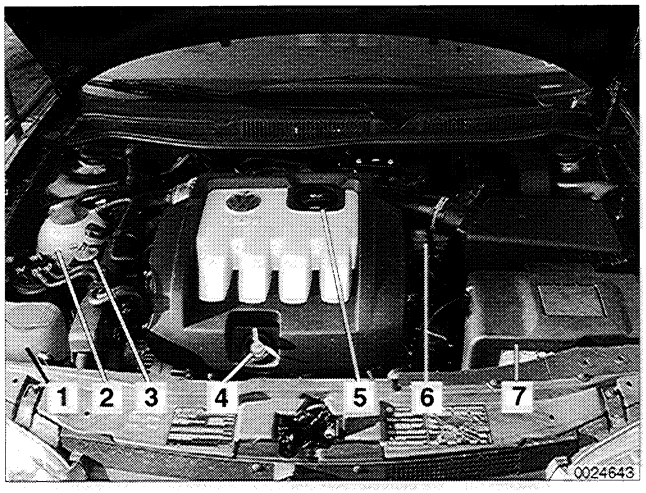
1.8 liter 20-valve 4-cylinder (code: AWD, AWW, AWP)

1. Windshield washer tank
2. Coolant expansion tank
3. Power steering fluid reservoir
4. Engine oil filler cap
5. Engine oil dipstick
6. Brake fluid reservoir
7. Battery (under trim cover)



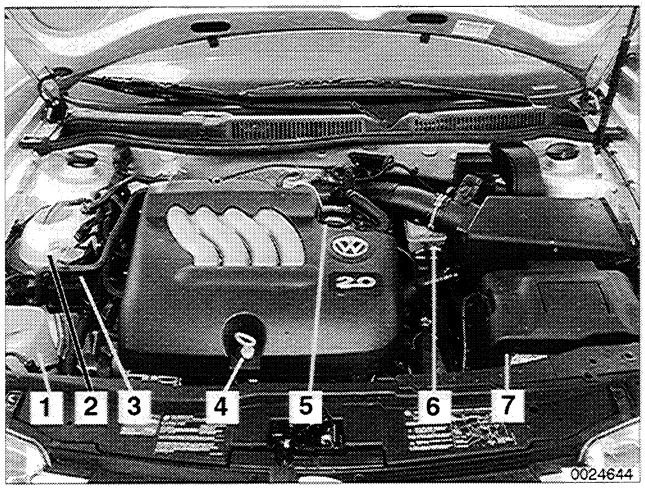
1.9 liter 4-cylinder TDI Diesel (code: ALH)

1. Windshield washer tank
2. Power steering fluid reservoir
3. Coolant expansion tank
4. Engine oil filler cap
5. Engine oil dipstick
6. Brake fluid reservoir
7. Battery (under trim cover)



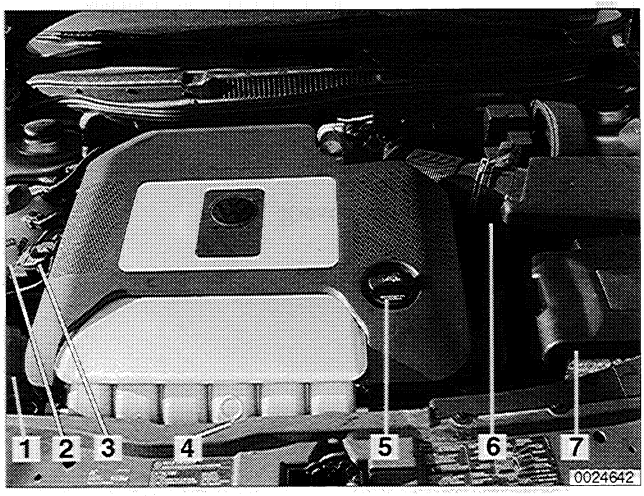
1.9 liter 4-cylinder PD Diesel (code: BEW)

1. Windshield washer tank
2. Coolant expansion tank
3. Power steering fluid reservoir
4. Engine oil dipstick
5. Engine oil filler cap
6. Brake fluid reservoir
7. Battery (under trim cover)



2.0 liter 4-cylinder (code: AEG, AVH, AZG, BBW, BEV)

1. Windshield washer tank
2. Coolant expansion tank
3. Power steering fluid reservoir
4. Engine oil dipstick
5. Engine oil filler cap
6. Brake fluid reservoir
7. Battery (under trim cover)

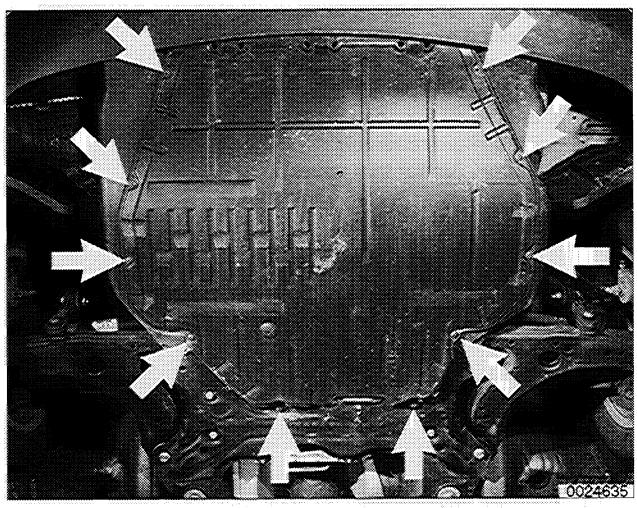


2.8 liter 24-valve VR6 (code: BDF)

1. **Windshield washer tank**
2. **Coolant expansion tank**
3. **Power steering fluid reservoir**
4. **Engine oil dipstick**
5. **Engine oil filler cap**
6. **Brake fluid reservoir**
7. **Battery (under trim cover)**

NOTE —

The early 2.8L engine (code: AFP) is similar to the later 2.8L engine (code: BDF) shown at left. Refer to illustration #0024645 given later, for AFP engine cover removal.

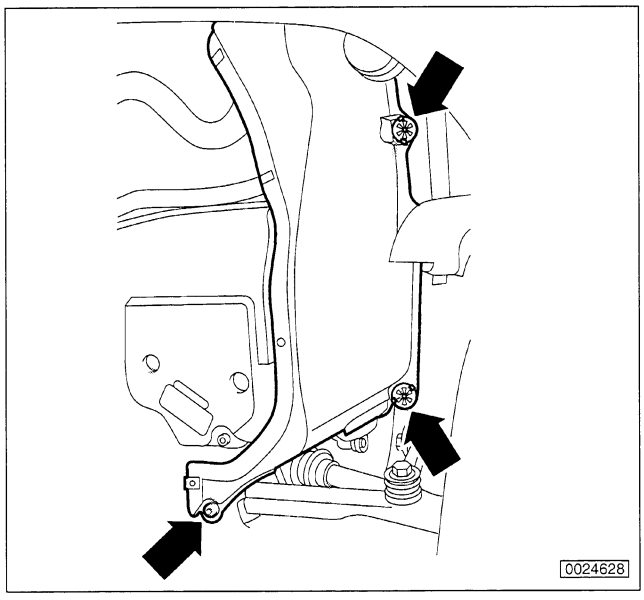


Sound absorber panels, removing and installing

Remove bolts (**arrows**) and pull lower sound absorber panels (belly pan) from below the engine to access lower engine and transmission components.

NOTE —

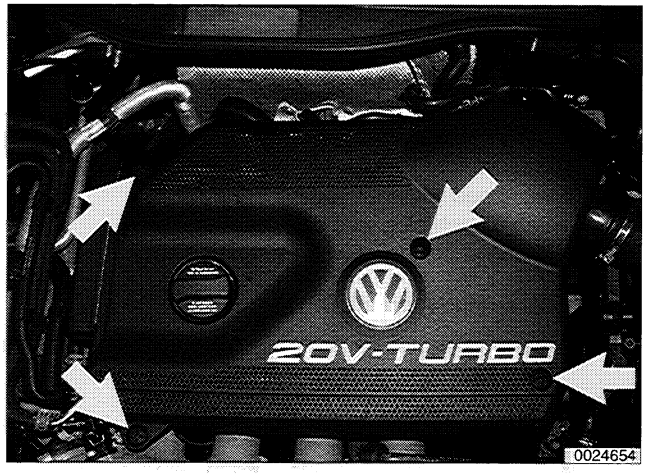
The sound absorber panels shown at left are for the ALH 1.9L diesel engine. For a more specific diagrams of gasoline engine sound absorber panels, see **50 Body–Front**.



Remove right and left side sound absorber panels by unthreading flat speed nuts (**arrows**) and pulling panel down. Drivers side shown, passenger side similar.

NOTE —

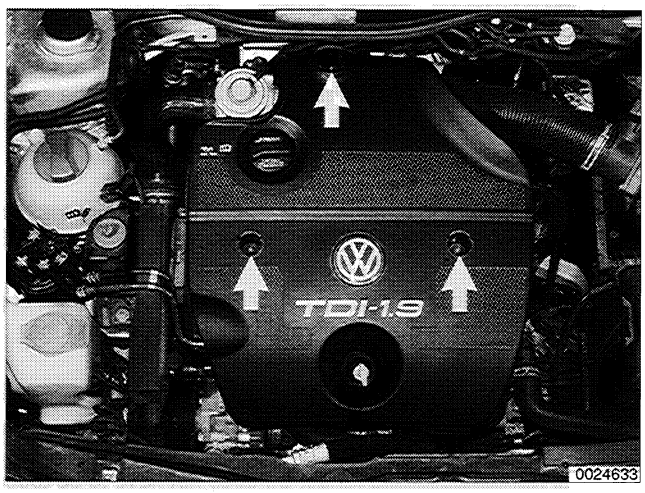
Speed nuts can be removed and installed with the aid of long-nosed plier jaws inserted into small holes near the edges.



– Remove upper engine cover.

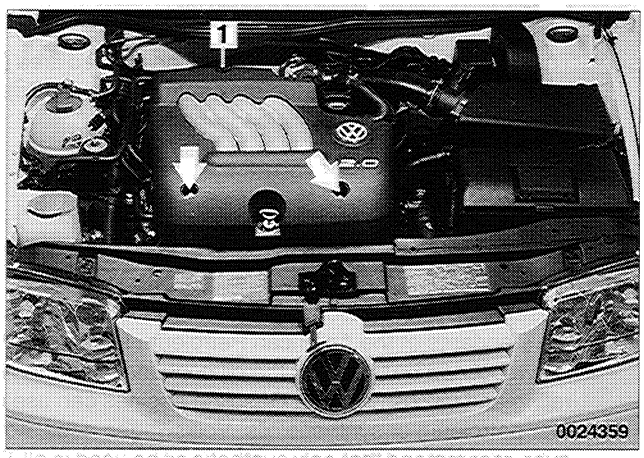
1.8L engine

- Release locking pins (**arrows**) for engine cover by turning 90°. Remove engine cover.



1.9L TDI engine

- Remove dipstick
- Remove small round plastic nut covers and mounting nuts (**arrows**). Pull off engine cover.

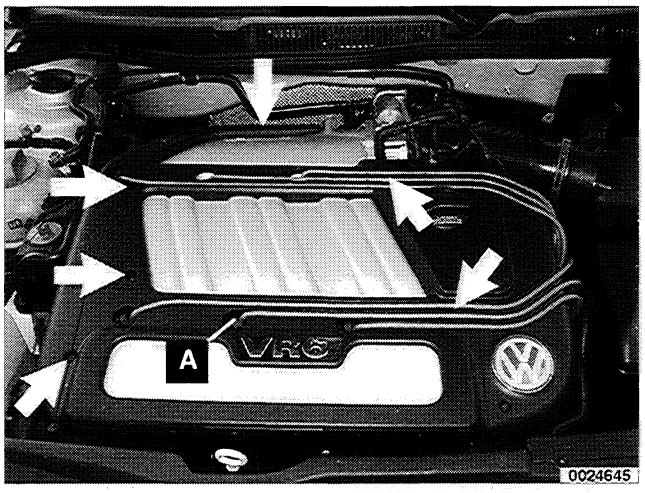


2.0L engine

- Remove dipstick
- Remove plastic covers (**arrows**) and mounting nuts underneath. Remove nut (**1**) and pull off engine cover.

NOTE —

On later model 2.0L engines, with only a retaining nut at the back of the engine cover, first remove the oil dipstick. Then grasp the engine cover with both hands at the sides, towards the front, and lift up and then slide the cover forward towards the radiator and out of the rear retaining nut grommet.



➤ **2.8L engine (code AFP)**

- Remove spark plug wires with VW special tool, T10029, or equivalent. On some models the plug wires have an attached loop handle (**A**) that can simply be pulled on to remove the plug wire from the spark plug. Special tool T10029 is not required for plug wires equipped with the loop handles.
- Label each plug wire and place to side.
- Remove nuts (**arrows**) and engine cover.

– **2.8L engine (code: BDF)**

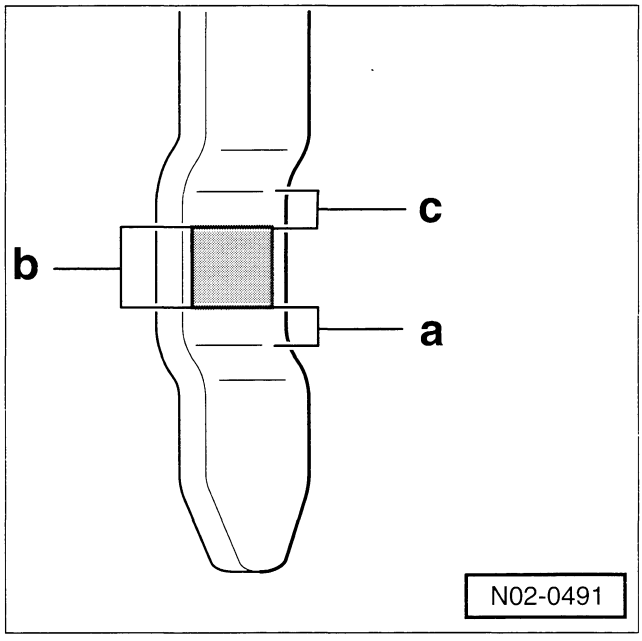
- Remove engine cover by pulling off in an upward direction.

Engine oil level, checking

It is normal for your engine to consume a small amount of oil. The rate of consumption will depend on the quality and viscosity of the oil and operating conditions. Make it a habit to check oil level at every fuel filling.

– After switching ignition OFF, wait at least 3 minutes to allow the oil to flow back into the oil pan.

– Remove dipstick located in front of intake manifold. Wipe dipstick with a clean cloth and fully re-insert into tube.



➤ Remove dipstick again and read oil level.

a. MIN mark. Oil must be topped off. After topping off, level is correct when it is within the area (b).
b. Normal operating range. Oil does not have to be topped off.
c. MAX mark. Oil must not be topped off.

The oil level can be at the top edge of the shaded area (**b**) but on no account above the maximum level mark (**c**). If oil level is at or below (**a**), fill to top mark.

> ***WARNING —***
> *Risk of damage to the catalytic converter if oil level is too high.*

Observe oil specifications! Select an oil that conforms to the standards of the American Petroleum Institute (API). A symbol can be found on the oil container with the API rating and viscosity grade. Gasoline engines can use either petroleum or synthetic oils. Volkswagen does, however, recommend that only synthetic oil be used in all TDI diesel engines.

Pay particular attention to oil requirements of the PD-TDI engine (code BEW). Oil must meet Volkswagen specification VW 505.01. If this specification is not specifically marked on the container, it is not suitable for use in this engine.

Engine oil, changing

– Warm car to normal operating temperature.

– Shut off engine and apply parking brake.

– Raise car and support on jackstands designed for the purpose.

> ***WARNING —***
> *Jack stands should be placed on hard level surface (e.g. concrete).*

– Remove lower sound absorber panel (belly pan) from beneath engine compartment. Remove drain plug from oil pan and allow oil to drain. See **17 Engine—Lubrication System** for drain plug location.

> ***WARNING —***
> *Hot oil can scald. Wear protective clothing, gloves and eye protection.*

NOTE —

- *Always replace oil-drain plug sealing ring anytime the drain plug is removed.*
- *On 6-cylinder engines an additional oil drain plug is located in oil filter cap. See* **Engine oil filter, replacing (6-cylinder engine)**.
- *Dispose of oil properly at a facility equipped for recycling or storage.*

– Replace oil filter. See **Engine oil filter, replacing** for applicable engine.

– Install new oil drain plug with seal. Tighten drain plug to proper torque.

NOTE —

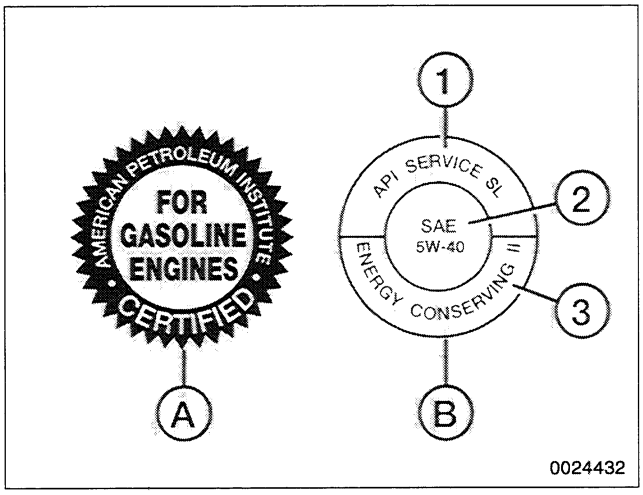
- *The oil drain plug seal (single-use copper "crush-style" washer) is supplied installed on replacement drain plugs. The seal can be cut off from the old drain plug and replaced with a new seal, thereby eliminating the need to replace the oil drain plug with every oil change.*
- *Replace oil drain plug seal with one of the same size as the original.*

Tightening torque

- Oil drain plug to oil pan
  - 4-cylinder . . . . . 30 Nm (22 ft-lb)
  - 6-cylinder . . . . . 30 Nm (22 ft-lb)



Fill engine with oil of proper viscosity and rating as described below. Volkswagen oil VW 505.01 shown.

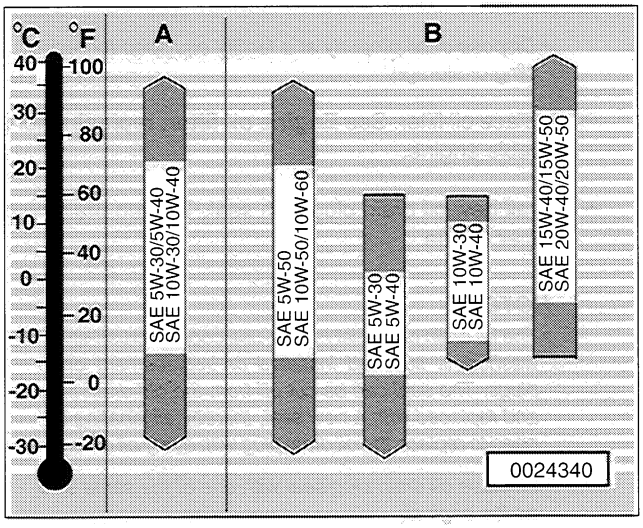


Oil for use in Volkswagen engines in the USA and Canada should display a label with this information:

A. American Petroleum Institute (API) Certification "starburst" label, indicates that oil meets gasoline engine certification requirements.
B. API application and information "donut" label.
1. Indicates type of engine and service classification.
2. Viscosity per Society of Automotive Engineers (SAE) standards.
3. Oil passes tests to certify energy conserving properties.

Recommended engine oils

- Gasoline engines (through model year 2003)
  Industry specification . . . . . API: SJ or SL
  ACEA: A2 or A3
  VW specification . . . . . 502 00, 501 01 or 500 00
- Diesel engines (through model year 2003)
  Industry specification . . . . . API: CF4 or CG4
  ACEA: B3 or B4
  VW specification . . . . . VW 505 00
- Gasoline engines (from model year 2004)
  Industry specification . . . . . API: SJ or SL
  ACEA: A3
  VW specification . . . . . 502 00, 501 01 or 500 00
- Diesel engines (from model year 2004)
  VW specification . . . . . VW 505 01



Engine oil for 4-cylinder and 6-cylinder gasoline engines may be either petroleum or synthetic engine based. Engine oil for the diesel engine should be synthetic.

Fill engine with proper quantity and type of oil. Section **A** is for energy conserving multigrade oils. Section **B** is for multigrade only. ALWAYS check dipstick for proper oil level.

Most 4-cylinder and 6-cylinder Volkswagen engines were initially filled at the factory with 5W-40 energy saving oil. The preferred viscosity is either 5W-40 or 10W-40. Oils meeting Volkswagen standard VW 503 00 should not be used on vehicles after model year 1999.

When changing or adding oil, use 5W-40, 10W-40 or 15W-50 meeting the above oil specifications. If the above listed oil types are not available, it is permissible to use ILSAC GF3 SAE 5W-30 (API SL Energy Conserving) for topping up purposes only. It should not be used when changing.

Engine oil capacity, with filter change

- 1.8L engine . . . . . 4.4 liters (4.6 qt.)
- 1.9L engine . . . . . 4.5 liters (4.8 qt.)
- 2.0L engine . . . . . 4.2 liters (4.4 qt.)
- 2.8L engine . . . . . 5.8 liters (6.1 qt.)

– Run engine and check for leaks. Shut off engine and reinstall sound dampening pan. Check oil level with dipstick after about 3 minutes.

WARNING —

After changing the engine oil and the oil filter, observe the following at the first engine start:

- *The engine must only run at idling speed as long as the oil pressure warning light in the instrument cluster is on. Do not rev the engine! If the engine is revved with the warning light on, the turbocharger on TDI and 1.8L turbo engines could be damaged or fail completely.*
- *The full oil pressure is not attained until the warning light has gone out. Only then can the engine be revved.*

Engine oil, changing by extracting

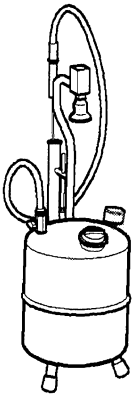
Engine oil can also be changed using an extraction system such as the VAG 1307A or the VAG 1358A. When using these devices, always follow the manufacturers instructions,

➤ Two different engine oil extraction systems offered by Volkswagen. Size is determined by service volume.

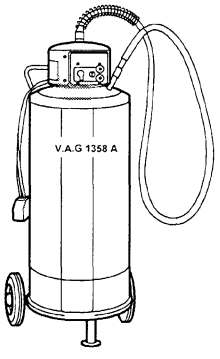
NOTE —

Observe all applicable regulations concerning disposal of used oil filters.

VAG 1307A



VAG 1358A

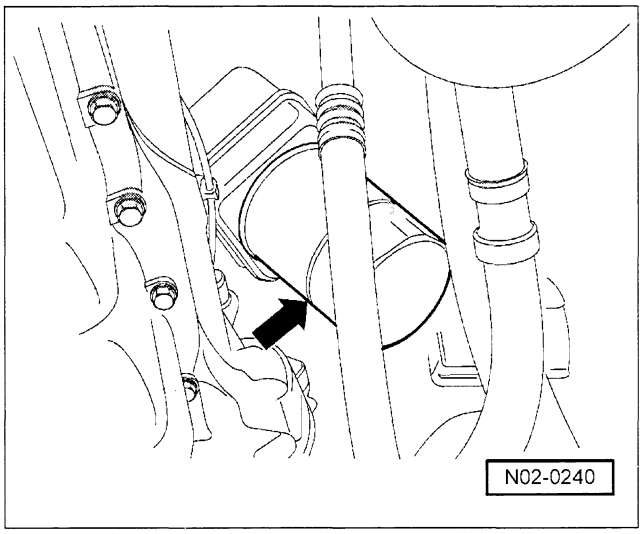


W00-0430
W00-0438

Special instructions for engines with turbo-charger

After engine oil and oil filter have been replaced, observe the following when first starting engine. As long as oil pressure warning light in instrument panel insert flashes. engine must only be allowed to run at idle. Do not touch accelerator pedal! Bumping accelerator pedal can damage turbocharger or destroy it completely. Only when warning light extinguishes is full oil pressure achieved. Only after that point can the engine be accelerated.

Although the above instructions apply specifically to turbo-charged engines, it is good practice to observe them for all engine types.



Engine oil filter, replacing (4-cylinder gasoline engines)

– Remove lower sound absorber panels as shown earlier.

– Position drain pan under oil filter to catch spills.

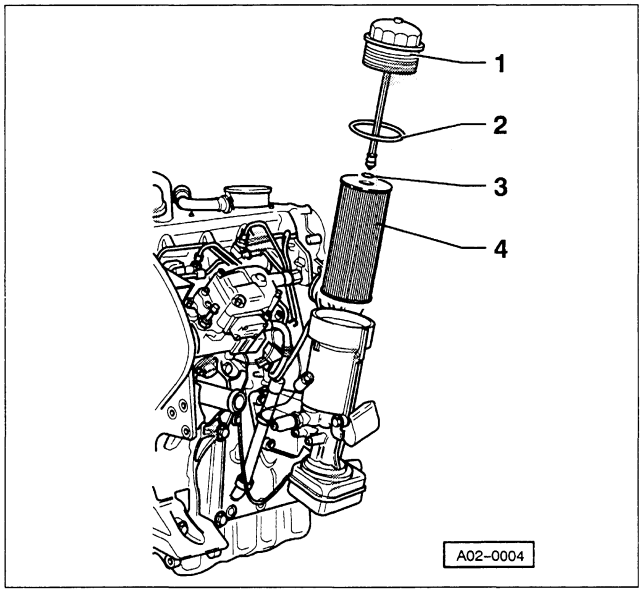
➢ Working from under engine, loosen and remove oil filter (**arrow**) with oil filter strap or suitable wrench.

– Clean sealing surface on oil filter flange.

– Lightly lubricate rubber seal with clean oil.

– Thread on new filter and tighten by hand.

NOTE —
Observe all applicable regulations concerning disposal of used oil filters.



Engine oil filter, replacing (diesel engines)

– Remove upper sound absorber panel.

– Working from above the engine, loosen and remove oil filter sealing cap.

– Pull filter up and out.

➢ Install new filter (**4**) with new gaskets (**2** and **3**).

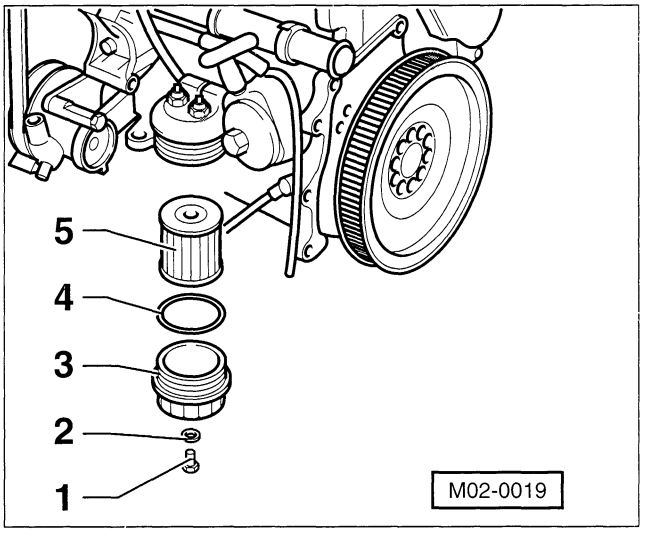
– Install filter sealing cap.

Tightening torque

- Oil filter sealing cap . . . . . 25 Nm (18 ft-lb)

– Install upper sound absorber panel.

NOTE —
Observe all applicable regulations concerning disposal of used oil filters.



Engine oil filter, replacing (6-cylinder engine)

➤ Remove oil drain plug (**1**) in oil filter sealing cap (**3**).

– Remove oil filter cap (lower part of oil filter housing) and install new filter element (**5**).

– Lubricate new rubber O-rings (**4**) with engine oil and install on filter sealing cap (**3**).

– Lubricate new rubber O-ring (**2**) and install with drain plug (**1**).

Tightening torques

- Oil filter sealing cap . . . . . 25 Nm (18 ft-lb)
- Oil filter drain plug . . . . . 10 Nm (7 ft-lb)

NOTE —

Observe all applicable regulations concerning disposal of used oil filters.

Coolant, checking

Cooling system maintenance consists of maintaining coolant level, checking coolant freezing point, and inspecting hoses. Coolant flushing is not part of Volkswagen's scheduled maintenance.



➤ Volkswagen uses only one type of coolant in vehicles covered by this manual. It can be identified by its red/pink or purple color. This coolant/antifreeze is phosphate free and also silicate free. When supplied by Volkswagen, this coolant/antifreeze is known as G12.

Advantages of G12 over earlier types include improvements in corrosion protection, thermal stability, heat transfer/control, hard water tolerance and environmental protection.

NOTE —

Volkswagen does not require replacing the coolant as part of routine maintenance. The cooling system has been filled at the factory with a permanent coolant. For coolant system draining and refilling procedures, see **19 Engine-Cooling System.** .

WARNING —

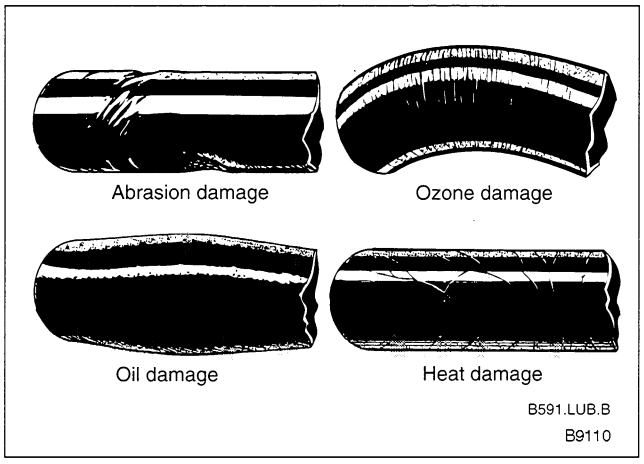
- *G12 (Red Coolant) must NEVER be mixed with ANY other coolant. Engine damage will result!*
- *Contamination of G12 with other colored coolants is identifiable by discoloration (brown, purple, etc.). This mixture causes a foamy deposit to appear in the expansion tank/radiator and MUST be drained immediately.*
- *The cooling system must be completely free of this mixture before refilling with the correct type of coolant/antifreeze.*

WARNING —

- *Hot coolant can scald. Do not work on the cooling system until it has fully cooled.*
- *Use extreme care when draining and disposing of coolant. Coolant is poisonous and lethal. Children and pets are attracted to it because of its sweet smell and taste. See a doctor or veterinarian immediately if any amount is ingested.*
- *Use only Volkswagen original anti-freeze when filling the cooling system. Use of any other anti-freeze may be harmful to the cooling system. Do not use an anti-freeze containing phosphates.*
- *Never mix green coolant (G11) with red coolant (G12). Mixing can cause serious engine damage.*
- *Do not use tap water in cooling system. Use distilled water only to mix anti-freeze.*



A translucent expansion tank, or overflow reservoir, on the left side of the engine compartment provides easy monitoring of coolant level without opening the system. The coolant level should always be checked when engine is cold. The coolant level should be in the shaded area above the **min** mark on the expansion tank.



Inspect hoses by first checking that all connections are tight and dry. Coolant seepage indicates that either the hose clamp is loose, that the hose is damaged, or that the connection is dirty or corroded. Dried coolant has a chalky appearance. Check hose condition by pinching them. Hoses should be firm and springy. Replace any hose that is cracked, that has become soft and limp, or has been contaminated by oil or diesel fuel.

To check freezing point of the coolant, (and also the boiling point), use a refractometer. With the engine cold, remove cap from expansion tank and draw up some coolant with refractometer siphon. Volkswagen recommends using a 50/50 mixture of anti-freeze and water, which has a freezing point of -35°F (-38°C). If the freezing point is too high, drain a small amount of coolant from the system and add new anti-freeze until proper protection level is obtained. Also see **19 Engine–Cooling System**.

NOTE —

For protection to approx. -40°C (-40°F) the percentage of anti-freeze may be increased up to 60%. The percentage of anti-freeze must not exceed 60%, as higher amounts will decrease frost protection and reduce cooling capacity.

Brake fluid level, checking

Routine maintenance of the brake system includes maintaining an adequate level of brake fluid in the reservoir, replacing brake fluid every 2 years, checking brake pads for wear, checking hand brake function, and inspecting system for fluid leaks or other damage. See **Under Car Maintenance** for pad inspection and brake system inspection.

WARNING —

- *Use only new, previously unopened brake fluid conforming to US Standard FMVSS 116 DOT 4.*
- *Brake fluid is poisonous. DO NOT ingest brake fluid. Wash thoroughly with soap and water if brake fluid comes into contact with skin.*
- *DO NOT let brake fluid come in contact with paint. Wash immediately with soap and water.*
- *Brake fluid absorbs moisture from the air and must be stored in an airtight container.*
- *DO NOT allow brake fluid to exceed the maximum level in the fluid reservoir.*



Check fluid level at brake fluid reservoir (**arrow**) , located on driver's side of engine compartment, under air cleaner connecting hose. The brake fluid level will drop slightly as the brakes wear.

Brake fluid

- Type . . . . . FVMSS 116 SAE DOT 4

WARNING —

Do not mix DOT 5 (silicone) brake fluid with DOT 4 brake fluid as severe component corrosion will result. Such corrosion could lead to brake system failure.

Brake fluid, replacing

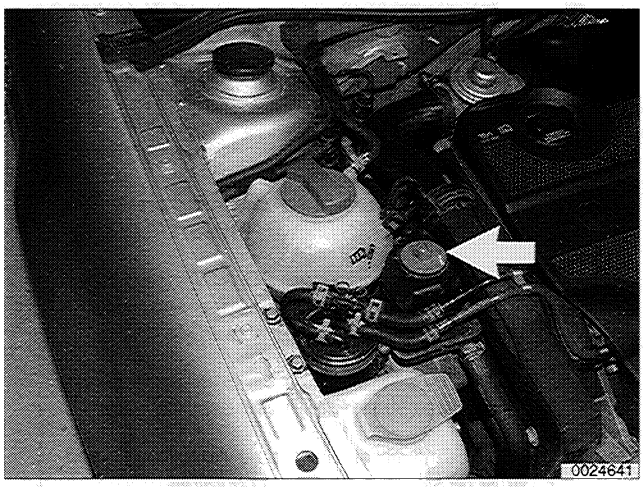
Brake fluid readily absorbs moisture from the atmosphere. This moisture can cause brake system corrosion and adversely affect braking performance. Therefore, the old brake should be flushed out of the system and new, fresh fluid added at least every 2 years, regardless of mileage. See **47 Brakes–Hydraulic System** for brake system bleeding procedures and brake fluid replacement.

NOTE —

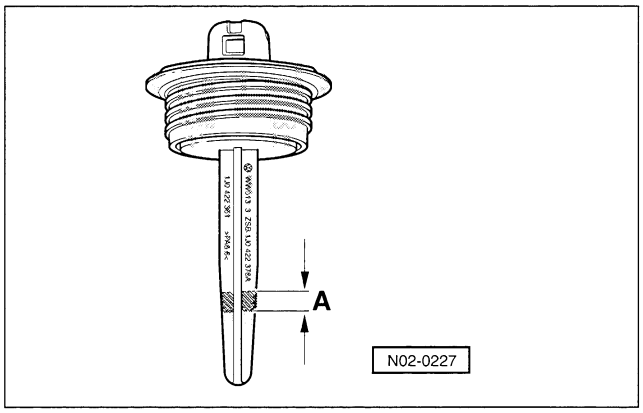
Vehicles equipped with ABS can be bled using conventional methods.

Power steering fluid level, checking

There are two methods for checking power steering fluid level.



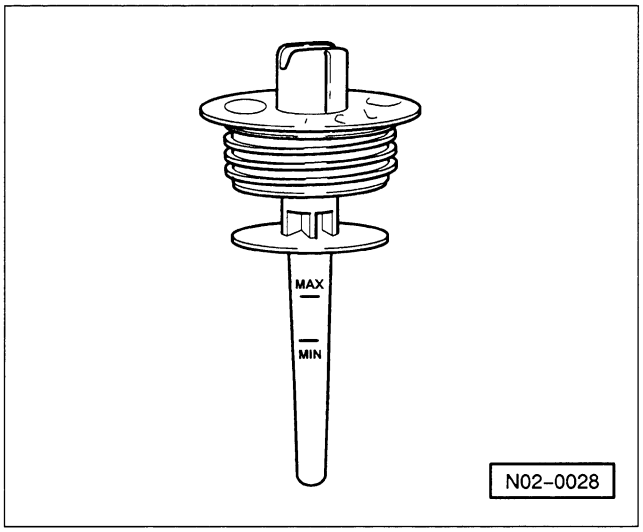
COLD - When cold checking the power steering fluid level, the engine should not be running and the front wheels should be in the straight ahead position. Use a screwdriver to remove the cap (**arrow**) from power steering fluid reservoir.



Use a clean shop cloth to wipe the dipstick end and screw the cap back on hand tight only. Remove the dipstick from the fluid reservoir again and check the level on the dipstick. The level should be within ± 2 mm of the **min** mark (**A**). Adjust the fluid level if required and screw the cap back on hand tight when done.

NOTE —

- *If fluid level is above (approx. 2 mm) the MIN mark, some fluid must be extracted.*
- *If fluid level is more than 2 mm below the MIN mark, the hydraulic system must be checked for leaks. It is not sufficient to top-up with fluid.*



HOT - When hot checking the power steering fluid level, start the engine and let it run until the power steering fluid temperature is above 50°C (122°F). The front wheels should be in the straight ahead position. Use a screwdriver to remove power steering reservoir cap. Use a clean shop cloth to wipe the dipstick end and screw the cap back on hand tight only. Remove the dipstick from the fluid reservoir again and check the level on the dipstick. The level should be between the **max** and **min** marks. Adjust the fluid level if required and screw the cap back on hand tight when done.

Power steering fluid

- Type . . . . . hydraulic oil (VW part no. G 002 000)

NOTE —

The power steering system uses a special hydraulic oil and not ATF.

WARNING —

- *Use only Volkswagen hydraulic oil G 002 000 in the power steering system. Do not use ATF or other non-approved types of power steering fluid. If the wrong fluid is used, power steering components may fail.*
- *Volkswagen part numbers are given for reference only! Always consult your Volkswagen parts department or aftermarket parts specialist for the latest parts information.*

Fluid leaks

Check the engine compartment for signs of fluid leaks. Fluid leaks attract dust making them easier to spot. Many expensive repairs can be avoided by prompt repair of minor fluid leaks.

Inspect for leaks in engine, cooling, fuel, heating and air conditioning systems. Visually inspect hoses and hose connections for leaks, worn areas, porosity and brittleness.

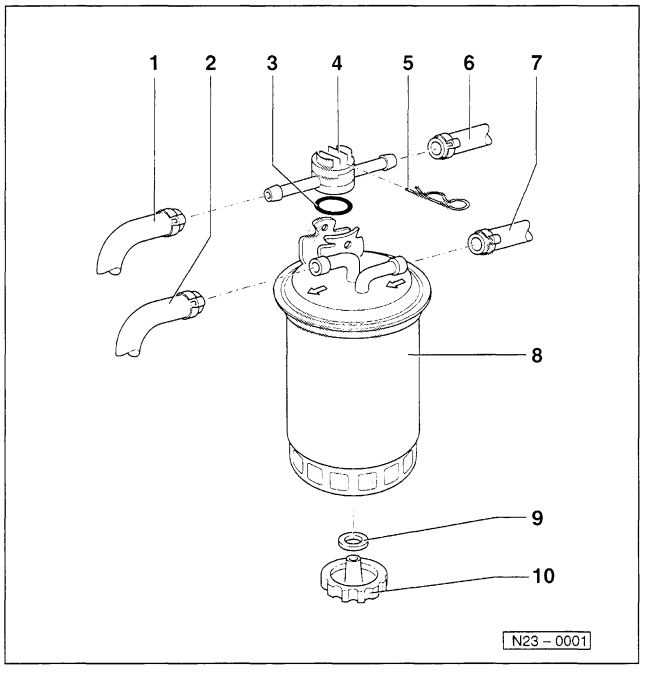
Fuel filter, replacing (gasoline engines)

Volkswagen specifies that the fuel filter used on gasoline engines is designed to last the life of the car. Replacement is only necessary if the filter becomes clogged due to contaminated fuel or failure to keep the fuel tank sealed. If dirt in the fuel filter is suspected, also check the screen on the bottom of the fuel delivery unit for contamination. See **20 Fuel Storage and Supply**.

Fuel filter, draining (diesel engine)

The diesel fuel filter functions to trap water. As water is heavier than diesel fuel, it settles to the bottom of filter and can be drained off.

> ***WARNING —***
> *Do not allow diesel fuel to contact coolant hoses or other rubber parts. Wipe diesel fuel off hoses immediately and wash with soap and water.*



➤ Remove control valve retaining clip.

1. **Fuel return line**
   - From diesel injection pump
2. **Fuel supply line**
   - To diesel injection pump
3. **O-ring**
   - Always replace
4. **Fuel control valve**
   - Recirculates fuel to filter at temperatures below 15°C (59°F)
   - Returns fuel to tank at temperatures above 31°C (88°F)
   - Installed position: arrow points toward fuel tank
5. **Retaining clip**
6. **Fuel return line**
   - To fuel tank
7. **Fuel supply line**
   - From fuel tank
8. **Diesel fuel filter**
   - Fill with diesel fuel before installing
   - Observe fuel flow direction marked on top
9. **Gasket**
10. **Water drain plug**

– Pull fuel control valve up with fuel lines connected.

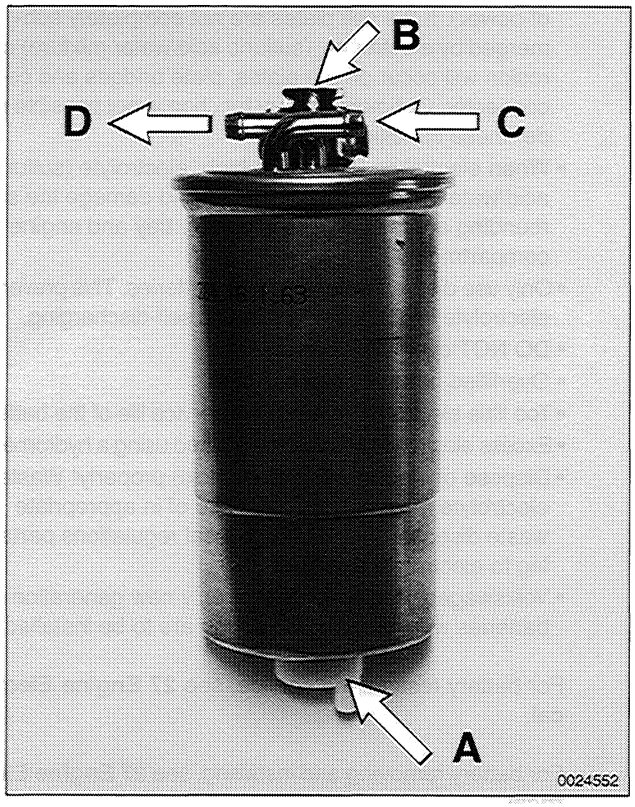
– Loosen water drain plug on bottom of filter and drain out approximately 100 cc (1.7 oz.) of fuel/water.

– Install fuel control valve with a new O-ring.

– Attach retaining clip and tighten drain plug.

– Check fuel system for leaks (visual inspection) with the engine running. Raise engine speed several times and let idle. Fuel flow through transparent pipe must be observed.

Fuel filter, replacing (diesel engine)



– Remove control valve retaining clip.

– Pull fuel control valve up with fuel lines connected.

➤ Label and disconnect fuel filter inlet and outlet lines.

A. Water drain fitting (no hose connection)
B. Fitting for fuel control valve
C. Fuel inlet (from fuel tank)
D. Fuel outlet (to engine)

– Unbolt filter bracket from passenger's of engine compartment near strut tower and remove with filter.

– Loosen bracket and remove filter.

– Install new filter.

– Fill new filter with fresh diesel fuel (to facilitate starting).

– Installation is reverse of removal, noting the following:

- Install fuel filter inlet and outlet lines. Use new fuel line clamps as required.
- Install fuel control valve with a new O-ring and attach retaining clip.

➤ Start engine and check fuel system for leaks (visual inspection) with the engine running. Raise engine speed several times and let idle. Fuel flow through transparent pipe must be observed.

NOTE —
Engine may require a longer cranking period before it starts due to the fuel system having been open.

Battery service

Under normal operating conditions, the battery is maintenance free. At high outside temperatures, however, it is advisable to check the electrolyte level through the translucent battery housing. The electrolyte level should be just above the battery plates and their separators. The battery plates can be seen once the filler caps are removed. If the electrolyte level is low, replenish it by adding distilled water only. When servicing the battery, observe the following points:

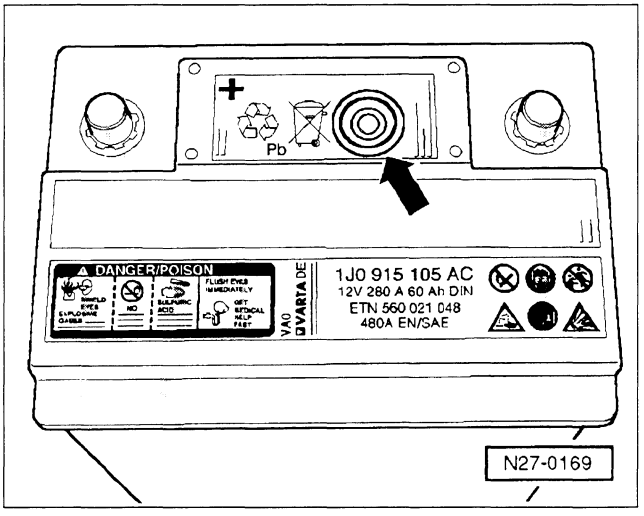
- All cell caps must be equipped with an O-ring seal.
- The electrolyte level on batteries with visible minimum and maximum markings on the outside of the (semi-transparent) battery case is checked by visual inspection.
- The electrolyte level must be above the minimum marking or just reach the maximum marking.
- On batteries where the exterior markings are difficult to recognize (due to installation location, battery case opaqueness or dirt), the cell caps must be removed and individual cell electrolyte levels checked from inside the battery.
- The electrolyte level must align with the internal electrolyte level indicator (lip). This equates to the external "maximum" marking on the battery case.

Battery service (continued)

- Check that battery is securely located and clamping bolt is tight.
- When the electrolyte level is too low and the cell plates are exposed, a loss of battery capacity will result (loss of power). If the cell plates are not completely submerged by electrolyte, (sulfuric acid/water mixture) corrosion will occur on the plates, plate bridges and cell connector. Optimum battery function is not possible under these conditions!
- When electrolyte level is too high, electrolyte (sulfuric acid/water mixture) may leak out and damage the surrounding areas such as the battery tray and engine compartment.
- Only use distilled water to top-up batteries. This prevents electrolyte impurities which cause self-discharging.
- DO NOT overfill the battery.
- Overfilled batteries can boil over.
- Too little electrolyte reduces the service life of the battery.
- Excess electrolyte MUST be extracted using a hydrometer.
- Dispose of electrolyte (sulfuric acid) properly! Waste electrolyte must only be disposed of in appropriate waste disposal sites. Refer to local regulations pertaining to electrolyte disposal.
- Volkswagen recommends that only new generation batteries with central gas venting are to be installed.

For battery testing and service, see **27 Engine Electrical**.

For battery removing and installing, see **27 Engine Electrical**.



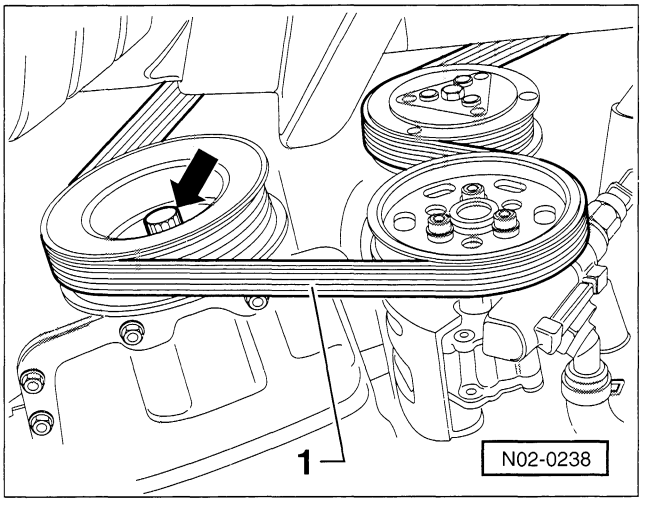
Some batteries have a charge indicator (**arrow**) (magic eye) on top that displays electrolyte level and charge condition.

- Green, charge and electrolyte level are OK.
- Black, there is insufficient or no charge.
- Yellow or colorless, the electrolyte level is critically low and should be topped off with distilled water immediately.

NOTE —

- *If the charge indicator on batteries in excess of 5 years old are colorless, do not attempt to top off or recharge battery. Battery must be replaced.*
- *Air bubbles that occur normally during battery charging (even during vehicle operation) may adversely affect charge indicator reading. To obtain an accurate reading, gently tap the charge indicator with a screwdriver handle or rock the vehicle to displace any possible air bubbles that have formed.*
- *For technical reasons, some batteries are equipped with sealing plugs with plastic foil. These batteries are considered maintenance free.*

Ribbed V-belt, checking



The ribbed V-belt is self-adjusting and does not require any routine maintenance aside from periodic inspection for wear. Belts of this design are known for their smooth running, high efficiency, and long life.

– Raise vehicle and support safely on jackstands or with hoist, see **Lifting Vehicle**.

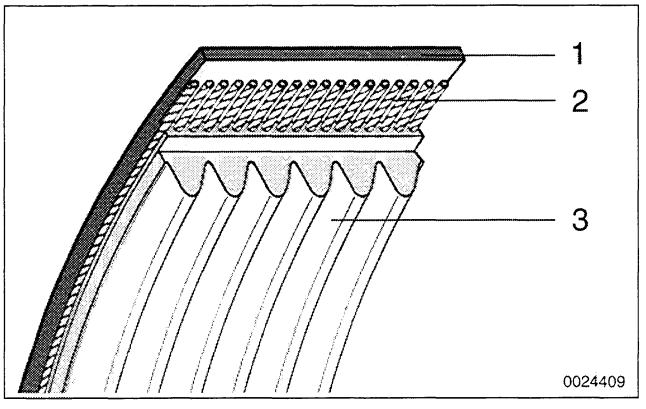
– Remove lower sound absorber panels as described earlier.

➢ Manually turn engine at vibration damper/belt pulley (**arrow**) using a socket and wrench.

– Check belt condition for the following:

- Splits in the base material (substrata) including cracks, core fractures and cross section fractures.
- Separation between the layers, especially between the top cover and the tension cord layers.
- Chunking or breaking of the base or lower layer material.
- Fraying of the tension cords.
- Flank (side) wear including flaking, fraying, chunking, glazing, hardening, and surface cracking.
- Oil and grease contamination.

NOTE —
It is essential to replace the ribbed belt if it is found to have any of the above listed faults.

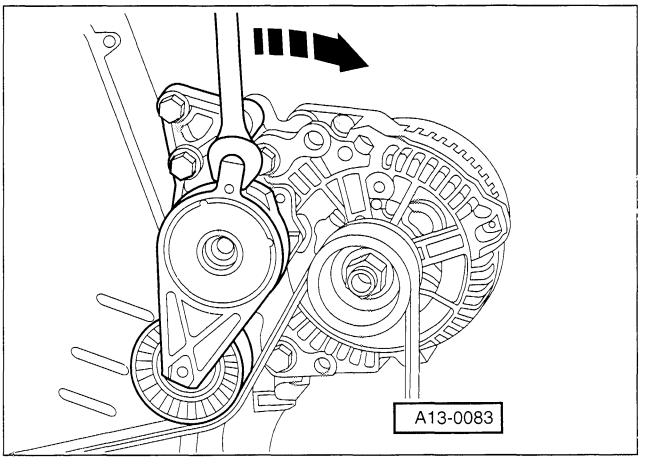


➢ Cross section of Volkswagen ribbed V-belt.

1. Top layer, cover
2. Tension cords
3. Base material

If any of the above conditions exist, the belt(s) must be replaced. Consult the maintenance tables at the end of this section for appropriate routine replacement intervals.

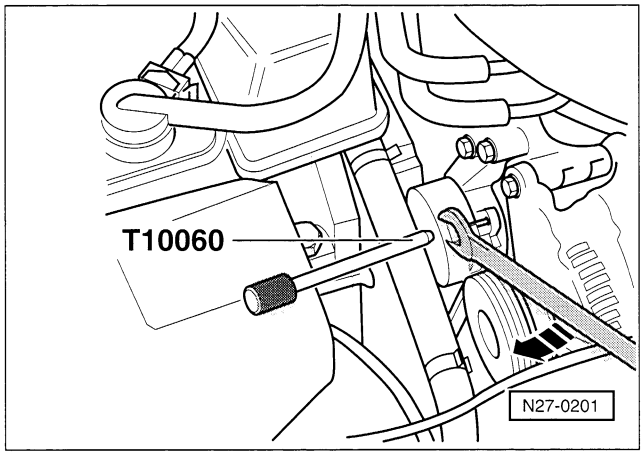
Ribbed V-belt, replacing (4-cylinder engines)



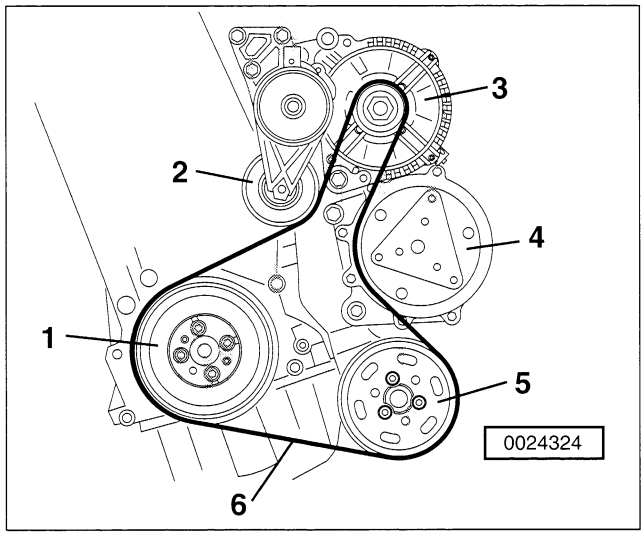
– Remove lower sound absorber panel below ribbed V-belt, as described earlier.

– Mark direction of rotation on ribbed V-belt with chalk or crayon.

➢ Swing tension roller off (**arrow**) of belt with a wrench and hold.

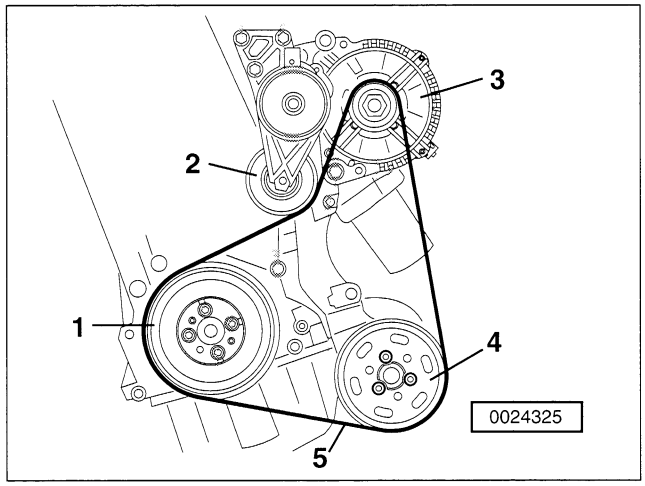


- Lock tensioner in released position with suitable tool (VW T10060 mandrel).
- Remove belt.
- Installation is the reverse of removal. Observe belt routing.



4-cylinder gasoline engines and 1.9L PD Diesel with air conditioning

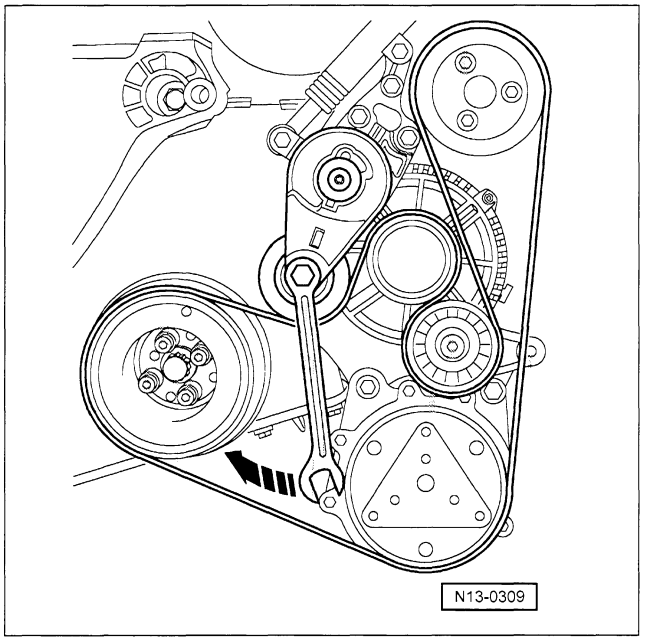
1. **Crankshaft pulley**
2. **Tensioner pulley**
3. **Generator pulley**
4. **A/C Compressor pulley**
5. **Power steering pump pulley**
6. **Ribbed V-belt**



4-cylinder gasoline engines and 1.9L PD Diesel without air conditioning

1. **Crankshaft pulley**
2. **Tensioner pulley**
3. **Generator pulley**
4. **Power steering pump pulley**
5. **Ribbed V-belt**

WARNING —
Ensure correct seating of ribbed V-belt in pulleys. Failure to seat belt properly will severely damage ribbed V-belt.



Ribbed V-belt, replacing (1.9L TDI diesel engine (code: ALH)

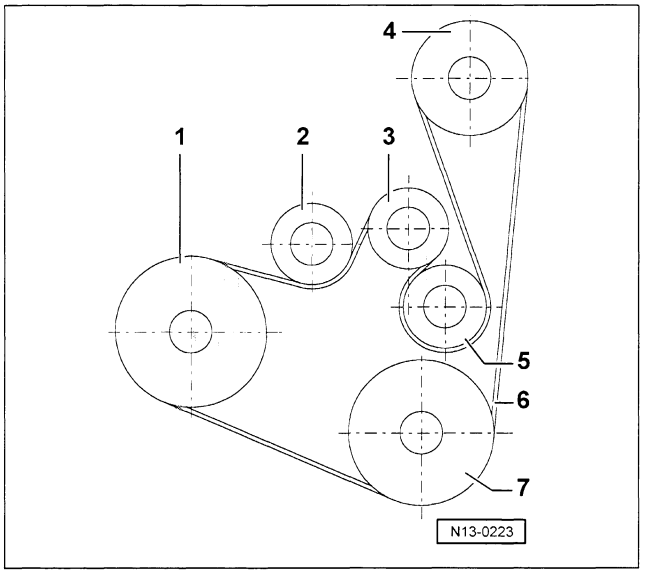
– Remove right side lower sound absorber panel as given earlier.

– Remove connecting pipe between intercooler and turbocharger.

– Mark direction of rotation on ribbed V-belt with chalk or crayon.

➢ Swing tension roller off (**arrow**) of belt with a wrench and hold while removing belt.

– Installation is the reverse of removal. Observe belt routing.

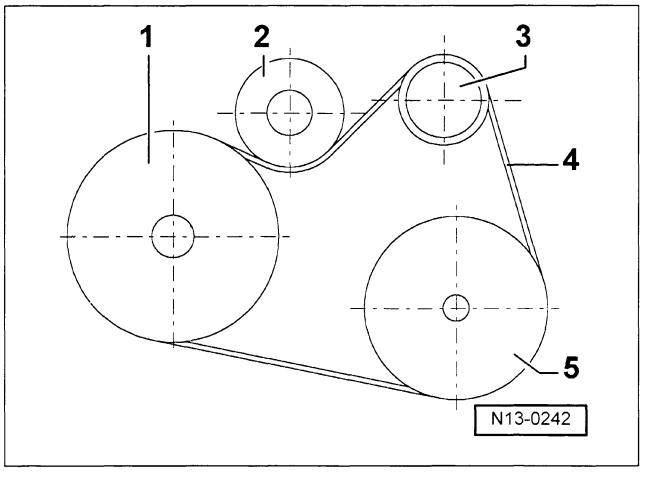


➢ TDI diesel engine (code: ALH) with air conditioning

1. Crankshaft pulley
2. Tensioner pulley
3. Generator pulley
4. Power steering pump pulley
5. Idler pulley
6. Ribbed V-belt
7. Compressor pulley

> ***CAUTION —***
> *Ensure correct seating of ribbed V-belt in pulleys. Failure to seat belt properly will severely damage ribbed V-belt very quickly.*

NOTE —
On engines with air conditioning, slip belt off of compressor pulley first and install to compressor pulley last.



➢ TDI diesel engine (code: ALH) without air conditioning

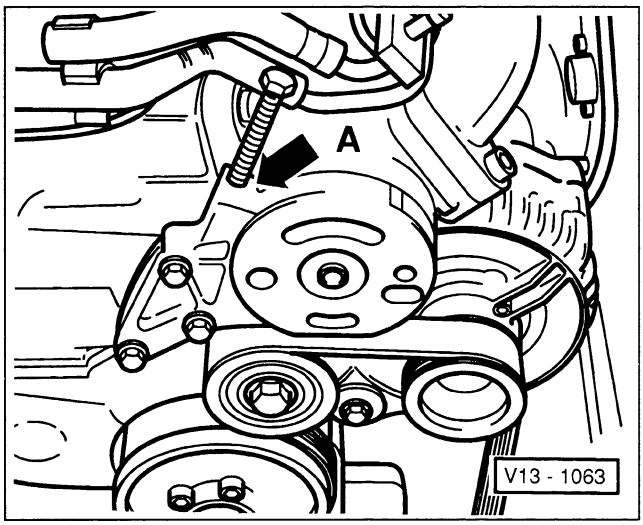
1. Crankshaft pulley
2. Tensioner pulley
3. Generator pulley
4. Ribbed V-belt
5. Power steering pump pulley

Ribbed V-belt, replacing (6-cylinder engine)

– Remove upper and lower right sound absorber panels as described earlier.

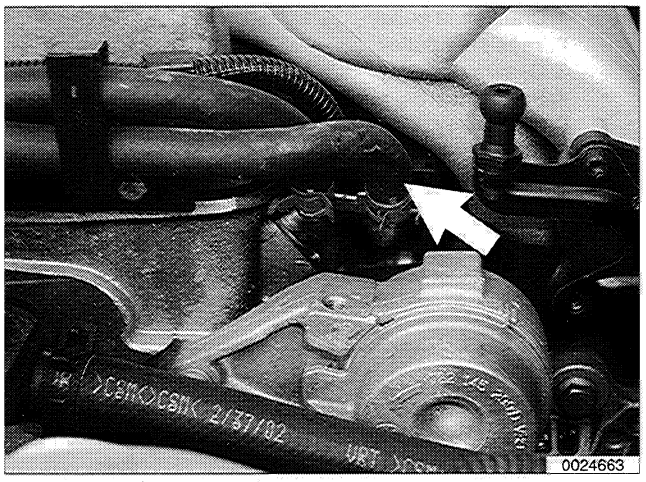
– If reinstalling the old belt, mark running direction on belt.

– Remove air cleaner housing complete with mass air flow sensor. See **24a Fuel Injection-Motronic**.



For **AFP engine**, temporarily install M8x80 bolt (**A**) in threaded hole in belt tensioner and thread bolt in until ribbed V-belt is free of tension.

> ***CAUTION —***
> *Do not over tighten bolt. Thread bolt in only until ribbed V-belt can be removed. The tensioner housing may be damaged if the bolt is overtightened.*

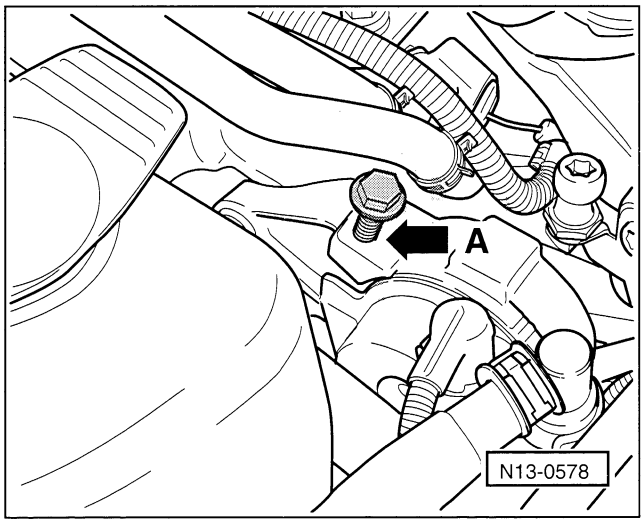


On **BDF engine**, pull off fuel return hose (**arrow**) above belt tensioner. This allows better access to the tensioner.

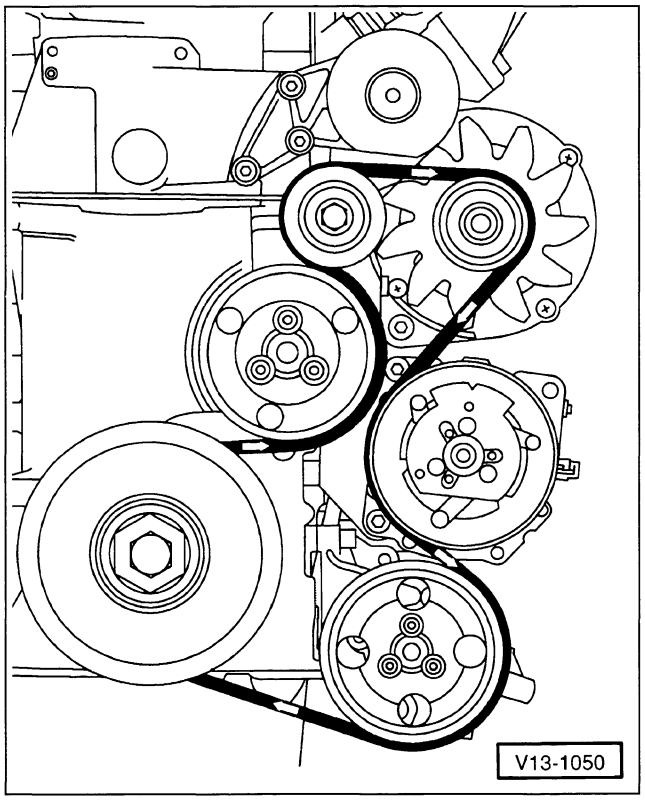
> ***NOTE —***
> *Fuel return line should be indicated with blue markings.*

> ***WARNING —***
> *Fire Hazard! Fuel will be expelled under pressure when fuel lines are disconnected. Do not smoke or work near heaters or other fire hazards. Keep a fire extinguisher handy. Cover fuel connections with cloth before disconnecting to prevent excess leakage,*

– Remove poly-ribbed belt from pulleys.



Temporarily install bolt (M8x45) (**arrow A**) in threaded hole in belt tensioner and tighten bolt in until ribbed V-belt is free of tension.

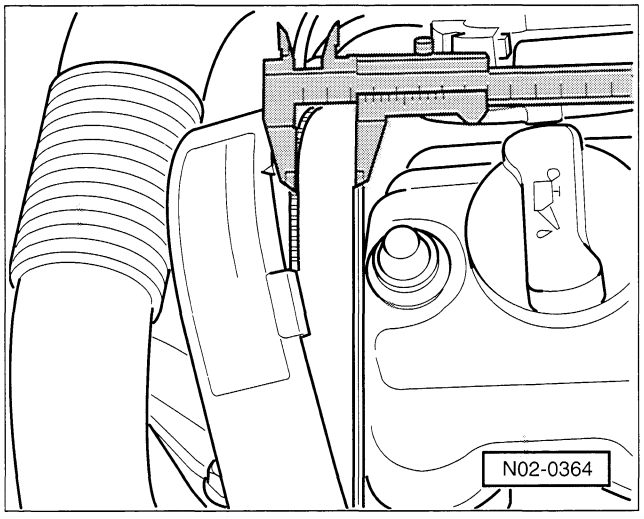


- Install poly-ribbed belt in position.
- Slowly remove M8 bolt from tensioner, making sure belt is correctly seated in pulley grooves.
- The remainder of installation is the reverse of removal. Start engine and check that belt runs smoothly.

NOTE —
Small arrows on belt indicate running direction.

Timing belt (toothed belt), checking

The timing belt, also called the toothed belt or camshaft drive belt, is a reinforced rubberized toothed belt that drives that camshaft. On TDI (code: ALH) diesel engines, the belt also drives the injection pump. The belt is subjected to high temperatures and should be inspected during scheduled maintenance intervals. See **Maintenance Schedules** at the back of this section.



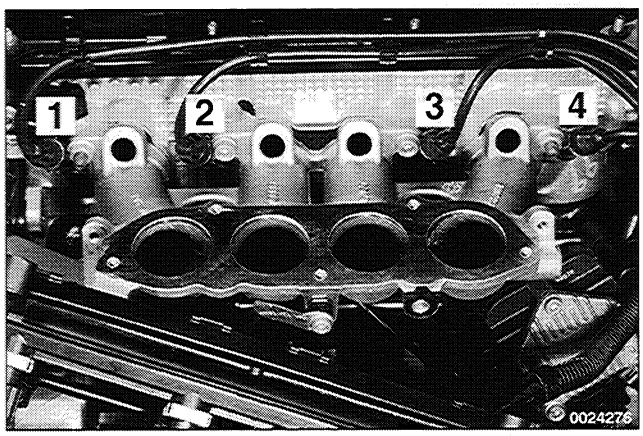
To inspect the toothed belt, the upper section of the toothed belt guard belt must first be removed. Release retaining clips and move timing belt upper cover to side. Inspect belt for tears, separation of layers, fraying of belt cords, surface cracks, or traces of oil and grease. Replace belt if any faults are found. The belt can also be measured with a Vernier caliper to determine if replacement is necessary.

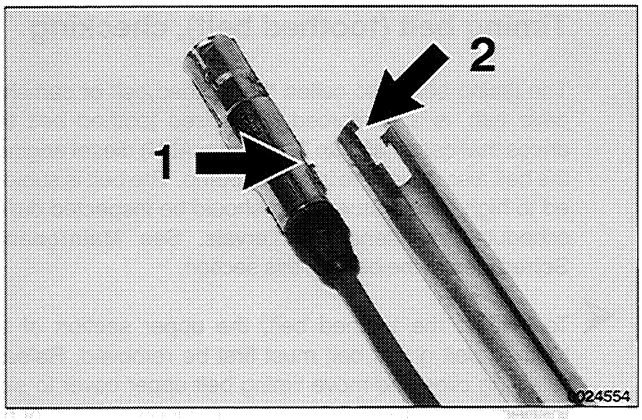
Measured width of timing belt

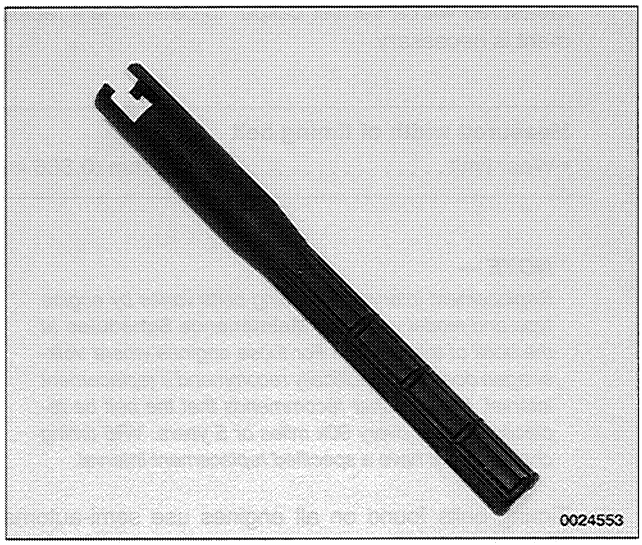
- Wear limit . . . . . 22 mm (0.866 in.)

NOTE —
Replacement intervals for timing belts varies by engine type and model year. See **Maintenance Schedules** *at the back of this section. For those engines where Volkswagen does not specifically recommend a replacement interval, the publisher recommends that the belt be replaced at least every 90k miles or 5 years. VR6 timing chains do not have a specified replacement interval.*

Timing belts found on all engines use semi-automatic tensioners that do not generally require adjustments. See **15 Cylinder Head and Valvetrain** for belt and tensioner replacement procedures.







Spark plugs, replacing (gasoline engines with single ignition coil)

Spark plugs are generally replaced during scheduled maintenance services. Due to the design of the combustion chambers and shape of the cylinder head, spark plug replacement can easily be accomplished without removal of intake manifold. Manifold and injector rail shown removed for clarity. Cylinder number 1 is the closest to the timing belt.

NOTE —
Note that spark plugs for cylinders #1 and #2 are angled to the left and that spark plugs for cylinders #3 and #4 are angled to the right.

– Remove the upper sound absorber panel.

NOTE —
- *On AFP (VR6) engines, the spark plug wires must first be removed with special tool T10029, or equivalent before removing the upper sound absorber panel.*
- *It may not be necessary to use special tool T10029 if spark plug wires are equipped with removal loops that allow the spark plug wires to be removed by hand.*

Remove the spark plug wire from cylinder 1 with a suitable tool such as VW special tool T10029. Do not pull on the wires. Tool is designed so that locks (**arrow 2**) engage tabs on spark plug connector (**arrow 1**). Pulling on the tabs, rather than the wire itself prevents damage.

NOTE —
- *It may be necessary to unplug the injector wire and gently turn the injector in the mounts for access.*
- *It may not be necessary to use special tool T10029 if spark plug wires are equipped with removal loops that allow the spark plug wires to be removed by hand.*

A plastic spark plug wire removal tool (Volkswagen part number 021 012 213) was included with some vehicle tool kits and can be useful in removing and installing the spark plug wires.

– Remove spark plug with a 5/8 in. (16 mm) spark plug socket and an extension.

– Check gap on new spark plug and install, re-install injector wire and plug wire.

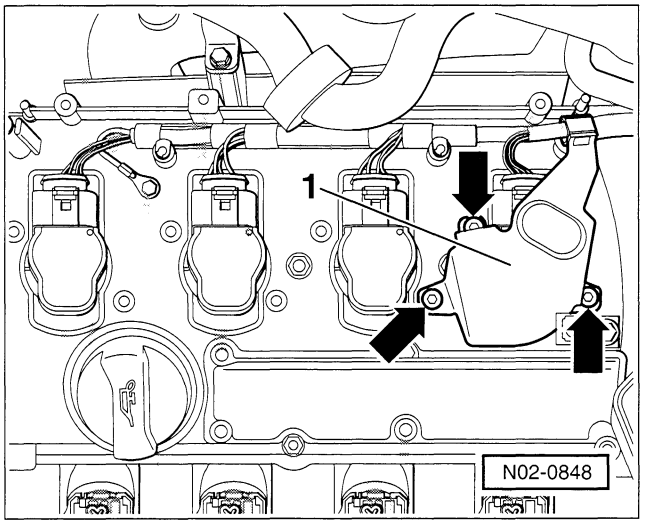
– Repeat for each remaining cylinder.

– Install upper sound absorber panel and spark plug wires.

Tightening torques

- Spark plug to cylinder head
  4-cylinder engine . . . . . 30 Nm (22 ft-lb)
  6-cylinder engine . . . . . 25 Nm (18 ft-lb)

Spark plugs, replacing (gasoline engines with multiple ignition coils)



– Remove the upper sound absorber panel.

➢ On 1.8L engine (code: AWW, AWP) remove mounting nut for vacuum reservoir, label vacuum lines and remove reservoir. Remove three mounting nuts for vacuum reservoir bracket and remove bracket (**1**).

– On 2.8L, 24-valve engine (code: BDF) release ignition coil connector at ignition coil.

– Remove ignition coil.

- On 1.8L (code: AWD) engine unbolt coil mounting bolts, remove coil and spark plug connector.
- On 1.8L (code: AWW, AWP) engines use special tool T10094 or T40039 to remove ignition coil.
- On 2.8L (code: BDF), use special tool T10095 to remove ignition coil.

– Remove spark plug with spark plug socket and extension (i.e. VW special tool 3122B).

– Repeat for each remaining cylinder.

– Install in reverse order of removal.

Tightening torques

- Spark plug to cylinder head
  4-cylinder engine . . . . . 30 Nm (22 ft-lb)
  6-cylinder engine . . . . . 25 Nm (18 ft-lb)

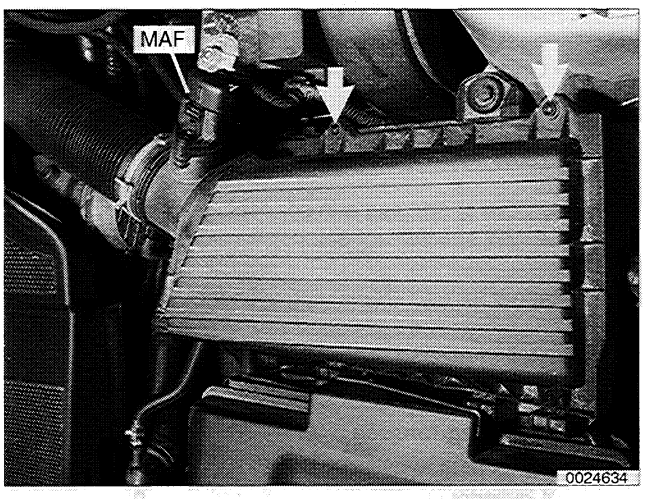
Specification

- Spark Plugs (1.8L engine)
  Original equipment number 101-000-063-AA
  Manufacturers number . . . . . NGK PFR 6Q
  Gap . . . . . max 0.80 mm (0.031 in)
- Spark Plugs (2.0L engine, code: AEG)
  Original equipment number 101-000-033-AA
  Manufacturers number . . . . . NGK BKUR 6 ET-10
  Gap . . . . . .0.90 to 1.10 mm (0.035 to 0.043 in)
- Spark Plugs (2.0L engine, code: AVH, AZG, BBW, BEV)
  Original equipment number 101-000-062-AB
  Manufacturers number . . . . . NGK PZF R5D-11
  Gap . . . . . .0.90 to 1.10 mm (0.035 to 0.043 in)
- Spark Plugs (2.8L engine, code: AFP)
  Original equipment number 101-000-035-AH
  Manufacturers number . . . . . NGK BKR 5 EKUP
  Gap . . . . . .0.70 mm (0.027 in)
- Spark Plugs (2.8L engine, code: BDF)
  Original equipment number 101-000-062-AB
  Manufacturers number . . . . . NGK PZF R5D-11
  Gap . . . . . max 1.1 mm (0.045 in.)

NOTE —
Volkswagen part numbers are given for reference only. Always consult with your Volkswagen parts department or aftermarket parts specialist for the latest parts information.

Air filter element, replacing

The air filter element should generally be replaced as specified in the maintenance tables. Under severe conditions, however, such as driving on dirt or desert roads, or in dusty areas, it is advisable to replace the element more frequently.



- Disconnect harness connector for mass air flow sensor (**MAF**).
- Loosen hose clamp on intake hose and take hose off near mass air flow sensor.
- Loosen air cleaner housing captive screws (**arrows**) and place top of housing to side.
- Remove old filter element.
- Clean filter housing.

NOTE —
Some vehicles may be equipped with a mesh screen across the air intake on the lower air cleaner housing. If equipped with this "snow screen", inspect and carefully clean as needed.

- Install new filter element.
- Remainder of installation is the reverse of removal.

UNDER CAR MAINTENANCE

Under car maintenance requires that the car be raised on a lift or properly supported on jackstands. Under car maintenance should not be carried out unless proper (safe) lifting equipment is available. See **Lifting Vehicle** for more information on lifting and working under the car.

WARNING —
- *Do not work under a car supported solely by a jack. Jack stands must always be used when working under the car.*
- *Jack stands must be placed on a hard, level surface (e.g. concrete).*

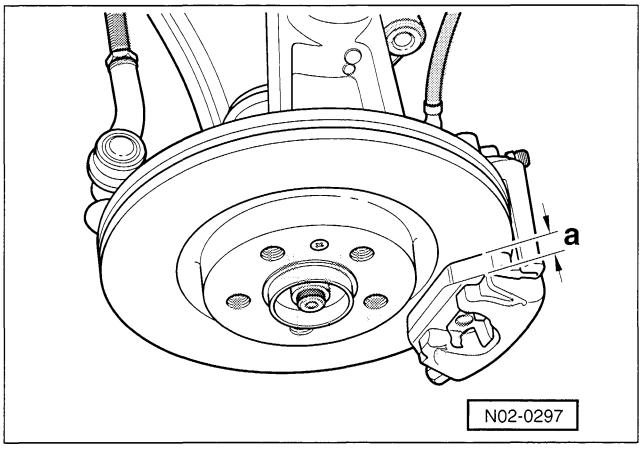
Brake system, visual inspection

Check the brake master cylinder, vacuum brake booster (also hydraulic unit if anti-lock brake system is fitted), brake pressure regulator, and brake calipers for leaks and damage.

- Brake hoses must not be twisted.
- Brake hoses must not touch any part of the vehicle when steering is at full lock.
- Check brake hoses for porosity and deterioration, brake hoses and brake lines for chafing points.
- Check brake connections and attachments for correct seating, leaks and corrosion.
- Any faults found must be repaired.

Brake pads (front and rear), checking

To accurately check the front brake pad thickness, the front wheels should be removed. With the wheel removed, measure the thickness of outer and inner pads. If pad thickness (including backing plate) is 7 mm (0.28 in.) or less, the brake pads should be replaced.

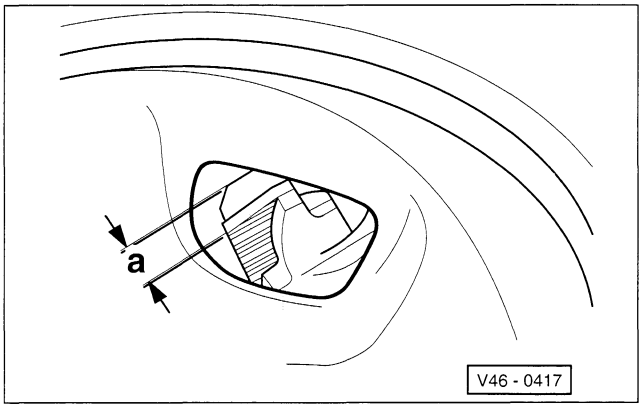


➤ Check front brake pad thickness dimension (**a**).

Brake pad wear limit

- Minimum width (incl. backing plate) . . 7 mm (0.28 in.)

NOTE —
Before removing the front wheels, mark their position in relation to the brake rotor so the wheel can be reinstalled in the same position.



➤ Rear brake pads can be inspected without removing wheel. Check brake pad thickness dimension (**a**) using flashlight and mirror to inspect if necessary.

Brake pad wear limit

- Minimum width (incl. backing plate) . . 7 mm (0.28 in.)

WARNING —
When tightening wheel bolts, tighten the bolts in stages using a criss-cross pattern.

Tightening torque

- Wheel bolt to wheel hub . . . . . 120 Nm (89 ft-lb)

Parking brake, adjusting

The parking brake acts on the rear brakes and is self-adjusting to compensate for wear. Adjustment of the parking brake is only necessary if brake components are replaced. See **46 Brakes–Mechanical Components** for parking brake adjustment and service procedures. The parking brake should begin to hold after approximately two clicks of the lever.

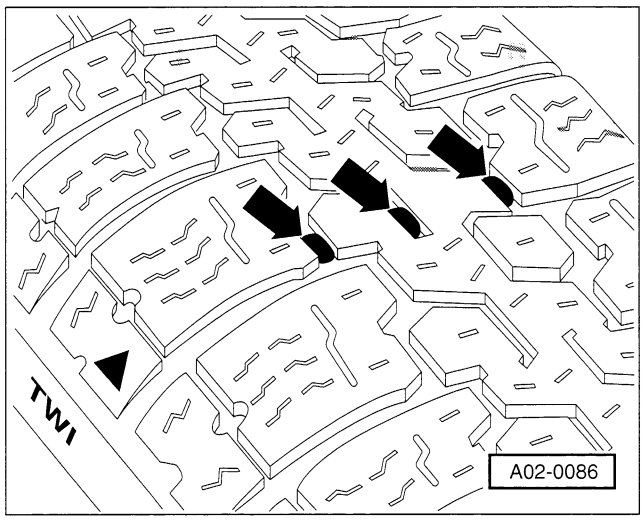
Tire service

Tire pressure should be checked on a regular basis. It is best to check pressures when the tires are cold. Refer to the data label on the fuel filler flap for proper inflation pressures. Be sure to also check the spare tire pressure. Check that all tires are the same type and tread pattern. Measure tread depth. New tires generally have 10/32 of an inch tread depth (tread depth is measured in 32nds of an inch). If the tire is worn beyond the minimum specification listed, it should be replaced.

Tire tread depth

- Minimum . . . . . 1.6 mm (2/32 in.)

CAUTION —
Wheel alignment must be checked after replacing tires to ensure maximum tire life.



Most tires have tread wear indicators (TWI) (**arrows**) spaced around the tires that will indicate when the tire has reached the wear limit. If the tops of the wear indicators no longer have any tread on them then the tire should be replaced.

The tires should also be checked for abnormal wear patterns. The tread wear pattern on the front tires is an indication of whether the toe and camber settings need to be checked. "Feathering" on the tread indicates incorrect toe. If the tread is worn on one side, this is usually caused by incorrect camber.

To extend tire life and minimize wear, Volkswagen recommends that the tires be rotated front to rear every 10,000 miles. For more information on tires, see **44 Wheels–Tires, Wheel Alignment**.

Drive axles, checking boots

There are inner and outer CV boots on each front axle shaft. The boots should be regularly inspected for tears, cracks, or deterioration. Once the boot is open to the weather, abrasive road debris can enter the joint and quickly destroy it. If boot replacement is carried out promptly, chances are good that the joint can be saved. See **40 Front Suspension and Drive Axles** for drive boot replacement procedures.

Front suspension components, checking

Check ball joint dust boots for damage and correct seating. Check for play in ball joints. Check inner and outer tie rod end boots for damage and correct seating. Check for play by moving tie rods and wheels. Check attachment of ball joints and tie rod ends. See **40 Front Suspension and Drive Axles** for suspension component replacement.

Transmission, checking for leaks

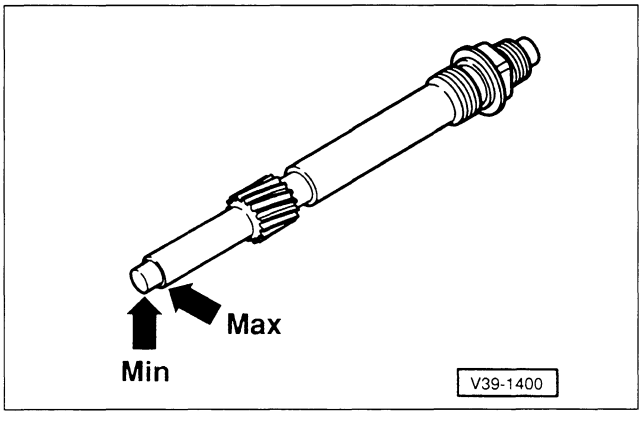
Inspect the transmission for signs of fluid leakage. Pay particular attention to the axle seals. Repair any leaks found, see **34 Manual Transmission**.

Final drive oil level, checking

On cars with manual transmission, the final drive lubricant shares a common supply with the transmission lubricant. For final drive and transmission fluid level checking, see **Transmission oil level, checking (manual transmission)**.

On cars with automatic transmission, the final drive oil level is checked by removing the speedometer drive gear from the transmission housing and using the drive gear as a dipstick. The car should be on a level surface when making the check.

– Remove speedometer drive, wipe clean with a cloth and install again.



➤ Remove drive and check oil level.

NOTE —

- *Oil level must be between MIN and MAX markings.*
- *The amount of oil between MIN and MAX markings is approximately 0.1 Liter (0.1 qt).*

– If oil level is too low, add oil in small amounts until proper level is reached.

Specification

- Automatic transmission, final drive lubricant G 052 145 A2. . . . . SAE 75 W90 (Synthetic oil)

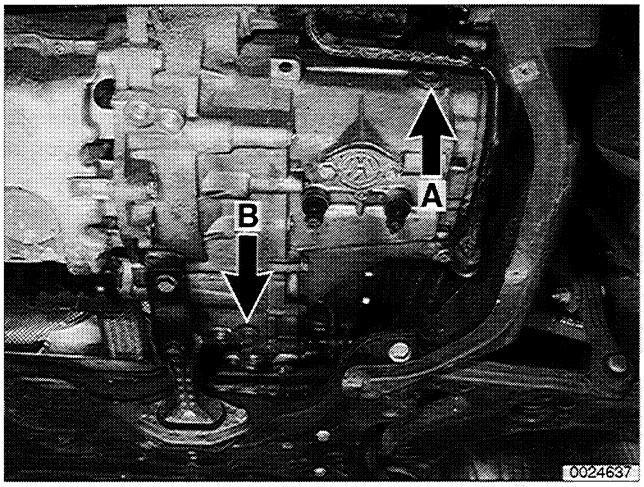
NOTE —

Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.

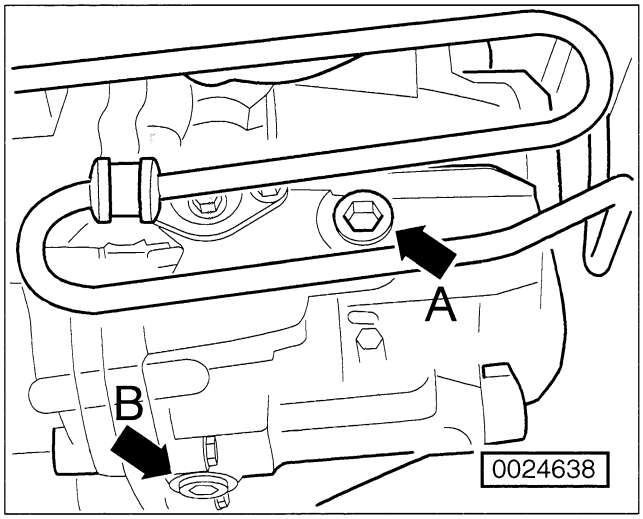
– If oil level is too high, suction out excess using VAG 1358A or equivalent.

– When proper level is obtained, install speedometer drive.

Transmission oil level, checking (manual transmission)



➤ **02J** - Remove oil filler plug (**arrow A**) with 17 mm Allen wrench. Transmission oil drain is also shown (**arrow B**).



➤ **02M** - Remove oil filler plug (**arrow A**) with 17 mm Allen wrench. Transmission oil drain is also shown (**arrow B**).

– Check oil level.

NOTE —
Oil level must be to lower edge of filler plug hole.

– If oil level is too low, add oil in small amounts until proper level is reached.

– Install oil filler plug.

Several different types of transmission oils are specified for both the 02J and 02M transmissions. Before topping-up or changing the transmission oil, consult the tables in **34 Manual Transmission** for the correct oil type.

NOTE —
Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.

Transmission fluid (ATF) level, checking and adjusting (automatic transmission)

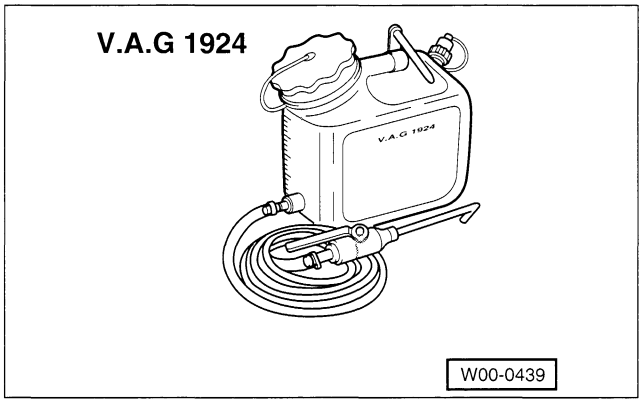
The 01M and 09A automatic transmissions do not have a dipstick and the procedure requires measuring and maintaining a specified ATF temperature (which is neither cold nor hot, but in between) during the ATF level checking. Special Volkswagen tools are required for this operation and it is therefore recommended that ATF level checking on 01M/09A transmissions be left to an authorized Volkswagen dealer.

Automatic Transmission codes

- 01M (from 1999 m.y.) 4-speed
- 09A (from 2001 m.y.) 5-speed

Before starting, be sure that the following checking conditions are met:

- Transmission not in limp-home mode, ATF temperature not above approx. 30°C (86° F)
- Vehicle must be level
- Selector lever in "P"
- Center and left sound absorber panels removed



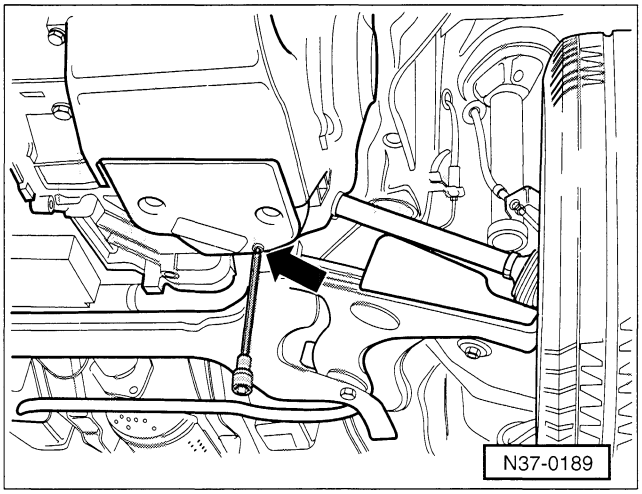
➤ Attach container of ATF filler VAG 1924 to vehicle.

– Start engine.

– Connect suitable scan tool and access Transmission Control Module. If using a Volkswagen supplied VAG 1551/1552, observe the following sequence in the scan tool display window:

- 1 - Rapid Data
- Address word 02 - Transmission electronics
- Advance to Read Measuring Value Blocks - 08
- Select display group 05
- Observe display field 1 for transmission temperature (must be below 30°C at start)

– Lift vehicle.



– Place container under transmission.

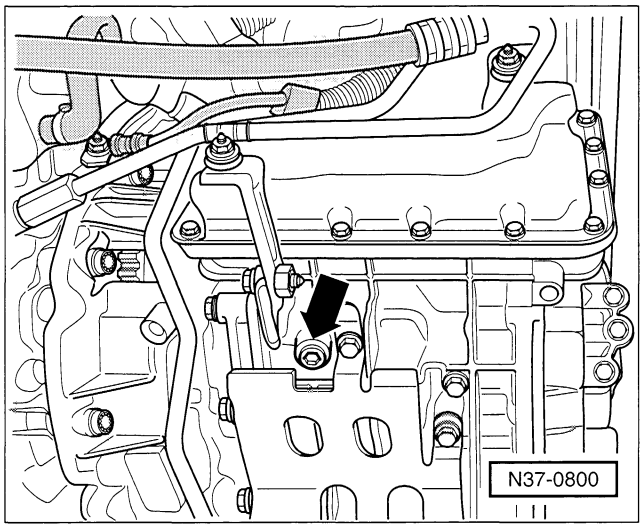
– Bring ATF to test temperature.

ATF test temperature

- 35 to 45°C (95 to 113°F)

– Remove ATF level plug (**arrow**) from oil pan.

➤ **01M transmission**



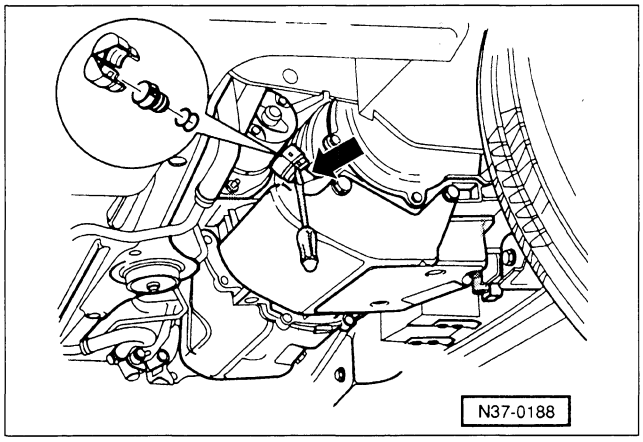
09A transmission

– If ATF drips out of hole when temperature is between 35°C to 45°C, ATF level is correct and no further action is required. Install new seal on level plug and torque. This completes the ATF check.

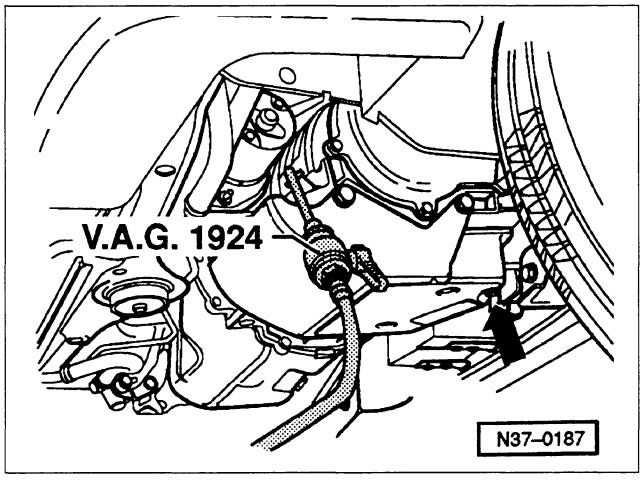
Tightening torque

- ATF level plug with new seal . . . . . 15 Nm (11 ft-lb)

– If no ATF drips out of hole by the time the temperature reaches 45°C (113°F), fill through the filler tube until fluid comes out of the level checking hole.



Pry off plug and seal (**arrow**) with screwdriver. The seal will be destroyed, always replace. 01M shown, 09A similar.



Special tool VAG 1924 shown inserted into filler tube for automatic transmission filling. 01M shown, 09A similar.

Automatic Transmission Lubricant (VW ATF)

- 01M transmission . . . . . part no. G 052 162 A2
- 09A transmission . . . . . part no. G 052 990 A2

– Install plug on filler tube and secure with new seal. Install new seal on level plug and torque. This completes the ATF check.

If ATF ran out immediately when plug was removed from level checking hole, transmission was overfilled. Allow fluid to run out until temperature on scan tool is between 35°C and 45°C. Install new seal on level plug and torque. This completes the ATF check.

ATF, replacing (01M transmission)

– Remove center and left sound absorber panels.

– Place suitable container under transmission.

– Remove ATF level plug from oil pan as shown previously.

– Remove overflow pipe from within level plug hole. ATF will flow out. Drain ATF.

– When fluid has drained, install overflow pipe.

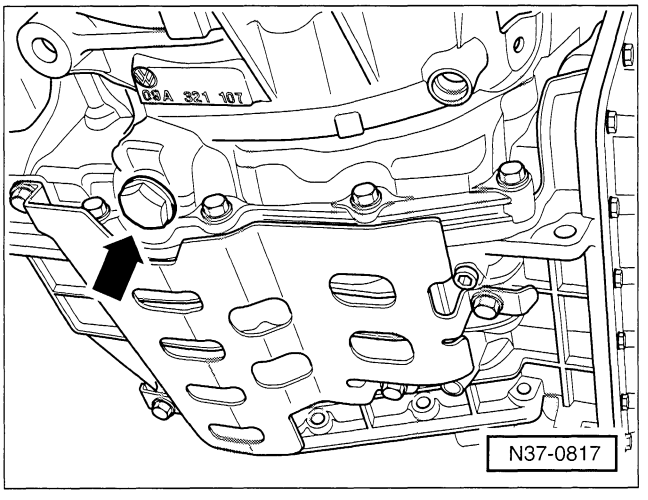
– Install level plug (with old seal) and tighten hand-tight.

– Fill with 3 liters (3.2 qt.) of ATF through filler line using VAG 1924.

– Start engine and shift through all selector lever positions with the vehicle stationary.

– Check and top up ATF level as given earlier.

ATF, replacing (09A transmission)



– Remove lower sound absorber panels.

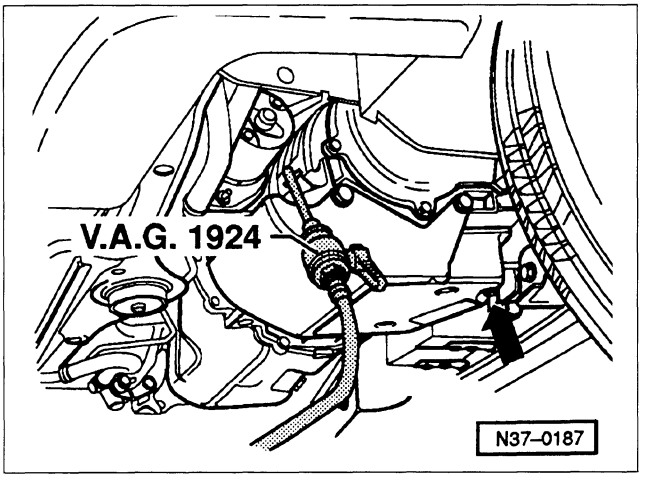
– Place suitable container under transmission.

➤ Remove ATF drain plug (**arrow**) from transmission housing and drain fluid.

– Install drain plug with new seal.

Tightening torque

• Drain plug to transmission (09A) . . . 45 Nm (33 ft-lb)



➤ Fill with 2.5 liters (2.6 qt.) of ATF through filler line using VAG 1924.

– Start engine and shift through all selector lever positions with the vehicle stationary.

– Check and top up ATF level as given earlier.

Exhaust system, checking

> ***WARNING —***
> - *The exhaust system operates at extremely high temperatures. Do not touch the exhaust system while the engine is running.*
> - *Allow exhaust system to cool at least one hour before touching.*

Inspect exhaust system for leaks or damage. Inspect exhaust system mounts. Replace faulty, missing or deteriorated parts.

Underbody sealant, checking

When performing a visual inspection for damage to the underbody sealant, also check the underbody, wheel housings and sill panels. Any faults found should be promptly repaired.

BODY AND INTERIOR MAINTENANCE

Body exterior

Automobile finishes are subjected to abuse from industrial fumes, corrosive road salt, acid rain, and other damaging air-born elements. Regular and correct care will contribute to maintaining and preserving the exterior of your Volkswagen.

NOTE —
Proper care may be a condition for upholding new car warranty should corrosion damage or paint defects occur.

The best protection against environmental influences is frequent washing and waxing. How often this is required depends on the environment where the vehicle is used.

Under certain circumstances weekly washing may be necessary. Under other conditions, a monthly washing and waxing may be adequate. Even if a wax solution is used when washing your vehicle, it is advisable to protect the paint with a coat of hard wax at least twice a year. Check the paint for chips and scratches. Paint defects should be touched up soon after they occur to prevent corrosion.

After the winter, the underside of the vehicle should be thoroughly washed.

Exterior plastic and vinyl should be kept clean. Occasionally apply a colorless vinyl or leather preservative. DO NOT wax plastic or vinyl.

Exterior lights, checking

Check operation of headlights (high and low beam), marker lights, taillights, turn signal lights, brake lights, reverse lights and emergency flasher lights. Use a helper when checking lights. See **94 Lights, Accessories–Exterior**.

Interior lights, checking

Check operation of indicator and instrument cluster warning bulbs. Check operation of interior cabin illumination bulbs. See **96 Lights, Accessories-Interior**.

Dust and pollen filter, replacing

All vehicles are equipped with a ventilation air dust and pollen filter. This filter prevents most dust and pollen from entering the passenger compartment. Volkswagen specifies replacement of this filter at regular mileage intervals. **See 80 Heating and Ventilation.**

Airbag unit, visual inspection

All models are fitted with driver and passenger side airbags. In addition, all models are fitted with side airbags built into the front seat backrest. Some models are also equipped with side curtain airbags in the upper pillars.

WARNING —

- *The padded airbag covers on the steering wheel and instrument panel must not be covered over or have any objects affixed to them.*
- *Do not apply any chemical treatment to airbag unit covers. Clean with a dry or water moistened cloth only.*

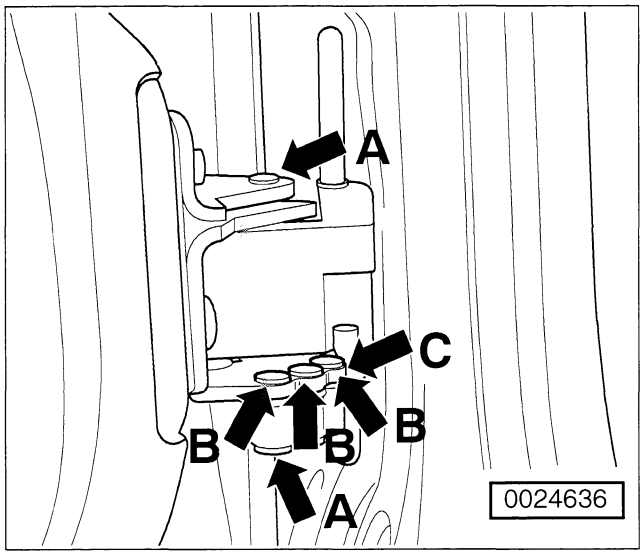
Inspect padded airbag unit covers on steering wheel and instrument panel and side airbag units for signs of external damage. Check with an authorized Volkswagen dealer if any faults are found.

Inspect seats for covers that may obstruct or hinder proper deployment of side airbag.

WARNING —

Volkswagen of America has issued a directive specifically warning against the installation of aftermarket upholstery on any vehicle equipped with side airbags. The factory-installed upholstery is designed to separate in specific places at specific rates, and in specific directions. Installation of non-factory upholstery including, but not limited to, "beads" and "sheepskins", may cause seat mounted airbags to deploy when they are not supposed to; fail to deploy when they should; or to deploy in some manner other than designed. This is a safety hazard and could result in serious injury or death to occupants of the vehicle.

Door check straps and hinges, lubrication



The door check mechanism and door hinge pins should be lubricated periodically. Lubricate door check rollers (**arrows B**) and tensioning spring (**arrow C**) with Volkswagen special grease G 000 150. It is also advisable to lubricate the hinge pins (**arrows A**) with a penetrating lubricant. In all cases, it is a good idea to clean old grease away before applying new lubricant.

Windshield wipers and washers, checking

Inspect windshield wiper blades, front and rear. Replace damaged or deteriorated parts. Check spray pattern of windshield washers, front and rear, adjust as necessary. Fill reservoir for windshield cleaning system. Always add a windshield cleaner to the water (windshield washer antifreeze in winter). See **92 Wipers and Washers**.

In cases where cleaning of windshield and replacement of wiper blades or inserts fails to eliminate streaking conditions, a more complete cleaning of windshield may be needed. Thoroughly clean outside of windshield with a non-abrasive cleaner such as Bon Ami® or Soft Scrub® using a soft cloth and water. Rub until windshield is completely clean of all foreign material. Rinse windshield thoroughly.

On board diagnostics (OBD), checking

A final part of Volkswagen's maintenance program specifies checking the On-board Diagnostic (OBD) system memory. The ODB system is integrated into the engine management control module and monitors emissions-related and other electrical components on the car, including the adaptive automatic transmission, the ABS system, and the airbag system. Checking the OBD memory for faults requires special tools and training. Therefore, it is recommended that this job be carried out by an authorized Volkswagen dealer or qualified independent repair shop.

NOTE —

- *A list of diagnostic trouble codes for generic aftermarket scan tools (P-codes) can be found at the back of this manual.*
- *More manufacturer supplied diagnostic scan tool information for using the VAG 1551/1552 or aftermarket equivalent scan tool, is available in the Official Factory Repair Manual, electronic edition. The CD-ROM can be purchased at www.bentleypublishers.com or by contacting the publisher at the address listed in the front of this manual.*

QUALITY REVIEW

When you have finished working under the hood and around other areas of the vehicle, it is advisable to take a moment to quality check or review your work. This helps to insure that the operation or repair has been completed properly with all affected systems functioning within normal parameters.

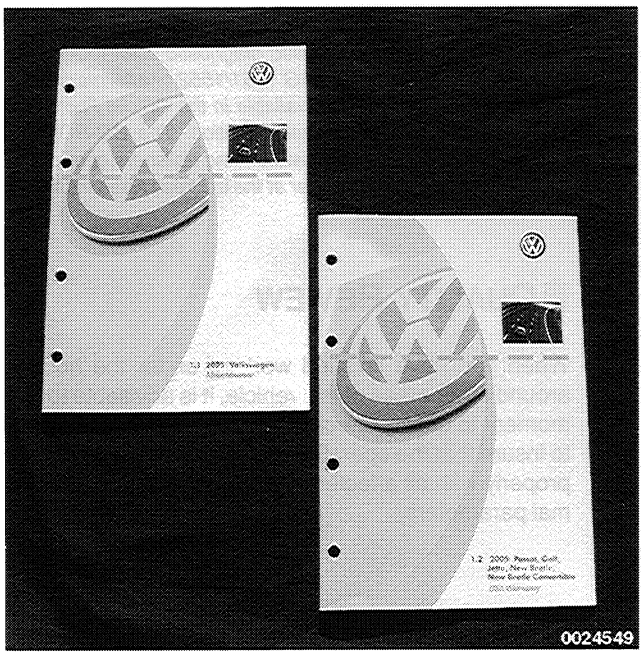
Road test

Upon completion of the maintenance work, the vehicle should be road tested. Check the following during road test:

- Automatic transmission shift lock:
  Shift lever should not be able to move unless foot brake is applied. For more information, see **37 Automatic Transmission**.
- Automatic park/neutral position switch:
  Engine should only start in park or neutral with brake on.
- Kickdown operation (automatic transmission):
  Depress accelerator pedal fully to floor. Depending on vehicle speed and engine speed, upshift is either delayed or transmission shifts down into next lower gear
- Manual gearshift smooth operation
- Clutch operation, smoothness and pedal pressure.
- Brake pedal and parking brake free play:
  Brake pedal: max. 1/3 of overall pedal travel
  Parking brake lever: 2 notches (clicks)
- Brake operation, noise and function of ABS if equipped.
- Engine performance, idle speed, acceleration, cold and hot starting.
- Steering play should be zero with engine running and vehicle on ground.
- Cruise control system operation.
- Radio operation, and reception.
- Vehicle handling and dynamics such as pulling to the side, cornering, vibrations in steering wheel and unusual noises.

MAINTENANCE SCHEDULES

The maintenance schedules list all of the routine maintenance specified by Volkswagen, as well as the mileage intervals at which they should be performed.



NOTE —

- *Volkswagen continually updates maintenance schedules to suit changing conditions through the issuance of Maintenance Schedule Service Circulars. If in doubt about any of the requirements for your vehicle, consult an authorized Volkswagen dealer.*
- *The maintenance tables on the following pages contain information for various Volkswagen models available at the time of publication. The information for V6 engines does not apply to vehicles covered by this manual.*
- *The maintenance tables list service intervals through 105,000 miles (168,000 km). For continued service, repeat intervals listed from the first 105, 000 miles for remaining life of vehicle.*

Table a. 1999 m.y. maintenance schedule

Miles Kilometers	5 8	10 16	15 24	20 32	25 40	30 48	35 56	40 64	45 72	50 80	55 88	60 96	65 104	70 112	75 120	80 128	85 136	90 144	95 152	100 160	105 168
TDI																					
Engine Oil – change	•	•		•		•		•		•		•		•		•		•		•	
Engine Filter – change	•	•		•		•		•		•		•		•		•		•		•	
Water Sep. – drain	•	•		•		•		•		•		•		•		•		•		•	
Timing Belt – check condition	•	•		•		•		•		•		•		•		•		•		•	
Fuel Filter – replace				•				•				•				•				•	
Timing Belt – replace**												•									
Timing Belt Tensioner – replace***												•									
1.8T																					
Engine Oil – change	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Engine Filter – change	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
V-Belt – replace																•					
Spark Plugs – replace								•								•					
Timing Belt – check condition								•								•					
Timing Belt – replace																					•
Timing Belt Tensioner – replace																					•
2.0																					
Engine Oil – change	•	•		•		•		•		•		•		•		•		•		•	
Engine Filter – change	•	•		•		•		•		•		•		•		•		•		•	
Spark Plugs – replace (all but New Beetle)				•				•				•				•				•	
Spark Plugs – replace (NB)								•								•					
Timing Belt – check condition								•								•					
VR6																					
Engine Oil – change	•	•		•		•		•		•		•		•		•		•		•	
Engine Filter – change	•	•		•		•		•		•		•		•		•		•		•	
Spark Plugs – replace								•								•					
V6																					
Engine Oil – change	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Engine Filter – change	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Spark Plugs – replace								•								•					
Timing Belt – check condition								•								•					
Timing Belt – replace																					•
Timing Belt Tensioner – replace																					•
All Cars																					
W/W Fluid – check level		•		•		•		•		•		•		•		•		•		•	
Auto-Shift Lock – check		•		•		•		•		•		•		•		•		•		•	
Brake System – check		•		•		•		•		•		•		•		•		•		•	
Wheels – rotate front to rear		•		•		•		•		•		•		•		•		•		•	
Battery – check electrolyte level				•				•				•				•				•	
Dust Pollen Filter – replace				•				•				•				•				•	
Manual Trans. – check for leaks				•				•				•				•				•	
Automatic Trans. – check for leaks				•				•				•				•				•	
Tires/Spare – check condition				•				•				•				•				•	
Drive Shafts – check boots				•				•				•				•				•	
OBD – check DTC memory				•				•				•				•				•	
Door Check Straps – lubricate				•				•				•				•				•	
During Road Test				•				•				•				•				•	
After Road Test				•				•				•				•				•	
Air Cleaner* – replace filter								•								•					
Cooling System – check level				•				•				•				•				•	
V-Belt – check tension/condition								•								•					
Ribbed Belt – check condition								•								•					
Front Axle – check								•								•					
Check ATF and diff. level								•								•					
Headlights – adjust				•				•				•				•				•	

*Every 40,000 miles and 4 years; except Passat and EuroVan, every 2 years **Recommended ***Recommended; replace once only
Brake Fluid – change every 2 years regardless of mileage
Air Bag System – check for function and damage after 4 years, 8 years and every 2 years thereafter

EDITOR'S NOTE —

Publisher's additional recommended maintenance interval:

- *1.8T timing belt and tensioner, inspect every 20K miles, replace every 60k miles.*
- *2.0 timing belt and tensioner, inspect every 20K miles, replace every 90k miles.*

Table b. 2000 m.y. maintenance schedule

Miles Kilometers	5 8	10 16	15 24	20 32	25 40	30 48	35 56	40 64	45 72	50 80	55 88	60 96	65 104	70 112	75 120	80 128	85 136	90 144	95 152	100 160	105 168
TDI																					
Engine Oil – change	•	•		•		•		•		•		•		•		•		•		•	
Engine Filter – change	•	•		•		•		•		•		•		•		•		•		•	
Water Sep. – drain	•	•		•		•		•		•		•		•		•		•		•	
Timing Belt – check condition	•	•		•		•		•		•		•		•		•		•		•	
Fuel Filter – replace				•				•				•				•				•	
Timing Belt – replace*								A				M				A					
1.8T																					
Engine Oil – change	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Engine Filter – change	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Spark Plugs – replace								•								•					
V-Belt – replace																•					
Timing Belt – check condition								•								•					
Timing Belt – replace																					•
Timing Belt Tensioner – replace																					•
2.0																					
Engine Oil – change	•	•		•		•		•		•		•		•		•		•		•	
Engine Filter – change	•	•		•		•		•		•		•		•		•		•		•	
Spark Plugs – replace (Cabrio)				•				•				•				•				•	
Spark Plugs – replace (except Cabrio)								•								•					
Timing Belt – check condition								•								•					
VR6																					
Engine Oil – change	•	•		•		•		•		•		•		•		•		•		•	
Engine Filter – change	•	•		•		•		•		•		•		•		•		•		•	
Spark Plugs – replace								•								•					
V6																					
Engine Oil – change	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Engine Filter – change	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Spark Plugs – replace								•								•					
Timing Belt – check condition								•								•					
Timing Belt – replace																					•
Timing Belt Tensioner – replace																					•
All Cars																					
W/W Fluid – check level		•		•		•		•		•		•		•		•		•		•	
Auto-Shift Lock – check		•		•		•		•		•		•		•		•		•		•	
Brake System – check		•		•		•		•		•		•		•		•		•		•	
Wheels – rotate front to rear		•		•		•		•		•		•		•		•		•		•	
Air Bag System **		•		•		•		•		•		•		•		•		•		•	
Battery – check electrolyte level				•				•				•				•				•	
Dust Pollen Filter – replace				•				•				•				•				•	
Cooling System – check level				•				•				•				•				•	
Manual Trans. – check for leaks				•				•				•				•				•	
Automatic Trans. – check for leaks				•				•				•				•				•	
Tires/Spare – check condition				•				•				•				•				•	
Drive Shafts – check boots				•				•				•				•				•	
OBD – check DTC memory				•				•				•				•				•	
Door Hinge				•				•				•				•				•	
Headlights – adjust				•				•				•				•				•	
During Road Test				•				•				•				•				•	
After Road Test				•				•				•				•				•	
Air Cleaner*** – replace filter								•								•					
V-Belt – check tension/condition								•								•					
Ribbed Belt – check condition								•								•					
Brake Fluid****								•								•					
Check ATF and diff. level								•								•					
Front Axle (tie rod, etc.)								•								•					

*Recommended **Every 12 months regardless of mileage ***Every 2 years: Cabrio, Passat, EuroVan. Every 4 years: Golf, Jetta, New Beetle
****Replace every 2 years regardless of mileage

EDITOR'S NOTE —

Publisher's additional recommended maintenance interval:

- *1.8T timing belt and tensioner, inspect every 20K miles, replace every 60k miles.*
- *2.0 timing belt and tensioner, inspect every 20K miles, replace every 90k miles.*

Table c. 2001 m.y. maintenance schedule

Miles	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Kilometers	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168
TDI																					
Engine Oil – change	•	•		•		•		•		•		•		•		•		•		•	
Engine Filter – change	•	•		•		•		•		•		•		•		•		•		•	
Water Sep. – drain	•	•		•		•		•		•		•		•		•		•		•	
Timing Belt – check condition	•	•		•		•		•		•		•		•		•		•		•	
Fuel Filter – replace				•				•				•				•				•	
Timing Belt – replace								A				M				A					
1.8T																					
Engine Oil – change	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Engine Filter – change	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Spark Plugs – replace								•								•					
V-Belt – replace																•					
Timing Belt – check condition								•								•					
Timing Belt – replace																					•
Timing Belt Tensioner – replace																					•
2.0																					
Engine Oil – change	•	•		•		•		•		•		•		•		•		•		•	
Engine Filter – change	•	•		•		•		•		•		•		•		•		•		•	
Spark Plugs – replace (Cabrio)				•				•				•				•				•	
Spark Plugs – replace (except Cabrio)								•								•					
Timing Belt – check condition								•								•					
VR6																					
Engine Oil – change	•	•		•		•		•		•		•		•		•		•		•	
Engine Filter – change	•	•		•		•		•		•		•		•		•		•		•	
Spark Plugs – replace								•								•					
V6																					
Engine Oil – change	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Engine Filter – change	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Spark Plugs – replace								•								•					
Timing Belt – check condition								•								•					
Timing Belt Tensioner – replace																					•
Timing Belt – replace																					•
All Cars																					
W/W Fluid – check level		•		•		•		•		•		•		•		•		•		•	
Auto-Shift Lock – check operation		•		•		•		•		•		•		•		•		•		•	
Brake System – check		•		•		•		•		•		•		•		•		•		•	
Wheels – rotate from front to rear		•		•		•		•		•		•		•		•		•		•	
Air Bag System – check function/ damage*		•		•		•		•		•		•		•		•		•		•	
Battery – check electrolyte level		•		•		•		•		•		•		•		•		•		•	
Dust Pollen Filter – replace				•				•				•				•				•	
Cooling System – check level				•				•				•				•				•	
Manual Transmission – for leaks				•				•				•				•				•	
Automatic Transmission – for leaks				•				•				•				•				•	
Tire/Spare Tire – check condition				•				•				•				•				•	
Drive Shafts – check boots				•				•				•				•				•	
OBD – check DTC memory				•				•				•				•				•	
Door Hinge				•				•				•				•				•	
Headlights – check and adjust if necessary				•				•				•				•				•	
Road Test – during				•				•				•				•				•	
Road Test – after				•				•				•				•				•	
Air Cleaner – replace filter**								•								•					
V-Belt – check tension/condition								•								•					
Ribbed Belt – check condition								•								•					
Brake Fluid***								•								•					
Check ATF and diff. level								•								•					
Front Axle (tie rods, etc.)								•								•					

*Check the air bag system every 12 months, regardless of mileage. Check the air bag system at 4 years, 8 years, and then every 2 years (10, 12, 14, etc.)
**Replace the air filter every 2 years or 40,000 miles, whichever occurs first: Cabrio, Passat, EuroVan. Replace the air filter every 4 years or 40,000 miles, whichever occurs first: Golf, Jetta, New Beetle
***Replace the brake fluid every 2 years, regardless of mileage

EDITOR'S NOTE —

Publisher's additional recommended maintenance interval:

- *1.8T timing belt and tensioner, inspect every 20K miles, replace every 60k miles.*
- *2.0 timing belt and tensioner, inspect every 20K miles, replace every 90k miles.*

Table d. 2002-2003 m.y., 1.8L engine, maintenance schedule

Kilometers	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168
Miles	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Engine Oil – change	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Engine Filter – change	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Timing Belt – check								•				•				•					
Timing Belt – replace																					•
Timing Belt Tensioner – replace																					•
V-belt/Ribbed Belt – check								•								•					
V-belt – replace																•					
Spark Plugs – replace								•								•					
Air Cleaner – replace filter								•								•					
W/W Fluid – check level		•		•		•		•		•		•		•		•		•		•	
Auto-shift Lock – check operation		•		•		•		•		•		•		•		•		•		•	
Brake System – check damage/ leaks, pad thickness, fluid level		•		•		•		•		•		•		•		•		•		•	
Wheels – rotate front to rear		•		•		•		•		•		•		•		•		•		•	
Airbag System – check function/ damage*		•		•		•		•		•		•		•		•		•		•	
Battery – check electrolyte level		•		•		•		•		•		•		•		•		•		•	
Engine – check for leaks				•				•				•				•				•	
Pollen Filter – replace				•				•				•				•				•	
Cooling System – check level				•				•				•				•				•	
Transmission – check for leaks**				•				•				•				•				•	
Tires/Spare – check condition				•				•				•				•				•	
Driveshaft – check boots				•				•				•				•				•	
OBD – check DTC memory				•				•				•				•				•	
Door Hinge – lube				•				•				•				•				•	
Headlights – check and adjust if necessary				•				•				•				•				•	
Exhaust System – check for damage and leaks				•				•				•				•				•	
Sunroof Frame – clean and lubricate				•				•				•				•				•	
Road Test				•				•				•				•				•	
Power Steering – check fluid level								•								•					
Brake Fluid***								•								•					
Check ATF and Differential for leaks and level; add if necessary								•								•					
Front Axle – check dust seals, ball joints, tie rods				•				•				•				•				•	

*Air Bag System – visual check every 12 months regardless of mileage **Manual Transmission – check level; add if necessary
***Brake Fluid – change every 2 years regardless of mileage

EDITOR'S NOTE —

Publisher's additional recommended maintenance interval:

• 1.8T timing belt and tensioner, inspect every 20K miles, replace every 60k miles.

Table e. 2002-2003 m.y, 1.9L engine, maintenance schedule

Kilometers	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168
Miles	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Engine Oil – change	•	•		•		•		•		•		•		•		•		•		•	
Engine Filter – change	•	•		•		•		•		•		•		•		•		•		•	
Timing Belt – check				•				•				•				•				•	
Timing Belt – replace																•					
Timing Belt Idler – replace																•					
V-belt/Ribbed Belt – check								•								•					
Air Cleaner – replace filter								•								•					
Water Sep – drain (TDI)	•	•		•		•		•		•		•		•		•		•		•	
Fuel Filter – replace (TDI)				•				•				•				•				•	
W/W Fluid – check level		•		•		•		•		•		•		•		•		•		•	
Auto-shift Lock – check operation		•		•		•		•		•		•		•		•		•		•	
Brake System – check damage/ leaks, pad thickness, fluid level		•		•		•		•		•		•		•		•		•		•	
Wheels – rotate front to rear		•		•		•		•		•		•		•		•		•		•	
Airbag System – check function/ damage*		•		•		•		•		•		•		•		•		•		•	
Battery – check electrolyte level		•		•		•		•		•		•		•		•		•		•	
Engine – check for leaks				•				•				•				•				•	
Pollen Filter – replace				•				•				•				•				•	
Cooling System – check level				•				•				•				•				•	
Transmission – check for leaks**				•				•				•				•				•	
Tires/Spare – check condition				•				•				•				•				•	
Driveshaft – check boots				•				•				•				•				•	
OBD – check DTC memory				•				•				•				•				•	
Door Hinge – lube				•				•				•				•				•	
Headlights – check and adjust if necessary				•				•				•				•				•	
Exhaust System – check for damage and leaks				•				•				•				•				•	
Sunroof Frame – clean and lubricate				•				•				•				•				•	
Road Test				•				•				•				•				•	
Power Steering – check fluid level								•								•					
Brake Fluid***								•								•					
Check ATF and Differential for leaks and level; add if necessary								•								•					
Front Axle – check dust seals, ball joints, tie rods				•				•				•				•				•	

*Air Bag System – visual check every 12 months regardless of mileage **Manual Transmission – check level; add if necessary
***Brake Fluid – change every 2 years regardless of mileage

Table f. 2002-2003 m.y., 2.0L engine, maintenance schedule

Kilometers	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168
Miles	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Engine Oil – change	•	•		•		•		•		•		•		•		•		•		•	
Engine Filter – change	•	•		•		•		•		•		•		•		•		•		•	
Timing Belt – check								•								•					
V-belt/Ribbed Belt – check								•								•					
Spark Plugs – replace								•								•					
Air Cleaner – replace filter								•								•					
W/W Fluid – check level		•		•		•		•		•		•		•		•		•		•	
Auto-shift Lock – check operation		•		•		•		•		•		•		•		•		•		•	
Brake System – check damage/ leaks, pad thickness, fluid level		•		•		•		•		•		•		•		•		•		•	
Wheels – rotate front to rear		•		•		•		•		•		•		•		•		•		•	
Airbag System – check function/ damage*		•		•		•		•		•		•		•		•		•		•	
Battery – check electrolyte level		•		•		•		•		•		•		•		•		•		•	
Engine – check for leaks				•				•				•				•				•	
Pollen Filter – replace				•				•				•				•				•	
Cooling System – check level				•				•				•				•				•	
Transmission – check for leaks**				•				•				•				•				•	
Tires/Spare – check condition				•				•				•				•				•	
Driveshaft – check boots				•				•				•				•				•	
OBD – check DTC memory				•				•				•				•				•	
Door Hinge – lube				•				•				•				•				•	
Headlights – check and adjust if necessary				•				•				•				•				•	
Exhaust System – check for damage and leaks				•				•				•				•				•	
Sunroof Frame – clean and lubricate				•				•				•				•				•	
Road Test				•				•				•				•				•	
Power Steering – check fluid level								•								•					
Brake Fluid***								•								•					
Check ATF and Differential for leaks and level; add if necessary								•								•					
Front Axle – check dust seals, ball joints, tie rods				•				•				•				•				•	

*Air Bag System – visual check every 12 months regardless of mileage **Manual Transmission – check level; add if necessary
***Brake Fluid – change every 2 years regardless of mileage

EDITOR'S NOTE —

Publisher's additional recommended maintenance interval:

• 2.0 timing belt and tensioner, inspect every 20K miles, replace every 90k miles

Table g. 2002 m.y., 2.8L (VR6) engine, maintenance schedule

Kilometers	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168
Miles	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Engine Oil – change	•	•		•		•		•		•		•		•		•		•		•	
Engine Filter – change	•	•		•		•		•		•		•		•		•		•		•	
V-belt/Ribbed Belt – check								•								•					
Spark Plugs – replace								•								•					
Air Cleaner – replace filter								•								•					
W/W Fluid – check level		•		•		•		•		•		•		•		•		•		•	
Auto-shift Lock – check operation		•		•		•		•		•		•		•		•		•		•	
Brake System – check damage/ leaks, pad thickness, fluid level		•		•		•		•		•		•		•		•		•		•	
Wheels – rotate front to rear		•		•		•		•		•		•		•		•		•		•	
Airbag System – check function/ damage*		•		•		•		•		•		•		•		•		•		•	
Battery – check electrolyte level		•		•		•		•		•		•		•		•		•		•	
Engine – check for leaks				•				•				•				•				•	
Pollen Filter – replace				•				•				•				•				•	
Cooling System – check level				•				•				•				•				•	
Transmission – check for leaks**				•				•				•				•				•	
Tires/Spare – check condition				•				•				•				•				•	
Driveshaft – check boots				•				•				•				•				•	
OBD – check DTC memory				•				•				•				•				•	
Door Hinge – lube				•				•				•				•				•	
Headlights – check and adjust if necessary				•				•				•				•				•	
Exhaust System – check for damage and leaks				•				•				•				•				•	
Sunroof Frame – clean and lubricate				•				•				•				•				•	
Road Test				•				•				•				•				•	
Power Steering – check fluid level								•								•					
Brake Fluid***								•								•					
Check ATF and Differential for leaks and level; add if necessary****								•								•					
Front Axle – check dust seals, ball joints, tie rods				•				•				•				•				•	

*Air Bag System – visual check every 12 months regardless of mileage **Manual Transmission – check level; add if necessary
***Brake Fluid – change every 2 years regardless of mileage ****Change ATF EuroVan only

Table h. 2003 m.y., 2.8L (VR6) engine, maintenance schedule

Kilometers	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168
Miles	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Engine Oil – change	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Engine Filter – change	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
V-belt/Ribbed Belt – check								•								•					
Spark Plugs – replace								•								•					
Air Cleaner – replace filter								•								•					
W/W Fluid – check level		•		•		•		•		•		•		•		•		•		•	
Auto-shift Lock – check operation		•		•		•		•		•		•		•		•		•		•	
Brake System – check damage/ leaks, pad thickness, fluid level		•		•		•		•		•		•		•		•		•		•	
Wheels – rotate front to rear		•		•		•		•		•		•		•		•		•		•	
Airbag System – check function/ damage*		•		•		•		•		•		•		•		•		•		•	
Battery – check electrolyte level		•		•		•		•		•		•		•		•		•		•	
Engine – check for leaks				•				•				•				•				•	
Pollen Filter – replace				•				•				•				•				•	
Cooling System – check level				•				•				•				•				•	
Transmission – check for leaks**				•				•				•				•				•	
Tires/Spare – check condition				•				•				•				•				•	
Driveshaft – check boots				•				•				•				•				•	
OBD – check DTC memory				•				•				•				•				•	
Door Hinge – lube				•				•				•				•				•	
Headlights – check and adjust if necessary				•				•				•				•				•	
Exhaust System – check for damage and leaks				•				•				•				•				•	
Sunroof Frame – clean and lubricate				•				•				•				•				•	
Road Test				•				•				•				•				•	
Power Steering – check fluid level								•								•					
Brake Fluid***								•								•					
Check ATF and Differential for leaks and level; add if necessary****								•								•					
Front Axle – check dust seals, ball joints, tie rods				•				•				•				•				•	

*Air Bag System – visual check every 12 months regardless of mileage **Manual Transmission – check level; add if necessary
***Brake Fluid – change every 2 years regardless of mileage ****Change ATF EuroVan only

Table i. 2004 m.y., 1.8L engine, maintenance schedule

1.8 Liter Turbo Engine:

Miles (in thousands)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Kilometers (in thousands)	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168
Engine: change engine oil and oil filter	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Engine: check for leaks				•				•				•				•				•	
Battery: check				•				•				•				•				•	
Door check straps: lubricate				•				•				•				•				•	
Dust & pollen filter: replace (where applicable)				•				•				•				•				•	
Cooling system: check coolant level; add if necessary				•				•				•				•				•	
Windshield washer fluid: check level; add if necessary		•		•		•		•		•		•		•		•		•		•	
Automatic shift lock: check operation including park/neutral position switch		•		•		•		•		•		•		•		•		•		•	
Automatic transmission: check for leaks				•				•				•				•				•	
Manual transmission: check oil level; add if necessary; check for leaks				•				•				•				•				•	
Wheels: rotate front to rear		•		•		•		•		•		•		•		•		•		•	
Tires/spare wheel: check condition and pressure				•				•				•				•				•	
Brake system: check for damage/leaks, brake pad thickness, brake fluid level		•		•		•		•		•		•		•		•		•		•	
Drive shafts: check boots				•				•				•				•				•	
On-Board Diagnostic system: check fault memory; erase if necessary				•				•				•				•				•	
Sunroof frame: clean and lubricate				•				•				•				•				•	

Miles (in thousands)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Kilometers (in thousands)	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168
Front axle: check dust seals on ball joints and tie rod ends; check tie rods				•				•				•				•				•	
Headlights: check & adjust if necessary				•				•				•				•				•	
Rear spoiler: lubricate if necessary		•		•		•		•		•		•		•		•		•		•	
Timing belt: check condition												•				•					
Timing belt and tensioning roller: Replace																					•
V-belt/ribbed belt: check tension and condition; adjust if necessary								•								•					
Spark plugs: replace								•								•					
Air cleaner: replace filter								•								•					
Automatic transmission: check ATF								•								•					
Exhaust system: check for damage & leaks				•				•				•				•				•	
Power steering: check fluid level								•								•					
Automatic transmission final drive: check oil level and for leaks; add if necessary								•				•				•					
Check operation of convertible top and roll-over protection with convertible top open using VAS 5051				•				•				•				•				•	
Road Test: check kickdown, braking, steering, heating and ventilation, air conditioning, power accessories and electrical systems				•				•				•				•				•	
Every 12 months, regardless of mileage (kilometers): Perform visual check on Airbag system.																					
Every 2 years, regardless of mileage (kilometers): Change brake fluid.																					
Every 2 yrs or 20,000 miles (32,000 kilometers), whichever comes first: Check function of convertible top and check roll-over protection with convertible top open.																					

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EDITOR'S NOTE —

Publisher's additional recommended maintenance interval:

- *1.8T timing belt and tensioner, inspect every 20K miles, replace every 60k miles.*

Table j. 2004 m.y., 1.9L PD engine, maintenance schedule

1.9 Liter TDI Engine:

Miles (in thousands)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Kilometers (in thousands)	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168
Engine: change engine oil and oil filter	•	•		•		•		•		•		•		•		•		•		•	
Engine: check for leaks				•				•				•				•				•	
Battery: check				•				•				•				•				•	
Door check straps: lubricate				•				•				•				•				•	
Windshield washer fluid: check level; add if necessary		•		•		•		•		•		•		•		•		•		•	
Dust & pollen filter: replace (where applicable)				•				•				•				•				•	
Automatic shift lock: check operation including park/neutral position switch		•		•		•		•		•		•		•		•		•		•	
Automatic transmission: check for leaks				•				•				•				•				•	
Manual transmission: check oil level; add if necessary; check for leaks				•				•				•				•				•	
Tires/spare wheel: check condition and pressure				•				•				•				•				•	
Wheels: rotate front to rear		•		•		•		•		•		•		•		•		•		•	
Drive shafts: check boots				•				•				•				•				•	
On-Board Diagnostic system: check fault memory; erase if necessary				•				•				•				•				•	
Brake system: check for damage/leaks, brake pad thickness, brake fluid level		•		•		•		•		•		•		•		•		•		•	
Rear spoiler: lubricate if necessary		•		•		•		•		•		•		•		•		•		•	

Miles (in thousands)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Kilometers (in thousands)	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168
Cooling system: check coolant level; add if necessary				•				•				•				•				•	
Automatic transmission: check ATF								•								•					
Direct shift transmission (DSG): change fluid								•								•					
Front axle: check dust seals on ball joints and tie rod ends; check tie rods				•				•				•				•				•	
Air cleaner: replace filter								•								•					
Headlights: check & adjust if necessary				•				•				•				•				•	
Exhaust system: check for damage & leaks				•				•				•				•				•	
Sunroof frame: clean and lubricate				•				•				•				•				•	
Power steering: check fluid level								•								•					
Water separator: drain water	•	•		•		•		•		•		•		•		•		•		•	
Fuel filter: replace				•				•				•				•				•	
Timing belt: check																•					
Timing belt: replace																				•	
V-belt/ribbed belt: check; adjust if necessary								•								•					
Road Test: check kickdown, braking, steering, heating and ventilation, air conditioning, power accessories and electrical systems				•				•				•				•				•	
Every 12 months, regardless of mileage (kilometers): Perform visual check on Airbag system.																					
Every 2 years, regardless of mileage (kilometers): Change brake fluid.																					

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Table k. 2004 m.y., 2.0L engine, maintenance schedule

2.0 Liter Engine:

Miles (in thousands)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Kilometers (in thousands)	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168
Engine: change engine oil and oil filter	•	•		•		•		•		•		•		•		•		•		•	
Engine: check for leaks				•				•				•				•				•	
Exhaust system: check for damage & leaks				•				•				•				•				•	
Battery: check				•				•				•				•				•	
Door check straps: lubricate				•				•				•				•				•	
Dust & pollen filter: replace (where applicable)				•				•				•				•				•	
Cooling system: check coolant level; add if necessary				•				•				•				•				•	
Windshield washer fluid: check level; add if necessary		•		•		•		•		•		•		•		•		•		•	
Automatic shift lock: check operation including park/neutral position switch		•		•		•		•		•		•		•		•		•		•	
Automatic transmission: check for leaks				•				•				•				•				•	
Manual transmission: check oil level; add if necessary; check for leaks				•				•				•				•				•	
Wheels: rotate front to rear		•		•		•		•		•		•		•		•		•		•	
Tires/spare wheel: check condition and pressure				•				•				•				•				•	
Brake system: check for damage/leaks, brake pad thickness, brake fluid level		•		•		•		•		•		•		•		•		•		•	
Drive shafts: check boots				•				•				•				•				•	
On-Board Diagnostic system: check fault memory; erase if necessary				•				•				•				•				•	

Miles (in thousands)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Kilometers (in thousands)	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168
Timing belt: check																•					
Sunroof frame: clean and lubricate				•				•				•				•				•	
V-belt/ribbed belt: check tension and condition; adjust if necessary								•								•					
Spark plugs: replace								•								•					
Air cleaner: replace filter								•								•					
Rear spoiler: lubricate if necessary		•		•		•		•		•		•		•		•		•		•	
Automatic transmission: check ATF								•								•					
Automatic transmission final drive oil: check level and for leaks; add if necessary								•				•				•					
Headlights: check & adjust if necessary				•				•				•				•				•	
Power steering: check fluid level								•								•					
Front axle: check dust seals on ball joints and tie rod ends; check tie rods				•				•				•				•				•	
Check operation of convertible top and roll-over protection with convertible top open using VAS 5051				•				•				•				•				•	
Road Test: check kick down, braking, steering, heating and ventilation, air conditioning, power accessories and electrical systems				•				•				•				•				•	
Every 12 months, regardless of mileage (kilometers): Perform visual check on Airbag system.																					
Every 2 years, regardless of mileage (kilometers): Change brake fluid.																					
Every 2 yrs or 20,000 miles (32,000 kilometers), whichever comes first: Check function of convertible top and check roll-over protection with convertible top open. VMS-04-1, Mar. 29, 2004																					

EDITOR'S NOTE —

Publisher's additional recommended maintenance interval:

• 2.0 timing belt and tensioner, inspect every 20K miles, replace every 90k miles.

Table I. 2004 m.y., 2.8L engine, maintenance schedule

2.8 Liter VR6 Engine:

Miles (in thousands)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Kilometers (in thousands)	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168
Engine: change engine oil and oil filter	•	•		•		•		•		•		•		•		•		•		•	
Windshield washer fluid: check level; add if necessary		•		•		•		•		•		•		•		•		•		•	
Automatic shift lock: check operation including park/neutral position switch		•		•		•		•		•		•		•		•		•		•	
Brake system: check for damage/leaks, brake pad thickness, brake fluid level		•		•		•		•		•		•		•		•		•		•	
Wheels: rotate front to rear		•		•		•		•		•		•		•		•		•		•	
Engine: check for leaks				•				•				•				•				•	
Dust & pollen filter: replace (where applicable)				•				•				•				•				•	
Battery: check		•		•				•		•		•		•		•		•		•	
Automatic transmission/final drive: check ATF; check oil level and for leaks; add if necessary								•				•				•					
Cooling system: check coolant level; add if necessary				•				•				•				•				•	
Automatic transmission: check for leaks				•				•				•				•				•	
Tires/spare wheel: check condition and pressure				•				•				•				•				•	
Manual transmission: check oil level; add if necessary; check for leaks				•				•				•				•				•	
Drive shafts: check boots				•				•				•				•				•	
On-Board Diagnostic system: check fault memory; erase if necessary				•				•				•				•				•	

Miles (in thousands)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Kilometers (in thousands)	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168
Door check straps: lubricate				•				•				•				•				•	
Automatic transmission: change ATF								•								•					
Exhaust system: check for damage & leaks				•				•				•				•				•	
Front axle: check dust seals on ball joints and tie rod ends; check tie rods				•				•				•				•				•	
Headlights: check & adjust if necessary				•				•				•				•				•	
Air cleaner: replace filter								•								•					
Sunroof frame: clean and lubricate				•				•				•				•				•	
Timing belt: check (not applicable)																					
Timing belt: replace (not applicable)																					
Timing belt tensioner: replace (not applicable)																					
V-belt/ribbed belt: check								•								•					
Spark plugs: replace								•													
Power steering: check fluid level								•								•					
Road Test: check kickdown, braking, steering, heating and ventilation, air conditioning, power accessories and electrical systems				•				•				•				•				•	
Every 12 months, regardless of mileage (kilometers): Perform visual check on Airbag system.																					
Every 2 years, regardless of mileage (kilometers): Change brake fluid.																					

VMS-04-1, Mar. 29, 2004

Table m. 2005 m.y., 1.8L engine, maintenance schedule

1.8 Liter Turbo Engine:

Miles (in thousands)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Kilometers (in thousands)	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168
Engine: change engine oil and oil filter	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Engine: check for leaks				•				•				•				•				•	
Battery: check				•				•				•				•				•	
Door check straps: lubricate				•				•				•				•				•	
Dust & pollen filter: replace (where applicable)				•				•				•				•				•	
Cooling system: check coolant level; add if necessary				•				•				•				•				•	
Windshield washer fluid: check level; add if necessary		•		•		•		•		•		•		•		•		•		•	
Automatic shift lock: check operation including park/neutral position switch		•		•		•		•		•		•		•		•		•		•	
Automatic transmission: check for leaks				•				•				•				•				•	
Manual transmission: check oil level; add if necessary; check for leaks				•				•				•				•				•	
Wheels: rotate front to rear		•		•		•		•		•		•		•		•		•		•	
Tires/spare wheel: check condition and pressure				•				•				•				•				•	
Brake system: check for damage/leaks, brake pad thickness, brake fluid level		•		•		•		•		•		•		•		•		•		•	
Drive shafts: check boots				•				•				•				•				•	
On-Board Diagnostic system: check fault memory; erase if necessary				•				•				•				•				•	
Sunroof frame: clean and lubricate				•				•				•				•				•	

Miles (in thousands)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Kilometers (in thousands)	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168
Front axle: check dust seals on ball joints and tie rod ends; check tie rods				•				•				•				•				•	
Headlights: check & adjust if necessary				•				•				•				•				•	
Rear spoiler: lubricate if necessary		•		•		•		•		•		•		•		•		•		•	
Timing belt: check condition												•				•					
Timing belt and tensioning roller: Replace																					•
V-belt/ribbed belt: check tension and condition; adjust if necessary								•								•					
Spark plugs: replace								•								•					
Air cleaner: replace filter								•								•					
Automatic transmission: check ATF								•								•					
Exhaust system: check for damage & leaks				•				•				•				•				•	
Power steering: check fluid level								•								•					
Automatic transmission final drive: check oil level and for leaks; add if necessary								•				•				•					
Check operation of convertible top and roll-over protection with convertible top open using VAS 5051				•				•				•				•				•	
Road Test: check kickdown, braking, steering, heating and ventilation, air conditioning, power accessories and electrical systems				•				•				•				•				•	
Every 12 months, regardless of mileage (kilometers): Perform visual check on Airbag system.																					
Every 2 years, regardless of mileage (kilometers): Change brake fluid.																					
Every 2 yrs or 20,000 miles (32,000 kilometers), whichever comes first: Check function of convertible top and check roll-over protection with convertible top open.																					

VMS-04-02 JULY 01 2004

EDITOR'S NOTE —

Publisher's additional recommended maintenance interval:

- *1.8T timing belt and tensioner, inspect every 20K miles, replace every 60k miles.*

Table n. 2005 m.y., 1.9L engine, maintenance schedule

1.9 Liter TDI Engine:

Miles (in thousands)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Kilometers (in thousands)	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168
Engine: change engine oil and oil filter	•	•		•		•		•		•		•		•		•		•		•	
Engine: check for leaks				•				•				•				•				•	
Battery: check				•				•				•				•				•	
Door check straps: lubricate				•				•				•				•				•	
Windshield washer fluid: check level; add if necessary		•		•		•		•		•		•		•		•		•		•	
Dust & pollen filter: replace (where applicable)				•				•				•				•				•	
Automatic shift lock: check operation including park/neutral position switch		•		•		•		•		•		•		•		•		•		•	
Automatic transmission: check for leaks				•				•				•				•				•	
Manual transmission: check oil level; add if necessary; check for leaks				•				•				•				•				•	
Tires/spare wheel: check condition and pressure				•				•				•				•				•	
Wheels: rotate front to rear		•		•		•		•		•		•		•		•		•		•	
Drive shafts: check boots				•				•				•				•				•	
On-Board Diagnostic system: check fault memory; erase if necessary				•				•				•				•				•	
Brake system: check for damage/leaks, brake pad thickness, brake fluid level		•		•		•		•		•		•		•		•		•		•	
Rear spoiler: lubricate if necessary		•		•		•		•		•		•		•		•		•		•	

Miles (in thousands)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Kilometers (in thousands)	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168
Cooling system: check coolant level; add if necessary				•				•				•				•				•	
Automatic transmission: check ATF								•								•					
Direct shift transmission (DSG): change fluid								•								•					
Front axle: check dust seals on ball joints and tie rod ends; check tie rods				•				•				•				•				•	
Air cleaner: replace filter								•								•					
Headlights: check & adjust if necessary				•				•				•				•				•	
Exhaust system: check for damage & leaks				•				•				•				•				•	
Sunroof frame: clean and lubricate				•				•				•				•				•	
Power steering: check fluid level								•								•					
Water separator: drain water	•	•		•		•		•		•		•		•		•		•		•	
Fuel filter: replace				•				•				•				•				•	
Timing belt: check																•					
Timing belt: replace																				•	
V-belt/ribbed belt: check; adjust if necessary								•								•					
Road Test: check kickdown, braking, steering, heating and ventilation, air conditioning, power accessories and electrical systems				•				•				•				•				•	
Every 12 months, regardless of mileage (kilometers): Perform visual check on Airbag system.																					
Every 2 years, regardless of mileage (kilometers): Change brake fluid.																					

VMS-04-02 July 01 2004

Table o. 2005 m.y., 2.0L engine, maintenance schedule

2.0 Liter Engine:

Miles (in thousands)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Kilometers (in thousands)	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168
Engine: change engine oil and oil filter	•	•		•		•		•		•		•		•		•		•		•	
Engine: check for leaks				•				•				•				•				•	
Exhaust system: check for damage & leaks				•				•				•				•				•	
Battery: check				•				•				•				•				•	
Door check straps: lubricate				•				•				•				•				•	
Dust & pollen filter: replace (where applicable)				•				•				•				•				•	
Cooling system: check coolant level; add if necessary				•				•				•				•				•	
Windshield washer fluid: check level; add if necessary		•		•		•		•		•		•		•		•		•		•	
Automatic shift lock: check operation including park/neutral position switch		•		•		•		•		•		•		•		•		•		•	
Automatic transmission: check for leaks				•				•				•				•				•	
Manual transmission: check oil level; add if necessary; check for leaks				•				•				•				•				•	
Wheels: rotate front to rear		•		•		•		•		•		•		•		•		•		•	
Tires/spare wheel: check condition and pressure				•				•				•				•				•	
Brake system: check for damage/leaks, brake pad thickness, brake fluid level		•		•		•		•		•		•		•		•		•		•	
Drive shafts: check boots				•				•				•				•				•	
On-Board Diagnostic system: check fault memory; erase if necessary				•				•				•				•				•	

Miles (in thousands)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Kilometers (in thousands)	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168
Timing belt: check																•					
Sunroof frame: clean and lubricate				•				•				•				•				•	
V-belt/ribbed belt: check tension and condition; adjust if necessary								•								•					
Spark plugs: replace								•								•					
Air cleaner: replace filter								•								•					
Rear spoiler: lubricate if necessary		•		•		•		•		•		•		•		•		•		•	
Automatic transmission: check ATF								•								•					
Automatic transmission final drive oil: check level and for leaks; add if necessary								•				•				•					
Headlights: check & adjust if necessary				•				•				•				•				•	
Power steering: check fluid level								•								•					
Front axle: check dust seals on ball joints and tie rod ends; check tie rods				•				•				•				•				•	
Check operation of convertible top and roll-over protection with convertible top open using VAS 5051				•				•				•				•				•	
Road Test: check kick down, braking, steering, heating and ventilation, air conditioning, power accessories and electrical systems				•				•				•				•				•	
Every 12 months, regardless of mileage (kilometers): Perform visual check on Airbag system.																					
Every 2 years, regardless of mileage (kilometers): Change brake fluid.																					
Every 2 yrs or 20,000 miles (32,000 kilometers), whichever comes first: Check function of convertible top and check roll-over protection with convertible top open.																					

VM6-04-02 July 01, 2004

Table p. 2005 m.y., 2.8L engine, maintenance schedule

2.8 Liter VR6 Engine:

Miles (in thousands)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Kilometers (in thousands)	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168
Engine: change engine oil and oil filter	•	•		•		•		•		•		•		•		•		•		•	
Windshield washer fluid: check level; add if necessary		•		•		•		•		•		•		•		•		•		•	
Automatic shift lock: check operation including park/neutral position switch		•		•		•		•		•		•		•		•		•		•	
Brake system: check for damage/leaks, brake pad thickness, brake fluid level		•		•		•		•		•		•		•		•		•		•	
Wheels: rotate front to rear		•		•		•		•		•		•		•		•		•		•	
Engine: check for leaks				•				•				•				•				•	
Dust & pollen filter: replace (where applicable)				•				•				•				•				•	
Battery: check		•		•				•		•		•		•		•		•		•	
Automatic transmission/final drive: check ATF; check oil level and for leaks; add if necessary								•				•				•					
Cooling system: check coolant level; add if necessary				•				•				•				•				•	
Automatic transmission: check for leaks				•				•				•				•				•	
Tires/spare wheel: check condition and pressure				•				•				•				•				•	
Manual transmission: check oil level; add if necessary; check for leaks				•				•				•				•				•	
Drive shafts: check boots				•				•				•				•				•	
On-Board Diagnostic system: check fault memory; erase if necessary				•				•				•				•				•	

Miles (in thousands)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Kilometers (in thousands)	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168
Door check straps: lubricate				•				•				•				•				•	
Exhaust system: check for damage & leaks				•				•				•				•				•	
Front axle: check dust seals on ball joints and tie rod ends; check tie rods				•				•				•				•				•	
Headlights: check & adjust if necessary				•				•				•				•				•	
Air cleaner: replace filter								•								•					
Sunroof frame: clean and lubricate				•				•				•				•				•	
Timing belt: check (not applicable)																					
Timing belt: replace (not applicable)																					
Timing belt tensioner: replace (not applicable)																					
V-belt/ribbed belt: check								•								•					
Spark plugs: replace								•													
Power steering: check fluid level								•								•					
Road Test: check kickdown, braking, steering, heating and ventilation, air conditioning, power accessories and electrical systems				•				•				•				•				•	
Every 12 months, regardless of mileage (kilometers): Perform visual check on Airbag system.																					
Every 2 years, regardless of mileage (kilometers): Change brake fluid.																					

VMS04-02 July 01, 2004

EDITOR'S NOTE —

Publisher's additional recommended maintenance interval:

• 2.0 timing belt and tensioner, inspect every 20K miles, replace every 90k miles.

1 Engine–General

GENERAL 1-1
1.8 LITER ENGINE 1-2
1.9 LITER ENGINE 1-3
2.0 LITER ENGINE 1-4
2.8 LITER ENGINE 1-5
1.9 LITER ENGINE (PD DIESEL) 1-6

GENERAL

This general information group gives engine application information and general technical data for the engines used in the Volkswagen Jetta, Golf and GTI. Engines are the same for both the United States and Canada.

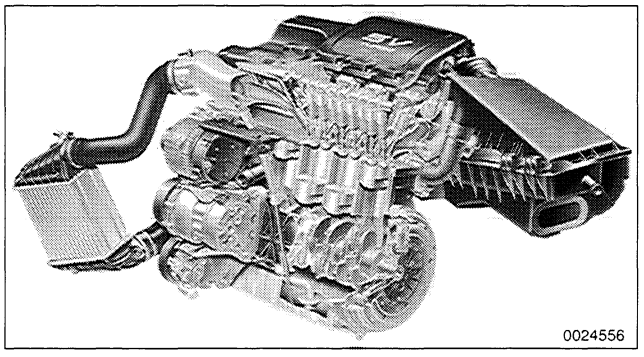
Much of the engine repair information in **1 Engine** is organized according to engine code. It is therefore important to know the code of the engine installed in your vehicle. For engine code location see **0 Maintenance**.

Engine Codes

- AWD, AWW, AWP . . . 1.8L 4-cylinder turbo gasoline
- ALH . . . . . 1.9L 4-cylinder turbo diesel
- BEW . . . . . 1.9L 4-cylinder PD turbo diesel
- AEG, AVH, AZG, BBW, BEV . . . . . 2.0L 4-cylinder gasoline
- AFP, BDF . . . . . 2.8L 6-cylinder gasoline

1.8 LITER ENGINE

The 1.8L engine is a further design evolution of the 4-cylinder gasoline turbocharged engine used on previous models of the Volkswagen Passat and New Beetle.



➢ 1.8L 4-cylinder turbo gasoline engine

Technical Data - 1.8L Engine

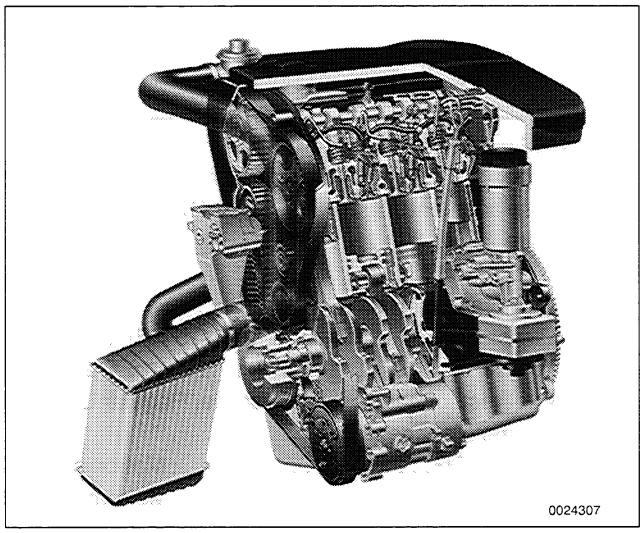
- Type . . . . . 4-cylinder inline, 5 valves/cylinder
- Displacement . . . 1.8L, 1781 cc (108.7 cubic inches)
- Bore . . . . . 81.0 mm
- Stroke . . . . . 86.4 mm
- Compression Ratio
  - Code: AWD, AWP 9.5:1
  - Code: AWW 9.3:1
- Power
  - Code: AWD, AWW . . . 110 kW (150 HP) @5700 rpm
  - Code: AWP . . . . . 132 kW (180 HP) @5500 rpm
- Torque
  - Code: AWD . . . . . 210 Nm (155 ft-lb) @1750 RPM
  - Code: AWW . . . . . 220 Nm (162 ft-lb) @ 1950 RPM
  - Code: AWP . . . . . 235 Nm (173 ft-lb) @ 1950 RPM
- Fuel requirement . . . . Gasoline, Premium Unleaded
- Engine Management . . . . . Motronic ME7.5, OBD II

– 1.8L engine design features:

- Cast iron cylinder block, light alloy crossflow cylinder head and aluminum oil pan.
- Crankshaft with 5 main bearings.
- Dual overhead camshafts. Exhaust camshaft driven by toothed belt with tensioning dampener. Intake camshaft driven by self-adjusting chain from the exhaust camshaft.
- Lightweight valvetrain, 5 valves per cylinder.
- Transverse mounting with "Pendulum" type engine mounts.
- Chain-drive internal gear oil pump driven from the front of the crankshaft.
- Coolant pump built into the cylinder block and driven by the toothed camshaft belt.
- Thermostat integral with the cylinder block.
- Turbocharger with intercooler.
- Distributorless ignition with separate coils for each cylinder.
- External engine accessories driven by a single poly-ribbed belt with tensioner.
- Bosch Motronic ME7.5 Multi-point Sequential Fuel Injection (MFI) system with electronic accelerator system.
- Engine code AWW and AWP have electronic engine performance control through the use of variable camshaft timing.

1.9 LITER ENGINE

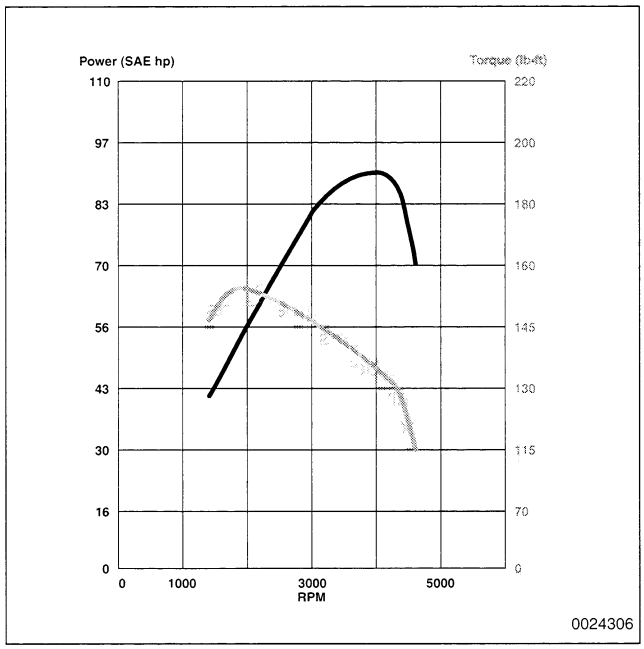
The 1.9L TDI Diesel engine is a design evolution of the 4 cylinder Diesel engines used on previous models of the Volkswagen Golf and Jetta. Just as in the gas versions, this new engine looks familiar to the older versions, but again there has been significant development.



➤ 1.9L TDI Diesel engine

Technical Data - 1.9L Engine

- Type . . . . . 4-cylinder inline, 2 valves/cylinder
- Displacement . . . 1.9L, 1896 cc (115.7 cubic inches)
- Bore . . . . . 79.5 mm
- Stroke . . . . . 95.5 mm
- Compression Ratio 19.5:1
- Power . . . . . 66 kW (90 HP) @3750 rpm
- Torque . . . . . 210 Nm (155 ft-lb) @1900 rpm
- Fuel requirement . . . . . Diesel 49 Cetane
- Engine Management . . . Turbo Direct Injection (TDI)



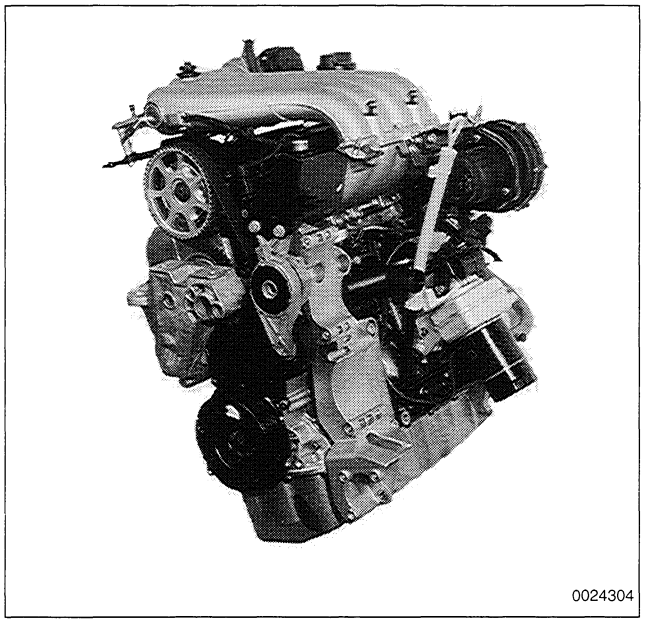
➤ 1.9L TDI engine performance graph.

– 1.9L TDI engine design features:

- Cast iron cylinder block, light alloy cylinder head and aluminum oil pan and cylinder head cover.
- Piston oil spray nozzles.
- Crankshaft with 5 main bearings.
- Single overhead camshaft driven by a toothed belt with semi-automatic belt tensioner and two guide pulleys.
- Lightweight valvetrain, 2 valves per cylinder.
- Transverse mounting with "Pendulum" type engine mounts.
- Chain-drive internal gear oil pump driven from the front of the crankshaft.
- Camshaft-driven vacuum pump.
- Coolant pump built into the cylinder block and driven by the toothed camshaft belt.
- Thermostat integral with the cylinder block.
- Cartridge-type oil filter.
- External engine accessories driven by a single poly-ribbed belt with tensioner.
- Turbo Direct Injection (TDI) Diesel Fuel Injection.

2.0 LITER ENGINE

The 2.0 liter engine is a design evolution of the 4-cylinder gasoline engines used on previous models of the Volkswagen Golf and Jetta. And although this new engine looks familiar to the older versions, there has been significant development of the basic 4-cylinder engine for the newest generation of Volkswagens.



2.0L gasoline engine

Technical Data - 2.0L Engine

- Type . . . . . 4-cylinder inline, 2 valves/cylinder
- Displacement . . . 2.0L, 1984 cc (121.1 cubic inches)
- Bore . . . . . 82.5 mm
- Stroke . . . . . 92.8 mm
- Compression Ratio 10.0:1
- Power . . . . . 85 kW (115 HP) @5200 rpm
- Torque . . . . . 165 Nm (122 ft-lb) @2600 rpm
- Fuel requirement . . . . . Gasoline, Regular Unleaded
- Engine Management
  Code: AEG . . . . . Motronic M5.9.2
  Code: AVH, AZG . . . . . Motronic ME 7.5

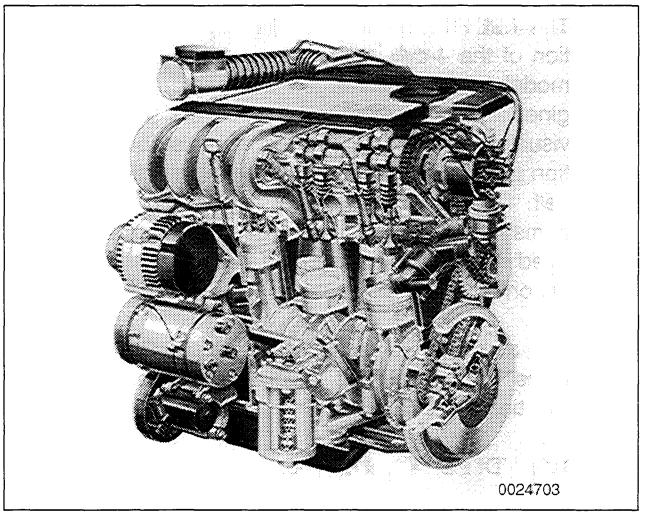


2.0L engine performance graph.

– 2.0L engine design features:

- Cast iron cylinder block, light alloy crossflow cylinder head and aluminum oil pan.
- Crankshaft with 5 main bearings.
- Single overhead camshaft driven by a toothed belt with semi-automatic belt tensioner.
- Lightweight valvetrain, 2 valves per cylinder.
- Transverse mounting with "Pendulum" type engine mounts.
- Chain-drive internal gear oil pump driven from the front of the crankshaft.
- Coolant pump built into the cylinder block and driven by the toothed camshaft belt.
- Thermostat integral with the cylinder block.
- Two-piece aluminum intake manifold.
- Tubular stainless steel exhaust manifold.
- Distributorless ignition.
- External engine accessories driven by a single poly-ribbed belt with tensioner.
- Bosch Motronic Multi-point Sequential Fuel Injection (MFI) system.

2.8 LITER ENGINE

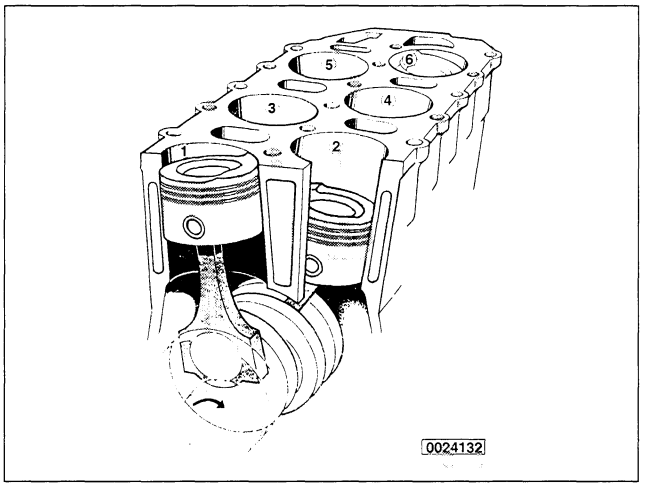


The 2.8L 6-cylinder, or VR6, engine is used in the 6-cylinder GTI and Jetta GLX models.

NOTE —
The name VR6 is derived from a combination of Vee (cylinder configuration) and the German word Reihenmotor, which roughly means in-line, or in-line V-6.

Technical Data - 2.8L Engine

- Type . . . . . 6-cylinder compact inline V-arrangement
- Displacement . . . . . 2.8L (2792 cc)
- Bore . . . . . 81.0 mm (3.19 in.)
- Stroke . . . . . 90.3 mm (3.55 in.)
- V-angle . . . . . 15°
- Compression ratio
  - Code: AFP 10:1
  - Code: BDE 10.75:1
- Power
  - Code: AFP . . . . . 130kW (174 hp) @5,800 rpm
  - Code: BDF . . . . . 147kW (200 hp) @6,200 rpm
- Torque
  - Code: AFP . . . . . 245 Nm (181 ft-lb) @3,200 rpm
  - Code: BDF . . . . . 265 Nm (195 ft-lb) @3,200 rpm
- Fuel requirement . . . . Gasoline, Premium Unleaded
- Engine management . . . . . Bosch Motronic ME 7.1



The VR6 engine has a unique 15° V-angle between cylinder banks, as compared to the more traditional 60° or 90° angles used in most other V-6 designs. This results in a compact engine that can be installed in small spaces, such as in Volkswagen models previously reserved for 4-cylinder engines.

The VR6 engine features a cast iron cylinder block with a one piece light-alloy cylinder head. The overhead camshafts are chain driven and operate two valves per cylinder (code: AFP) or 5-valves per cylinder (code: BDF). The ignition system is distributorless and all fuel and ignition requirements are controlled by the Bosch Motronic Engine Management System.

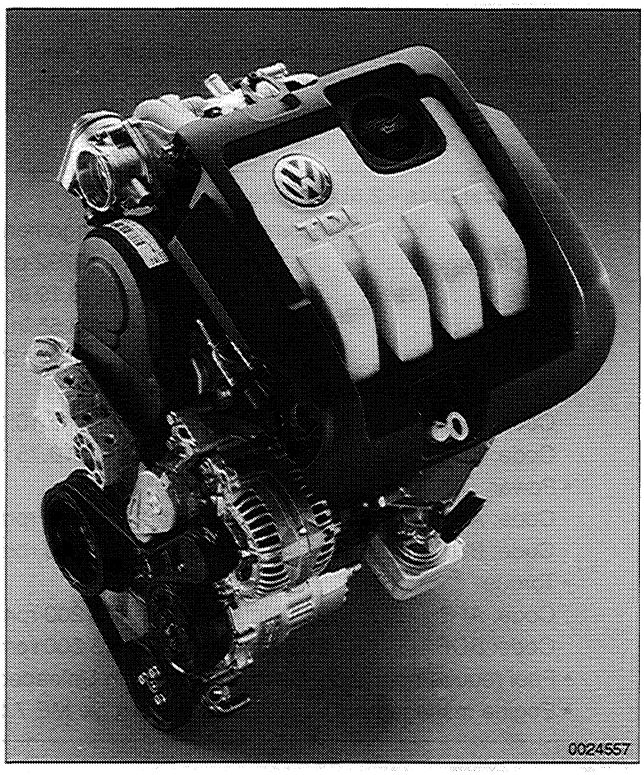
The 24-valve (4-valves per cylinder) VR6 (code: BDF) was introduced for the 2002 model year. Some of the distinctive features of this new engine are:

- Individual coils for each cylinder
- No exhaust gas recirculation (EGR)
- Electronic Power Control (EPC); no throttle cable
- Variable intake manifold
- 2 independently variable camshafts and variable valve timing

1.9 LITER ENGINE (PD DIESEL)

The 1.9L PD TDI Diesel engine is a further design evolution of the 4-cylinder Diesel engines used on previous models of the Volkswagen Golf and Jetta. This new engine has a look similar to the older versions, but the major visual difference is the lack of the distributor-type injection pump. Each injector is a small injection pump by itself. Due to the extremely high loads placed on the camshaft lobes by this arrangement, special oil must be used in this engine class. See **0 Maintenance** for specification requirements.

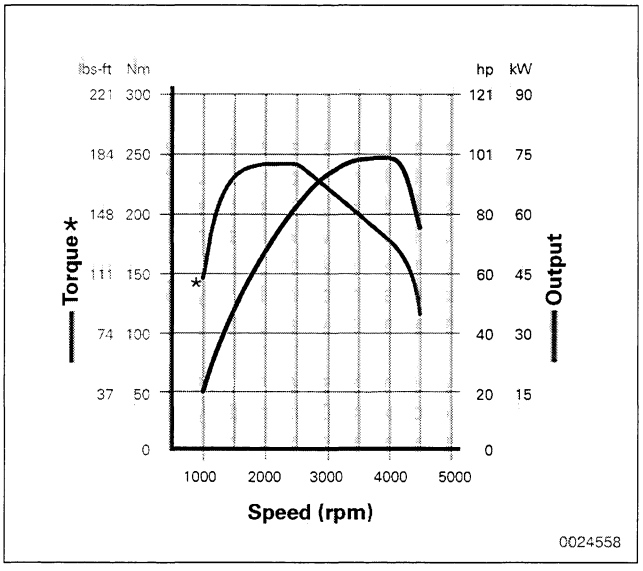
The acronym PD is derived from the German "Pumpe Düse" meaning Pump Injection and refers to the pump function of the individual injectors.



1.9L TDI PD Diesel engine.

Technical Data - 1.9L PD Engine

- Type . . . . . 4-cylinder inline, 2 valves/cylinder
- Displacement . . . 1.9L, 1896 cc (115.7 cubic inches)
- Bore . . . . . .79.5 mm
- Stroke. . . . . .95.5 mm
- Compression Ratio. 19.0:1
- Power . . . . . 74 kW (100 HP) @4000 rpm
- Torque . . . . . .240 Nm (177 ft-lb) @1900-2400 rpm
- Fuel requirement . . . . . Diesel 49 Cetane
- Engine Management . . . Turbo Direct Injection (TDI) with Pump Injection (PD), EDC 16



1.9L TDI PD Diesel engine performance graph.

– Major design differences between the 1.9L TDI PD engine and 1.9L non-PD Diesel:

- Trapezoidal pistons and connecting rods to accommodate higher combustion pressures.
- Wider toothed belt with non-uniform tooth gap clearance (spacing).
- Separate mechanical fuel pump.
- Expanded fuel cooling system with separate pump.
- Solenoid fuel injectors with integral high pressure pumps.
- Injector pressures of up to 27,846 psi (1,920 bar).
- Revised cylinder head and camshaft with four extra lobes for injector pump activation.
- Camshaft position sensor and 7-pin sensor wheel.

10 Engine–Removing and Installing

GENERAL 10-1

ENGINE, REMOVING AND INSTALLING (1.8L 4-CYLINDER GASOLINE) 10-2
- Engine/transmission assembly, removing. 10-2
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ENGINE, REMOVING AND INSTALLING (1.9L 4-CYLINDER DIESEL). 10-13
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ENGINE, REMOVING AND INSTALLING (2.8L 6-CYLINDER GASOLINE) 10-33
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QUALITY REVIEW 10-44

10

GENERAL

The engine and transmission are removed as a unit from below and separated from each other once removed from vehicle.

The operations needed to remove the engine and transmission assembly are generally grouped into two main areas: jobs under the hood and jobs under the vehicle. The steps below follow this general sequence. Most of the operations are simple and straight forward. References to additional repair groups are provided in bold type where additional information may be helpful to complete a step.

Engine Codes

- AWD, AWW, AWP . . . . 1.8L 4-cylinder turbo gasoline
- ALH. . . . . 1.9L 4-cylinder turbo diesel
- BEW . . . . . 1.9L 4-cylinder PD turbo diesel
- AEG, AVH, AZG, BBW, BEV. . . . . 2.0L 4-cylinder gasoline
- AFP, BDF . . . . . 2.8L 6-cylinder gasoline

WARNING —

Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be reset using a VAG 1551/1552, VAS 5051/5052 or equivalent scan tool or diagnostic computer.

NOTE —

- *It will be necessary to cut many wire tie wraps when removing the engine. The tie wraps are installed to prevent the wiring harnesses from chaffing or contacting engine parts. Be sure to make note of all tie wraps removed and install new ones during engine installation.*
- *Route all lines (e.g. for fuel, hydraulics, EVAP system, coolant, refrigerant, brake fluid and vacuum, etc.) as well as electrical wiring so that the original positions are maintained. Ensure sufficient clearance to all moving or hot components.*
- *Most of the hardware used in the vehicles covered by this repair manual is specially coated to prevent corrosion. This coating is known as "dacromet" or "delta tone" and is identified by a green tinted finish. Always use replacement hardware with the same specification.*
- *Be sure to have the anti-theft radio code on hand before disconnecting the battery.*

ENGINE, REMOVING AND INSTALLING (1.8L 4-CYLINDER GASOLINE)

Engine/transmission assembly, removing

– Ensure ignition is switched off. Disconnect battery negative (–) terminal and then positive (+) terminal.

NOTE —

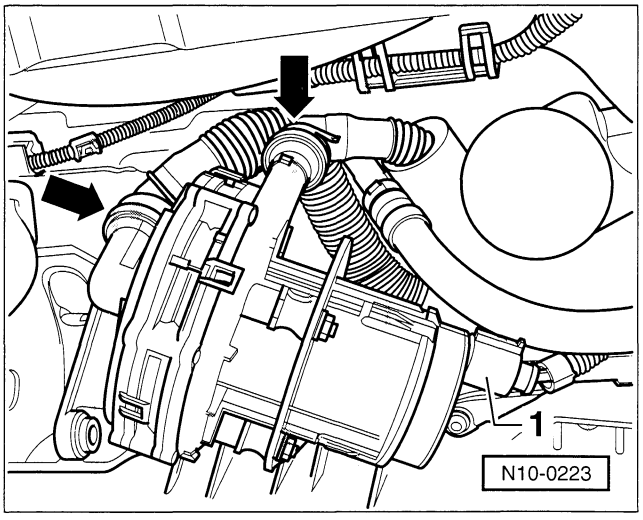
Be sure to have the anti-theft radio code on hand before disconnecting the battery.

– Remove engine cover.

NOTE —

Experience suggests that in some cases, moving the lock carrier to the service position will facilitate access to the engine.

- *Remove front bumper, see* **63 Bumpers**.
- *Put lock carrier (radiator support) into service position, see* **50 Body–Front**.

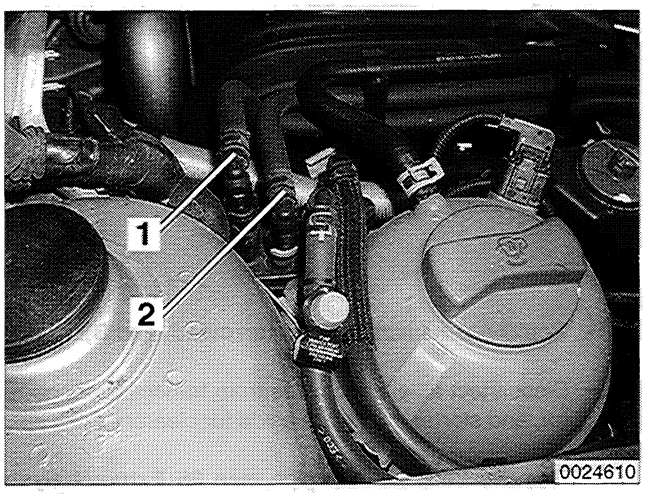


➤ On vehicles with secondary air system, remove connecting hoses (**arrows**) between secondary air injection pump/combi-valve and secondary air injection pump.

NOTE —

Press release tabs on hose couplings to remove connecting hoses.

– Pull connector (**1**) off secondary air injection pump.



– Remove air cleaner assembly.
  • Disconnect at hose at Mass Air Flow Sensor. MAF remains attached to air cleaner housing.

– Pull vacuum and breather hoses off engine.

➢ Pull off fuel supply line/hose (**1**) (sometimes marked with white) and return line/hose (**2**) (marked with blue) and collect fuel that leaks out.

> ***WARNING —***
> • *The fuel system is under pressure and fuel will be expelled when lines are opened! Before opening the system place a cloth around the connection and release the pressure by carefully loosening the connection.*
>
> • *Fire hazard! Do not smoke or work near heaters or other fire hazards. Have a fire extinguisher handy.*

– Pull hose off solenoid valve.

> ***NOTE —***
> *Press release tabs on hose couplings to remove connecting hoses.*

– Seal (plug) all lines so that fuel system is not contaminated by dirt, leaking fluids, etc.

– Remove intake hose between MAF sensor and turbocharger.

Vehicles with manual transmission

– Disconnect selector mechanism from transmission, see **34 Manual Transmission**.

– Remove hydraulic slave cylinder.

> ***NOTE —***
> *Do do depress clutch pedal with slave cylinder removed!*

Vehicles with automatic transmission

– Remove selector cable from transmission, see **37 Automatic Transmission**.

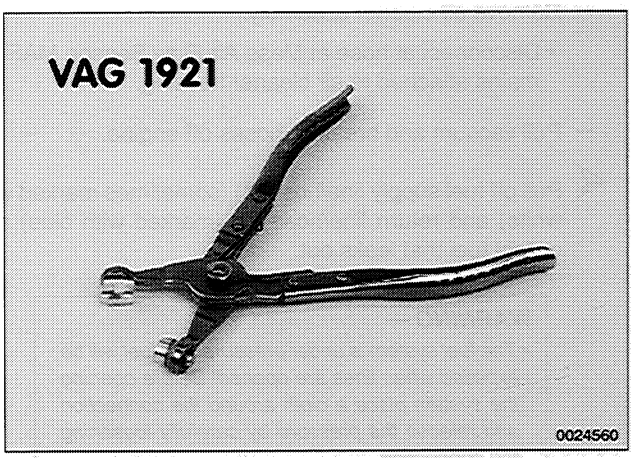
Continued for all vehicles

– Remove intake air duct between charge air cooler (intercooler) and Throttle Valve Control Module.

– Remove lower sound absorber covers, see **50 Body - Front**.

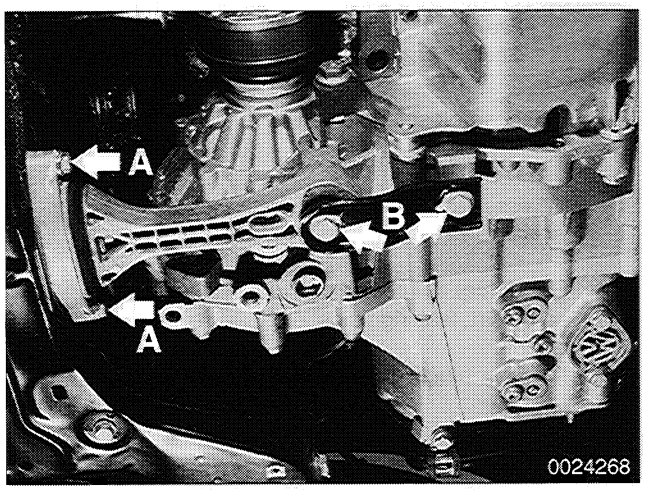
– Drain coolant, see **19 Cooling System**.

> ***WARNING —***
> *Hot coolant can scald! Drain the coolant only with engine cold.*



➢ Disconnect coolant hoses from radiator at engine using spring-type pliers.

NOTE —
Spring-type hose clamps are used from the factory. Special pliers such as VAG 1921 or VAS 5024 or equivalent are recommended for ease of removal and installation.



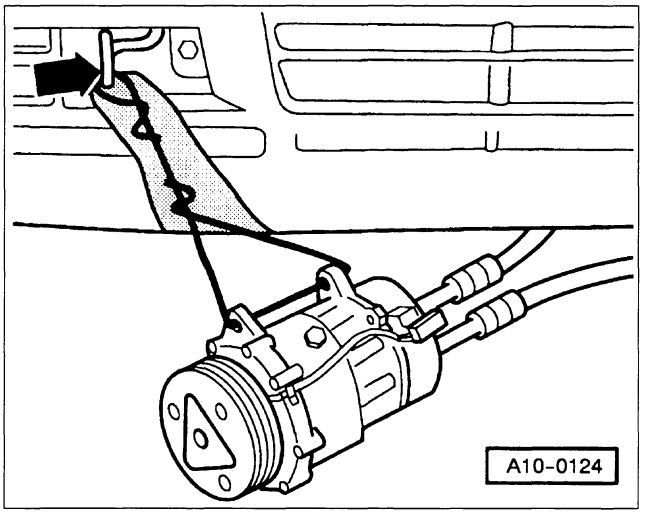
➢ Remove pendulum support (**arrows A** and **B**).

- Disconnect all electric wires from transmission, generator, and starter and move aside for clearance.
- Remove front exhaust pipe, see **26 Exhaust System and Emission Controls.**
- Mark running direction and remove ribbed V-belt, see **0 Maintenance**.
- Remove securing clamps for power steering pressure line.
- Remove power steering pump with bracket and hoses still attached and set to one side. See **48 Steering**.
- Pull off and/or disconnect all other electrical connections from engine as needed and move to the side.

NOTE —
In some cases, labeling connections before removal will facilitate their easy re-installation.

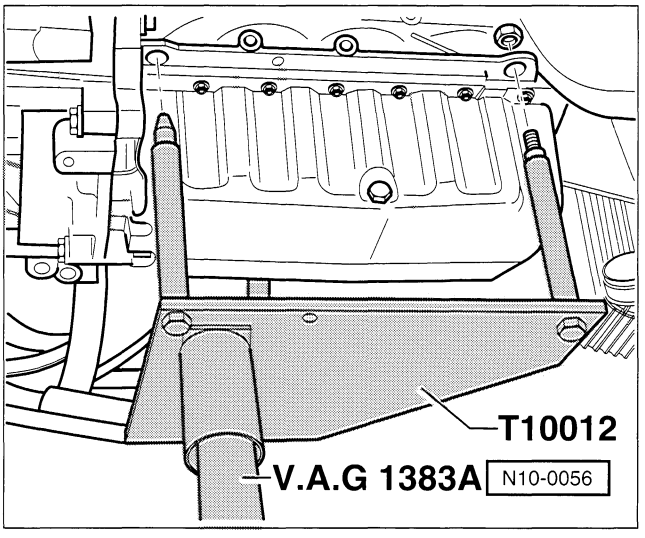
- Remove right side inner CV joint protective cover from engine if equipped.
- Remove right side drive shaft and disconnect left side driveshaft at the transmission. See **40 Front Suspension and Drive Axles**.
- Remove securing clamps from air conditioning refrigerant hoses/lines. Do not disconnect hoses/lines.
- Remove air conditioner compressor without disconnecting hoses/lines, see **87 Air Conditioning**.

NOTE —
To avoid damage to condenser as well as to refrigerant lines and hoses, make sure that the lines and hoses are not stretched, kinked or bent.



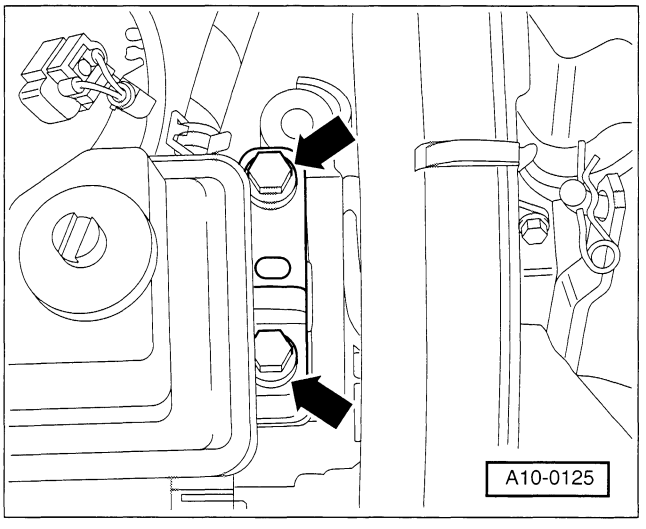
➢ Secure air conditioner compressor to towing eye (**arrow**) so that refrigerant hoses/lines are not under tension.

NOTE —
To prevent damage to lower bumper surface, protect with adhesive tape.



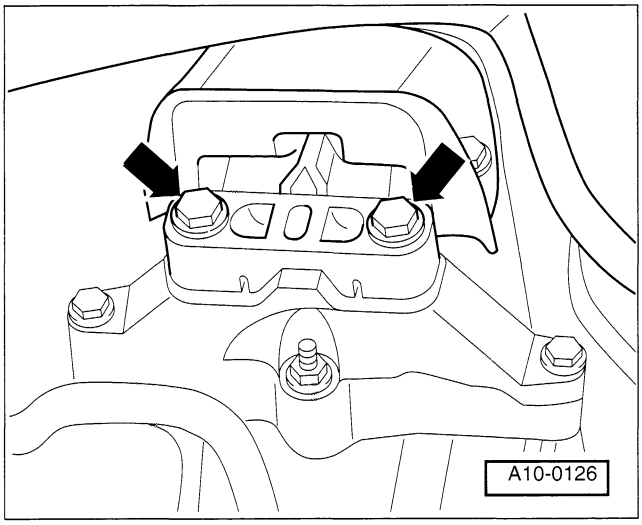
➢ Install engine support bracket T10012 onto cylinder block as shown and secure with an M 10X25 8.8 bolt and nut. Tighten to 40 Nm (30 ft-lb).

– Install support T10012 onto engine/transmission jack VAG 1383A and lift engine and transmission slightly.



➢ Unbolt engine side of assembly mount from carrier at top (**arrows**).

NOTE —
To remove securing bolts while vehicle is supported on a lift, use Volkswagen special tool VAS 5085 (a ladder) or equivalent.



➢ Unbolt transmission side of assemble mount from transmission carrier at top (**arrows**).

– Carefully lower engine with transmission attached.

NOTE —

Engine with transmission attached must be guided carefully when lowering to prevent damage to the bodywork.

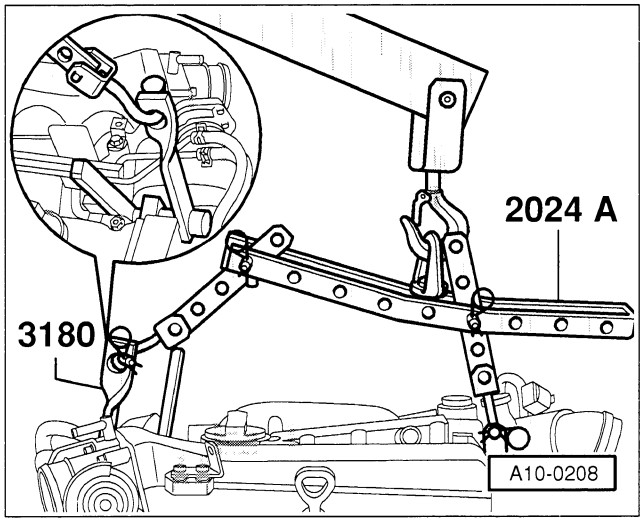
Engine/transmission, separating/transporting

When working on the engine/transmission assembly after removal, it should be transported to an assembly stand with a workshop crane and the appropriate lifting tackle. The two units should then be separated and the engine secured to the assembly stand support clamp VW 313 using the engine and transmission box support VW 540.

– Remove transmission from engine.

NOTE —

- *On cars with automatic transmissions, be sure the drive plate separates cleanly from the torque converter without pulling the torque converter off of its support. Once the engine and transmission are separated, install a suitable bar across the open bell bellhousing to keep the torque converter from falling out.*
- *On cars with manual transmissions, be sure that the weight of the transmission or the engine is never supported on the transmission mainshaft. Clutch or transmission damage could result.*

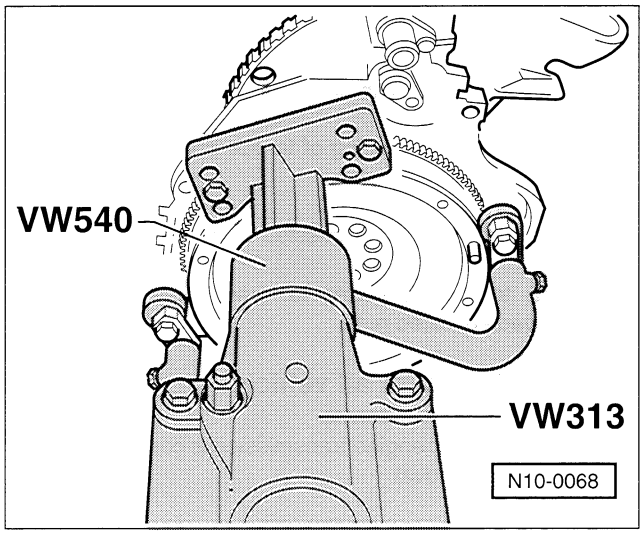


➤ Attach lifting support 2024A with bracket 3180 as shown.

- Position number **1** on 2024A bracket should be at pulley end.
- Attach at pulley end: third (**3rd**) hole in hook, position one (**1**) in bracket.
- Attach at flywheel end: second (**2nd**) hole in hook, position six (**6**) in bracket.

WARNING —
The hooks and locating pins must be secured with locking clips!

– Lift off of engine/transmission jack VAG 1383A with a workshop crane.



➤ Secure engine to bracket mounting VW 540 as shown and attach to engine stand VW 313 or equivalent.

NOTE —
It is usually necessary to remove intermediate plate before attaching engine to VW 540.

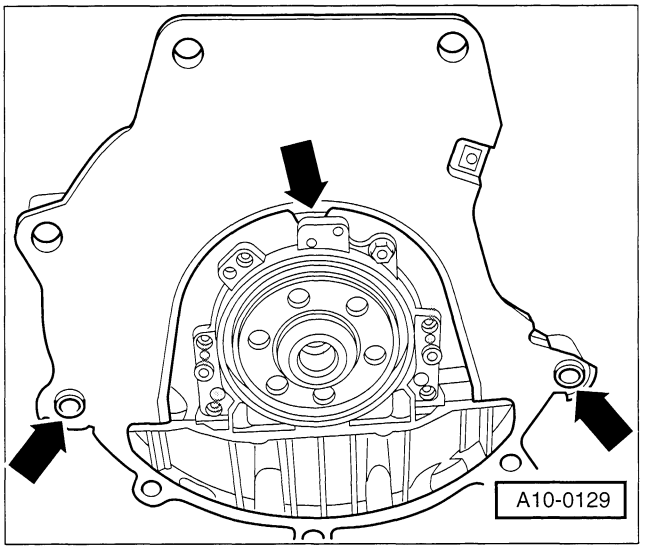
WARNING —

- *When reattaching transmission to engine, check that centering dowels are installed in engine block. Replace them if they are missing.*
- *Clutch or drive plate damage will result if centering dowels are not installed.*

Engine/transmission assembly, installing

WARNING —

- *When working in the engine compartment, due to the cramped, tight conditions, pay attention to the following points*
- *Route all lines (e.g. for fuel, hydraulics, EVAP system, coolant, refrigerant, brake fluid and vacuum, etc.) as well as electrical wiring so that the original positions are maintained. Ensure sufficient clearance to all moving or hot components.*
- *Make sure there is sufficient clearance to all moving or hot components.*
- *Be sure to replace all tie wraps cut during removal and install new ones to prevent lines and wiring harnesses from chaffing or contacting engine parts.*



➢ Check to ensure dowel sleeves (**lower arrows**) for centering engine/transmission are in cylinder block, install/replace as necessary.

– Install intermediate plate onto rear sealing flange dowel (**upper arrow**) if removed.

– Before mating engine and transmission, observe the appropriate points depending on transmission type.

Vehicles with manual transmission

– Check centering of clutch drive plate as required.

– Check clutch release bearing and guide sleeve for wear.

– Lightly lubricate clutch release bearing, release bearing guide sleeve and splines on input shaft with G 000 100.

– Bolt engine and transmission together.

Vehicles with automatic transmission

– Remove any locking device used to secure torque converter to transmission.

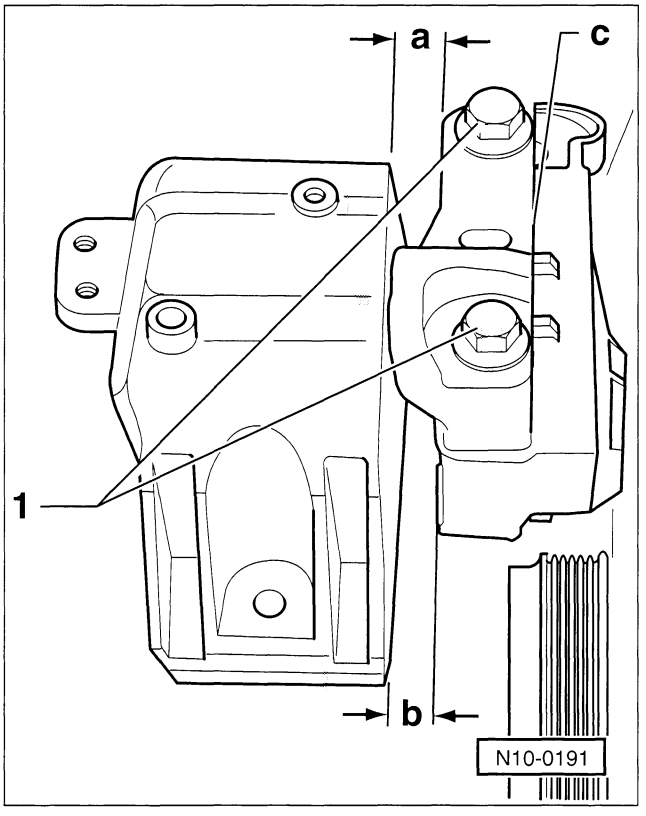
– Ensure proper seating of torque converter on transmission shafts.

– Bolt engine and transmission together.

– Bolt torque converter to drive plate with only approved/specified nuts.

Continued for all vehicles

Installation of engine/transmission is carried out in the reverse of removal.

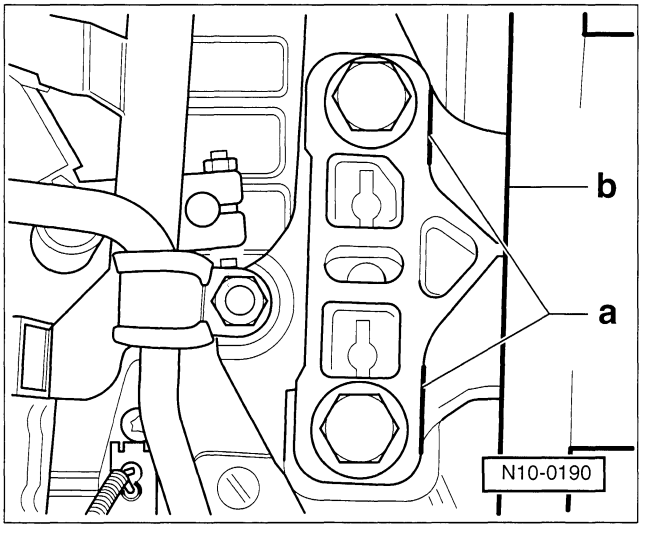


– With engine/transmission assembly on same devices as was used for removal, carefully raise assembly up and into position from below.
  - Ensure sufficient clearance for installation of left side drive axle.
  - Ensure sufficient clearance for installation of A/C compressor and lines.

➢ When engine/transmission assembly is in position, align engine mount as shown.

Gap **a** = 14.0 mm (0.55 in)
Gap **b** = at least 10.0 mm (0.40 in)
Both bolt head shoulders (**1**) must line up flush with edge (**c**).

> ***WARNING —***
> *Do not loosen engine mounting bolts if weight of engine is not fully supported by hoist, lift or support bridge.*



➢ Align transmission mount edges parallel to each other.
  - Ensure that edges **a** of left side transmission mount are parallel to **b**.

– Install engine, transmission and pendulum mounts with new bolts where indicated and torque to specification, see **Engine and Transmission Mounts**.

– Install and connect drive both axles, see **40 Front Suspension and Drive Axles**.

– Install right side inner CV joint protective cover from engine if equipped.

– Install A/C compressor and secure A/C lines, see **87 Air Conditioning**.

– Install front exhaust pipe, see **26 Exhaust System/Emission Controls**.

Vehicles with manual transmission

– Install hydraulic clutch slave cylinder, see **30 Clutch**.

– Install and adjust gear selector mechanism, see **34 Manual Transmission**.

Vehicles with automatic transmission

– Install and adjust gear selector cable and replace lock washer on selector cable mount. See **37 Automatic Transmission**.

Continued for all vehicles

- Install intake air duct between charge air cooler (intercooler) and Throttle Valve Control Module.
- Install intake hose between MAF sensor and turbocharger.
- Install power steering pump and lines, see **48 Steering**.
- Install connecting hoses between secondary air injection pump/combi-valve and secondary air injection pump and secondary air injection pump and air cleaner.
- Connect all electrical wiring to engine, transmission, generator, and starter and check for clearance and proper routing.
- Reinstall fuel supply and return lines.
- Note running direction and install poly-ribbed, see **0 Maintenance**.
- Connect all cooling system and heater hoses and refill cooling system with appropriate ratio of distilled water and G12 coolant and check for leaks, see **19 Engine – Cooling System**.
- If lock carrier was moved to the service position, return it to normal position and install front bumper.
- Connect battery cables.
- Ensure that all removed tie wraps are replaced, and that all electrical wiring and hoses are properly routed and secured.
- Ensure that engine oil and all fluids are at correct levels.
- Perform procedure following interruption of voltage supply, see **27 Engine Electrical**.
- Adapt Transmission Control Module (TCM) to Basic Settings, see **37 Automatic Transmission**.
- Start engine and let it idle. Inspect for oil and coolant leaks. Check for smooth operation of shifter and clutch as required. Road test as required.
- Shut off engine and install lower sound absorber panel (belly pan) and upper engine cover.
- If DTC (Diagnostic Trouble Code) memory has been erased or engine control module separated from permanent positive supply, readiness code must be generated again, see **Scan Tool** section at back of manual.

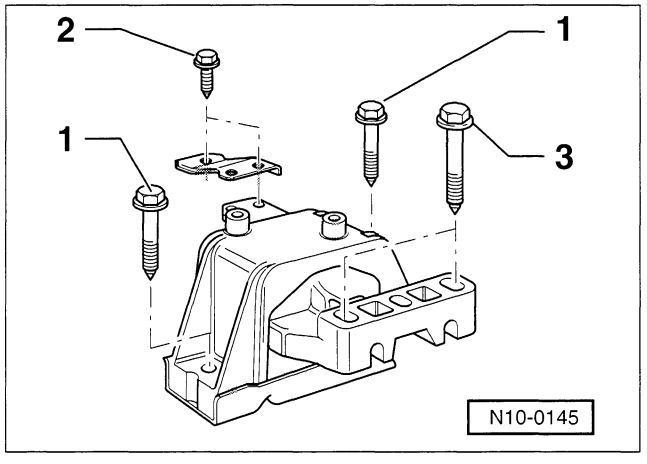
Tightening torques

Tightening torques (1.8L 4-cylinder turbo engines)

- Engine to transmission bolts,
  - M10 . . . . . 45 Nm (33 ft-lb)
  - M12 . . . . . 80 Nm (59 ft-lb)
- Starter to transmission . . . . . 65 Nm (48 ft-lb)
- Triple rotor/CV joint to transmission . 40 Nm (30 ft-lb)
- Torque converter to drive plate. . . . . 60 Nm (44 ft-lb)
- Bolts & nuts, not specifically listed
  - M6 . . . . . 10 Nm (7 ft-lb)
  - M7 . . . . . 15 Nm (11 ft-lb)
  - M8 . . . . . 25 Nm (18 ft-lb)
  - M10 . . . . . 40 Nm (30 ft-lb)
  - M12 . . . . . 60 Nm (44 ft-lb)

Engine/transmission, mounts

The engine/transmission assembly is suspended on its rotational axis by the engine mount on the right side and the transmission mount on the left side. Engine movement known as torque reaction is limited by the pendulum support mounted in the center underneath. Engine mounts differ slightly depending on transmission type (manual vs. automatic), but all are similar.

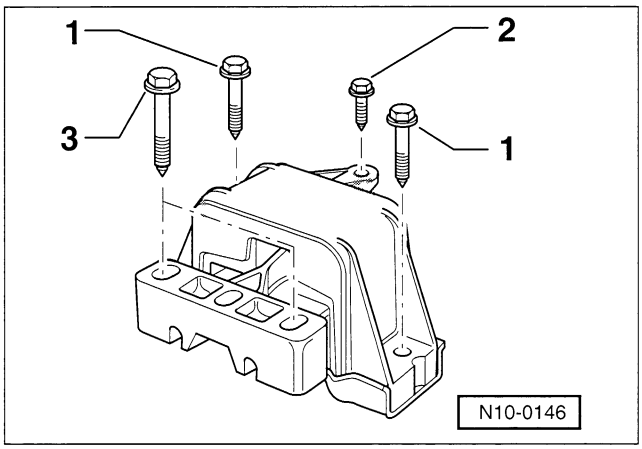


Engine mount, right side:

1. Mount to body bolt
- 40 Nm (30 ft-lb) plus 90° (¼ turn)
- always replace

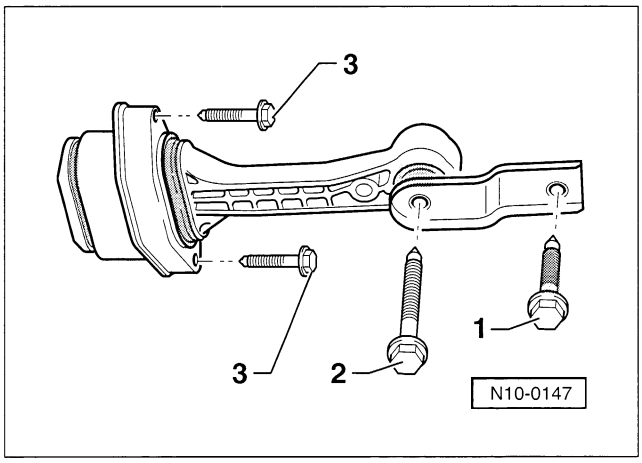
2. Mount bracket to body bolt
- 25 Nm (18 ft-lb)

3. Mount to engine bracket bolt
- 100 Nm (74 ft-lb)



Transmission mount, left side

1. **Mount to body bolt**
   - 40 Nm (30 ft-lb) plus 90° (¼ turn)
   - always replace
2. **Mount bracket to body bolt**
   - 25 Nm (18 ft-lb)
3. **Mount to transmission bracket bolt**
   - 100 Nm (74 ft-lb)



Pendulum support, lower center

1. **Pendulum support to transmission bolt**
   - 40 Nm (30 ft-lb) plus 90° (¼ turn)
   - always replace
2. **Pendulum support to transmission bracket bolt**
   - 40 Nm (30 ft-lb)
   - always replace
3. **Pendulum support to subframe bolt**
   - 20 Nm (15 ft-lb) plus 90° (¼ turn)
   - always replace

ENGINE, REMOVING AND INSTALLING (1.9L 4-CYLINDER DIESEL)

Engine/transmission assembly, removing

– Ensure ignition is switched off. Disconnect battery negative (–) terminal and then positive (+) terminal.

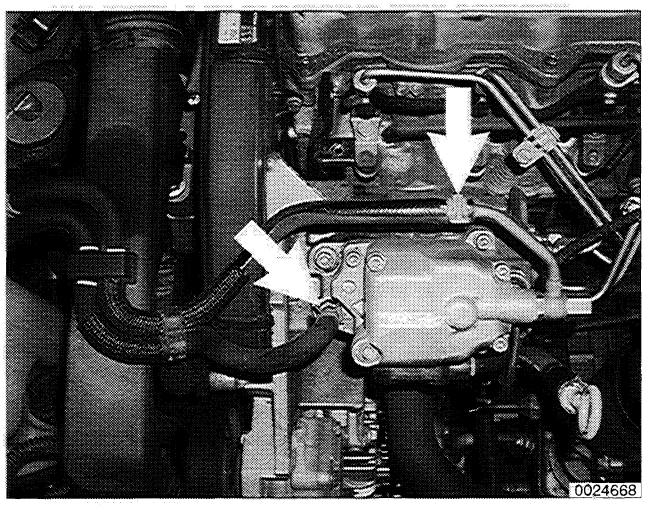
NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.

– Remove engine cover.

NOTE —
Experience suggests that in some cases, moving the lock carrier to the service position will facilitate access to the engine.

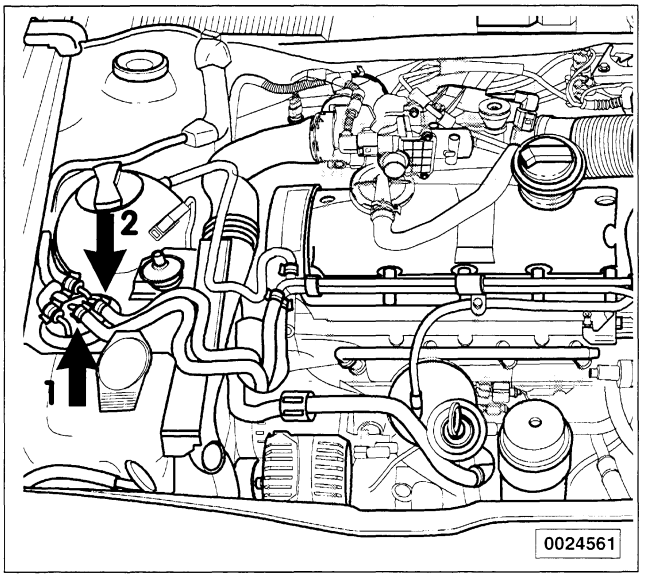
- *Remove front bumper, see* **63 Bumpers**.
- *Put lock carrier (radiator support) into service position, see* **50 Body–Front**.

– Remove battery and hold-down, see **27 Engine Electrical**.



◀ On **ALH** engines, pull off fuel supply line/hose (**lower arrow**) and return line/hose (**upper arrow**) (marked with blue) at injection pump and collect fuel that leaks out.

WARNING —
- *The fuel and the fuel lines in the PD fuel system can become very hot as a result of heat generated by the extremely high operating pressures. Use caution; there is danger from scalding!*
- *The fuel system is under pressure and fuel will be expelled when lines are opened! Before opening the system place a cloth around the connection and release the pressure by carefully loosening the connection. Wear eye and hand protection when performing any type of repair work on the fuel system!*
- *Fire hazard! Do not smoke or work near heaters or other fire hazards. Have a fire extinguisher handy.*



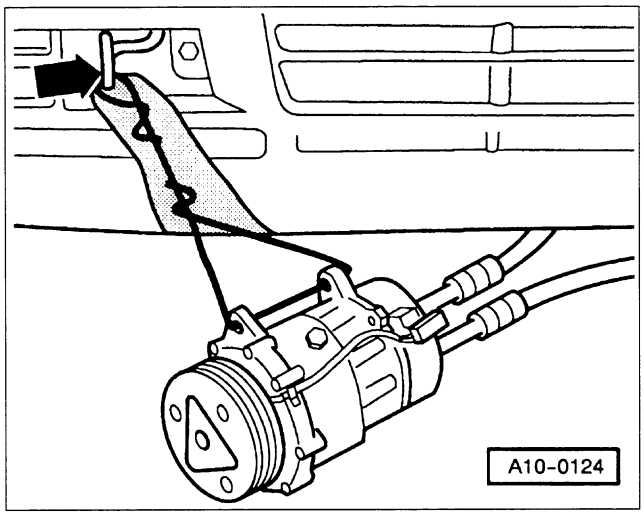
◀ On **BEW** engines, pull off fuel supply line/hose (**2**) and return line/hose (**1**) at fuel filter and collect fuel that leaks out.

– Remove air cleaner assembly, connecting hoses and ducts.
- Remove connecting pipe between turbocharger and intercooler and intercooler and intake manifold complete with the EGR vacuum regulator solenoid valve.

– Remove lower sound absorber covers, see **50 Body - Front**.

– Remove securing clamps from air conditioning refrigerant hoses/lines. Do not disconnect hoses/lines.

– Remove air conditioner compressor without disconnecting hoses/lines, see **87 Air Conditioning**.



NOTE —
To avoid damage to condenser as well as to refrigerant lines and hoses, make sure that the lines and hoses are not stretched, kinked or bent.

➢ Secure air conditioner compressor to towing eye (**arrow**) so that refrigerant hoses/lines are not under tension.

NOTE —
To prevent damage to lower bumper surface, protect with adhesive tape.

Vehicles with manual transmission

– Disconnect selector mechanism from transmission, see **34 Manual Transmission**.

– Remove hydraulic slave cylinder.

NOTE —
Do do depress clutch pedal with slave cylinder removed!

Vehicles with automatic transmission

– Remove selector cable from transmission, see **37 Automatic Transmission**.

Continued for all vehicles

– Pull vacuum and breather hoses off engine.

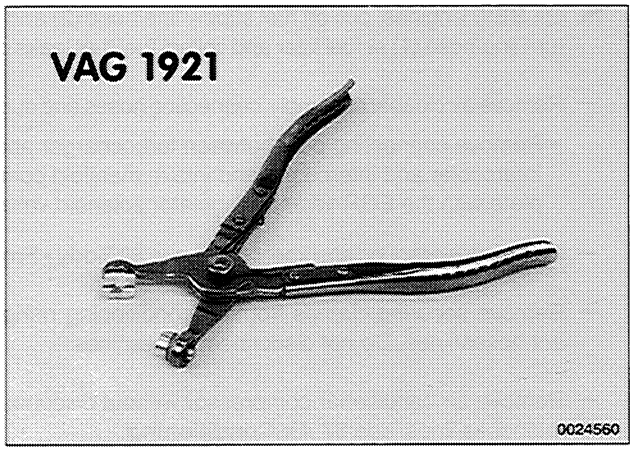
– Disconnect all electric wires from transmission, generator, and starter and move aside for clearance.

– Mark running direction and remove ribbed V-belt, see **0 Maintenance**.

– Remove intake hose between charge air cooler (intercooler) and turbocharger.

– Remove power steering pump with bracket and hoses still attached and set to one side. See **48 Steering**.

– Remove power steering hose/line mounting clamps. Do not disconnect hoses/lines.



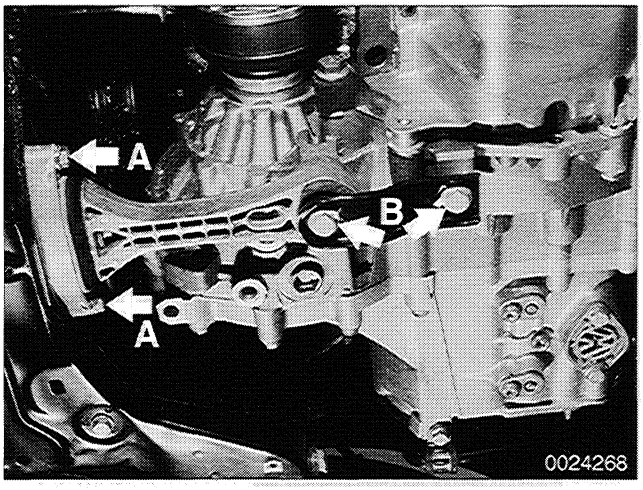
– Remove right side inner CV joint protective cover from engine if equipped.

– Remove right side drive shaft and disconnect left side driveshaft at the transmission. See **40 Front Suspension and Drive Axles**.

– Drain coolant, see **19 Cooling System**.

> ***WARNING —***
> *Hot coolant can scald! Drain the coolant only with engine cold.*

➢ Disconnect coolant hoses from radiator at engine using spring-type pliers.



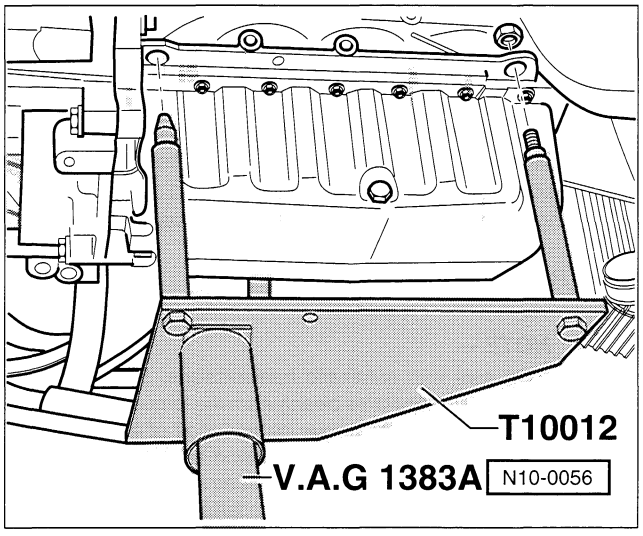
NOTE —

- *In some situations, it may be easier to completely disconnect the radiator hoses and remove them.*
- *Spring-type hose clamps are used from the factory. Special pliers such as VAG 1921 or VAS 5024 or equivalent are recommended for ease of removal and installation.*

➢ Remove pendulum support (**arrows A** and **B**).

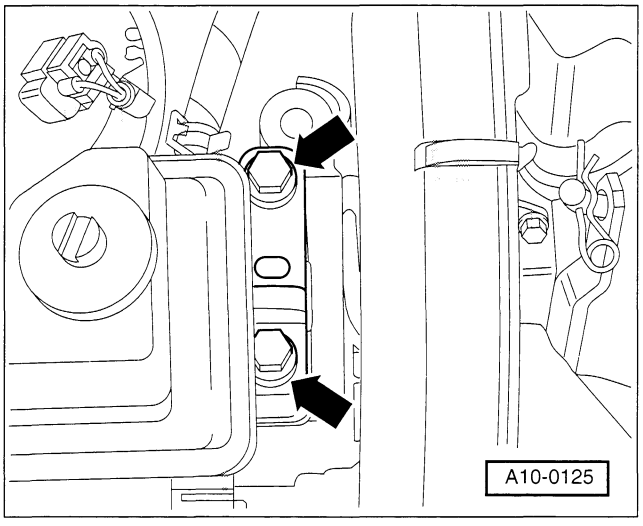
– Remove front exhaust pipe, see **26 Exhaust System and Emission Controls.**

– Remove coolant hose and lower bracket from cylinder block. Mounting hole is used to attach T10012 engine support.



➢ Install engine support bracket T10012 onto cylinder block as shown and secure with an M 10X25 8.8 bolt and nut. Tighten to 40 Nm (30 ft-lb).

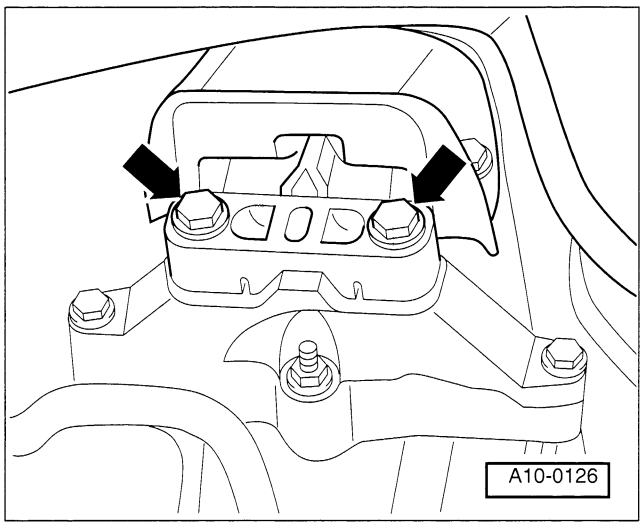
– Install support T10012 onto engine/transmission jack VAG 1383A and lift engine and transmission slightly.



➢ Unbolt engine side of assembly mount from carrier at top (**arrows**).

NOTE —

To remove securing bolts while vehicle is supported on a lift, use Volkswagen special tool VAS 5085 (a ladder) or equivalent.



➢ Unbolt transmission side of assemble mount from transmission carrier at top (**arrows**).

– Carefully lower engine with transmission attached.

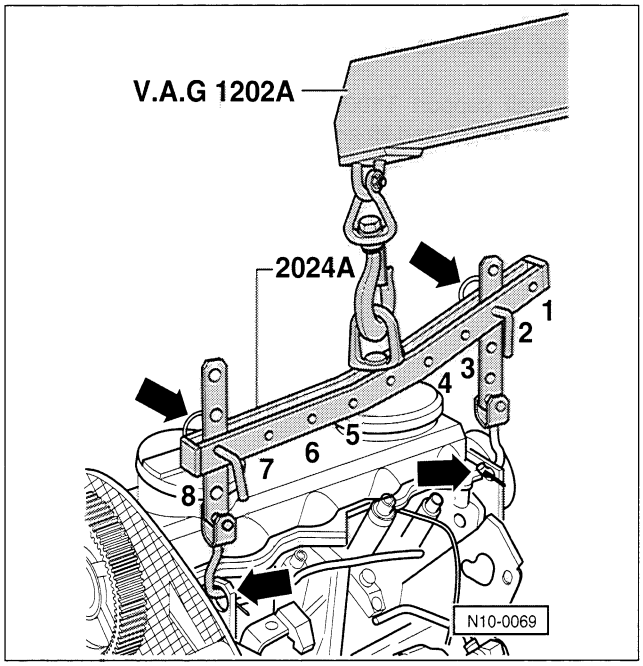
NOTE —
Engine with transmission attached must be guided carefully when lowering to prevent damage to the power steering line and bodywork.

Engine/transmission, separating/transporting

When working on the engine/transmission assembly after removal, it should be transported to an assembly stand with a workshop crane and the appropriate lifting tackle. The two units should then be separated and the engine secured to the assembly stand support clamp VW 313 using the engine and transmission box support VW 540.

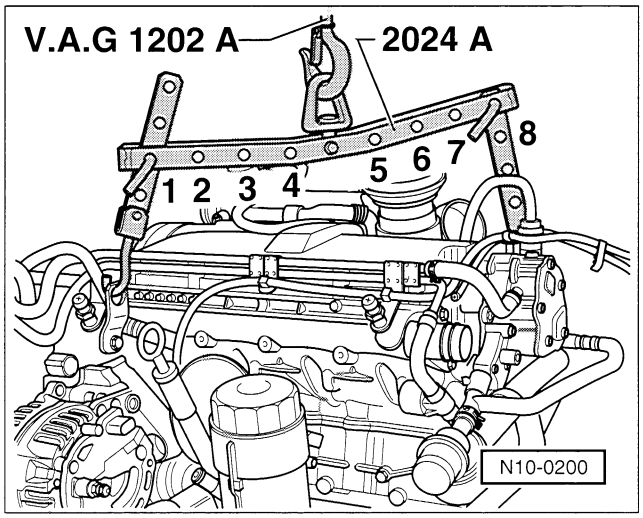
– Remove transmission from engine.

NOTE —
- *On cars with automatic transmissions, be sure the drive plate separates cleanly from the torque converter without pulling the torque converter off of its support. Once the engine and transmission are separated, install a suitable bar across the open bell bellhousing to keep the torque converter from falling out.*
- *On cars with manual transmissions, be sure that the weight of the transmission or the engine is never supported on the transmission mainshaft. Clutch or transmission damage could result.*



➢ On **ALH** engines, attach lifting support 2024A as shown.

- Position number **8** on 2024A bracket should be at pulley end.
- Attach at pulley end: second (**2nd**) hole in hook, position eight (**8**) in bracket.
- Attach at flywheel end: third (**3rd**) hole in hook, position two (**2**) in bracket.



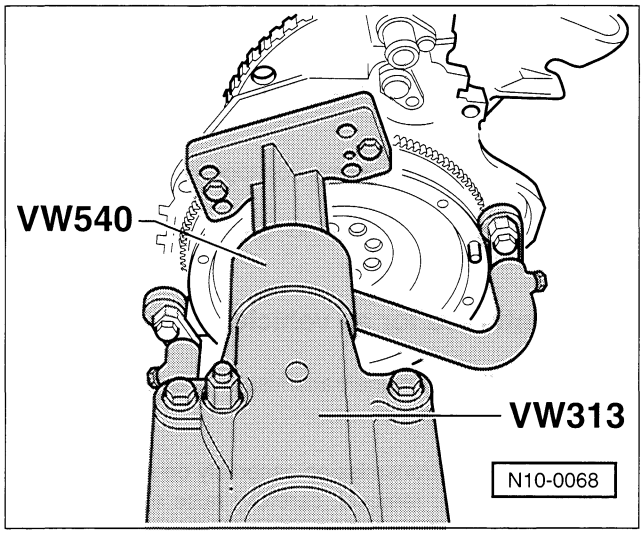
WARNING —
The hooks and locating pins must be secured with locking clips!

➢ On **BEW** engines, attach lifting support 2024A as shown.

- Position number **1** on 2024A bracket should be at pulley end.
- Attach at pulley end: second (**2nd**) hole in hook, position one (**1**) in bracket.
- Attach at flywheel end: fourth (**4th**) hole in hook, position eight (**8**) in bracket.

WARNING —
The hooks and locating pins must be secured with locking clips!

– Lift off of engine/transmission jack VAG 1383A with a workshop crane (VAG 1202A shown).

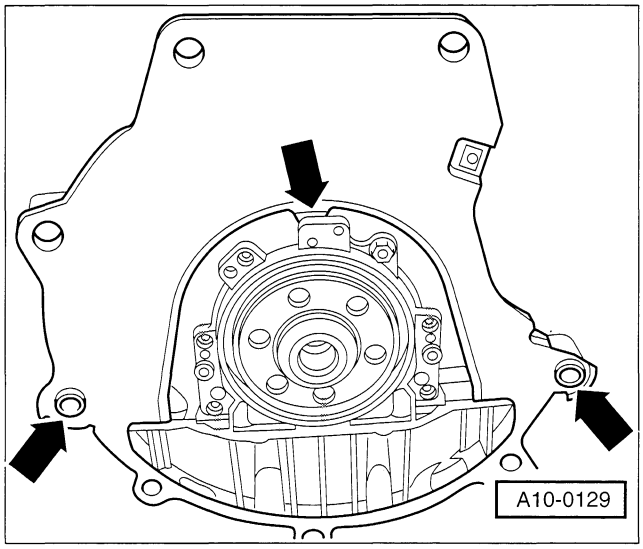


➢ Secure engine to bracket mounting VW 540 as shown and attach to engine stand VW 313 or equivalent.

NOTE —
- *It is usually necessary to remove intermediate plate before attaching engine to VW 540.*
- *It may be necessary to loosen and/or remove the coolant pipe at the flywheel end of the engine before attaching to VW 540.*

Engine/transmission assembly, installing

WARNING —
- *When working in the engine compartment, due to the cramped, tight conditions, pay attention to the following points*
- *Route all lines (e.g. for fuel, hydraulics, EVAP system, coolant, refrigerant, brake fluid and vacuum, etc.) as well as electrical wiring so that the original positions are maintained. Ensure sufficient clearance to all moving or hot components.*
- *Make sure there is sufficient clearance to all moving or hot components.*
- *Be sure to replace all tie wraps cut during removal and install new ones to prevent lines and wiring harnesses from chaffing or contacting engine parts.*



➢ Check to ensure dowel sleeves (**lower arrows**) for centering engine/transmission are in cylinder block, install/replace as necessary.

– Install intermediate plate onto rear sealing flange dowel (**upper arrow**) if removed.

– Before mating engine and transmission, observe the appropriate points depending on transmission type.

Vehicles with manual transmission

– Check centering of clutch drive plate as required.

– Check clutch release bearing and guide sleeve for wear.

– Lightly lubricate clutch release bearing, release bearing guide sleeve and splines on input shaft with G 000 100.

– Bolt engine and transmission together.

Vehicles with automatic transmission

– Remove any locking device used to secure torque converter to transmission.

– Ensure proper seating of torque converter on transmission shafts.

– Bolt engine and transmission together.

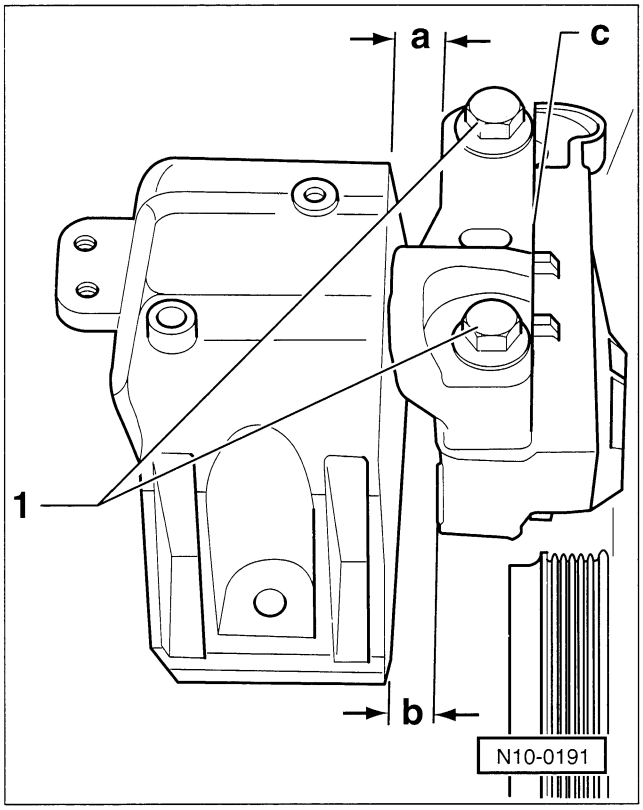
– Bolt torque converter to drive plate with only approved/specified nuts.

Continued for all vehicles

Installation of engine/transmission is carried out in the reverse of removal.

– With engine/transmission assembly on same devices as was used for removal, carefully raise assembly up and into position from below.

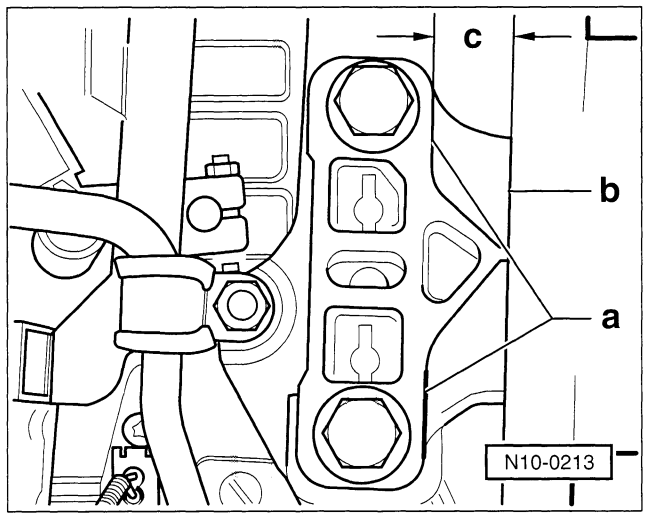
- Ensure sufficient clearance for installation of both drive axles.
- Ensure sufficient clearance for installation of A/C compressor and lines
- Use caution to avoid damage to engine/transmission mounts and radiator during installation.
- Guide power steering lines past transmission during installation.



➤ When engine/transmission assembly is in position, align engine mount as shown.

Gap **a** = 14.0 mm (0.55 in)
Gap **b** = at least 10.0 mm (0.40 in)
Both bolt head shoulders (**1**) must line up flush with edge (**c**).

> ***WARNING —***
> *Do not loosen engine mounting bolts if weight of engine is not fully supported by hoist, lift or support bridge.*



➢ Align transmission mount edges parallel to each other.
- Ensure that edges **a** of left side transmission mount are parallel to **b**.
- Gap **c** = 18 - 20 mm (0.71 - 0.78 in)

– Install engine, transmission and pendulum mounts with new bolts where indicated and torque to specification, see **Engine and Transmission Mounts**.

Vehicles with manual transmission

– Install hydraulic clutch slave cylinder, see **30 Clutch**.

– Install and adjust gear selector mechanism, see **34 Manual Transmission**.

Vehicles with automatic transmission

– Install and adjust gear selector cable and replace lock washer on selector cable mount. See **37 Automatic Transmission**.

Continued for all vehicles

– Install and connect drive both axles, see **40 Front Suspension and Drive Axles**.

– Install right side inner CV joint protective cover from engine if equipped.

– Install front exhaust pipe, see **26 Exhaust System/Emission Controls**.

– Install power steering pump and lines, see **48 Steering**.

– Note running direction and install poly-ribbed, see **0 Maintenance**.

– Install air cleaner assembly and connecting hoses and ducts.

– Connect all electric wiring to engine, transmission, generator, and starter and check for clearance and proper routing.

– Connect all cooling system and heater hoses and refill cooling system with appropriate ratio of distilled water and G12 coolant and check for leaks, see **19 Engine – Cooling System**.

– Reinstall fuel supply and return lines.

– If lock carrier was moved to the service position, return it to normal position and install front bumper.

– Connect battery cables.

– Ensure that all removed tie wraps are replaced, and that all electrical wiring and hoses are properly routed and secured.

– Ensure that engine oil and all fluids are at correct levels.

– Perform procedure following interruption of voltage supply, see **27 Engine Electrical**.

– Adapt Transmission Control Module (TCM) to Basic Settings, see **37 Automatic Transmission**.

– Start engine and let it idle. Inspect for oil and coolant leaks. Check for smooth operation of shifter and clutch as required. Road test as required.

– Shut off engine and install lower sound absorber panel (belly pan) and upper engine cover.

– If DTC (Diagnostic Trouble Code) memory has been erased or engine control module separated from permanent positive supply, readiness code must be generated again, see **Scan Tool** section at back of manual.

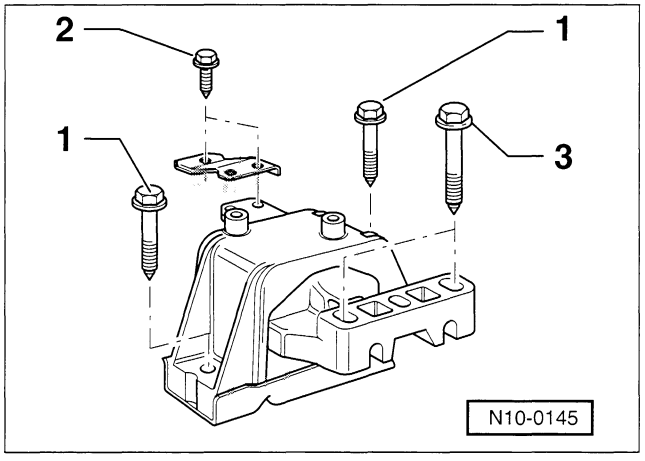
Tightening torques

Tightening torques (1.9L 4-cylinder turbo engines)

- Engine to transmission bolts,
  - M10 . . . . . 60 Nm (44 ft-lb)
  - M12 . . . . . 80 Nm (59 ft-lb)
- Starter to transmission . . . . . 65 Nm (48 ft-lb)
- Triple rotor/CV joint to transmission . 40 Nm (30 ft-lb)
- Torque converter to drive plate. . . . . 60 Nm (44 ft-lb)
- Front exhaust pip to turbocharger . . 25 Nm (18 ft-lb)
- Bolts & nuts, not specifically listed
  - M6 . . . . . 10 Nm (7 ft-lb)
  - M8 . . . . . 25 Nm (18 ft-lb)
  - M10 . . . . . 40 Nm (30 ft-lb)
  - M12 . . . . . 60 Nm (44 ft-lb)

Engine/transmission, mounts

The engine/transmission assembly is suspended on its rotational axis by the engine mount on the right side and the transmission mount on the left side. Engine movement known as torque reaction is limited by the pendulum support mounted in the center underneath. Engine mounts differ slightly depending on transmission type (manual vs. automatic), but all are all similar.



Engine mount, right side.

ALH engines:

1. Mount to body bolt
- 40 Nm (30 ft-lb) plus 90° (¼ turn)
- always replace

2. Mount bracket to body bolt
- 25 Nm (18 ft-lb)

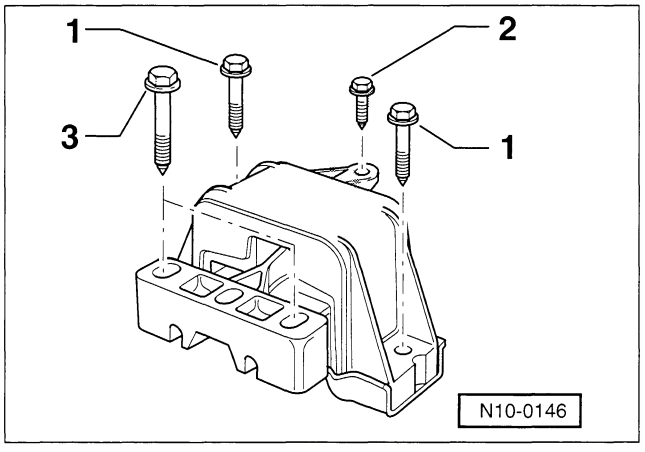
3. Mount to engine bracket bolt
- 60Nm (44 ft-lb) plus 90° (¼ turn)
- always replace

BEW engines:

1. Mount to body bolt
- 40 Nm (30 ft-lb) plus 90° (¼ turn)
- always replace

2. Mount bracket to body bolt
- 25 Nm (18 ft-lb)

3. Mount to engine bracket bolt
- 100Nm (74 ft-lb)



Transmission mount, left side

ALH engines:

1. Mount to body bolt
- 40 Nm (30 ft-lb) plus 90° (¼ turn)
- always replace

2. Mount bracket to body bolt
- 25 Nm (18 ft-lb)

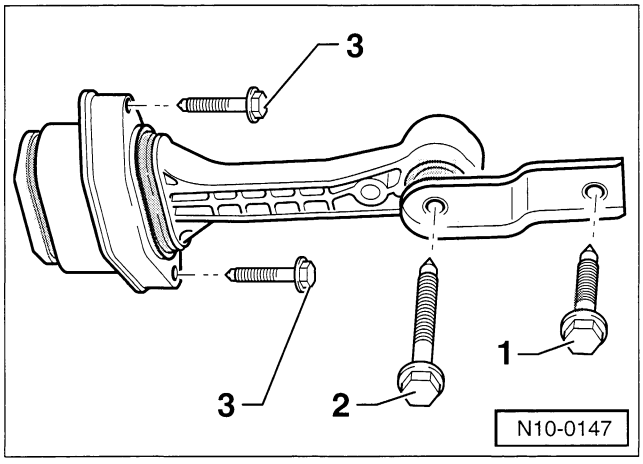
3. Mount to transmission bracket bolt
- 60Nm (44 ft-lb) plus 90° (¼ turn)
- always replace

BEW engines:

1. Mount to body bolt
- 40 Nm (30 ft-lb) plus 90° (¼ turn)
- always replace

2. Mount bracket to body bolt
- 25 Nm (18 ft-lb)

3. Mount to engine bracket bolt
- 100Nm (74 ft-lb)



➢ Pendulum support, lower center

ALH engines:

1. Pendulum support to transmission bolt
- 40 Nm (30 ft-lb) plus 90° (¼ turn)
- always replace

2. Pendulum support to transmission bracket bolt
- 40 Nm (30 ft-lb) plus 90° (¼ turn)
- always replace

3. Pendulum support to subframe bolt
- 20 Nm (15 ft-lb) plus 90° (¼ turn)
- always replace

BEW engines:

1. Pendulum support to transmission bolt
- 40 Nm (30 ft-lb) plus 45° (1/8 turn)
- always replace

2. Pendulum support to transmission bracket bolt
- 40 Nm (30 ft-lb) plus 45° (1/8 turn)
- always replace

3. Pendulum support to subframe bolt
- 20 Nm (15 ft-lb) plus 90° (¼ turn)
- always replace

ENGINE, REMOVING AND INSTALLING (2.0L 4-CYLINDER GASOLINE)

Engine/transmission assembly, removing

– Ensure ignition is switched off. Disconnect battery negative (–) terminal and then positive (+) terminal.

NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.

– Remove engine cover.

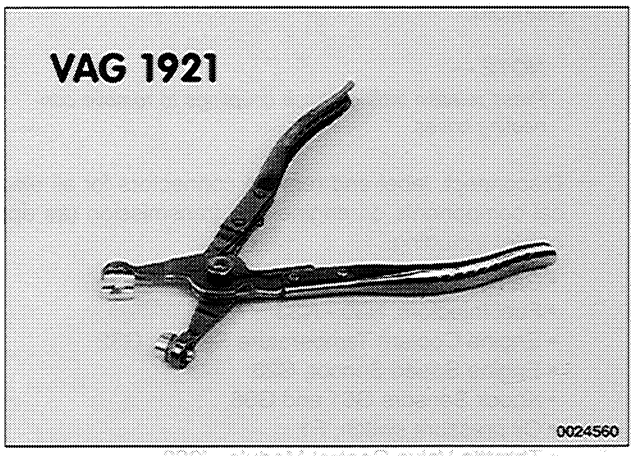
NOTE —
Experience suggests that in some cases, moving the lock carrier to the service position will facilitate access to the engine.

- *Remove front bumper, see* **63 Bumpers**.
- *Put lock carrier (radiator support) into service position, see* **50 Body–Front**.

– Remove lower sound absorber covers, see **50 Body - Front**.

– Drain coolant, see **19 Cooling System**.

> ***WARNING —***
> *Hot coolant can scald! Drain the coolant only with engine cold.*



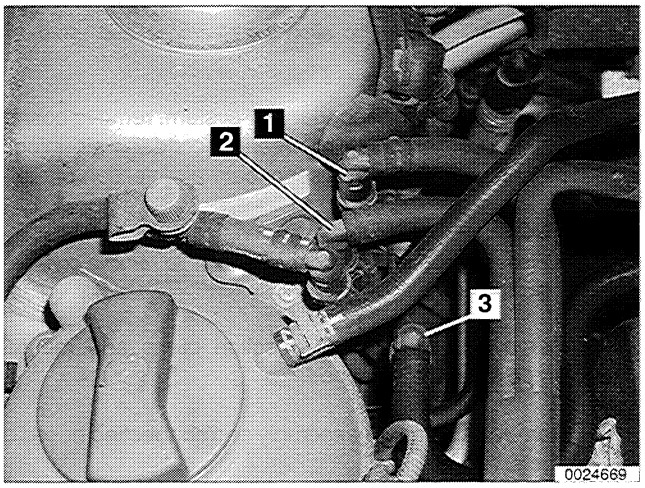
➢ Disconnect coolant hoses using spring-type pliers.

NOTE —
Spring-type hose clamps are used from the factory. Special pliers such as VAG 1921 or VAS 5024 or equivalent are recommended for ease of removal and installation.

– Remove battery and hold-down, see **27 Engine Electrical**.

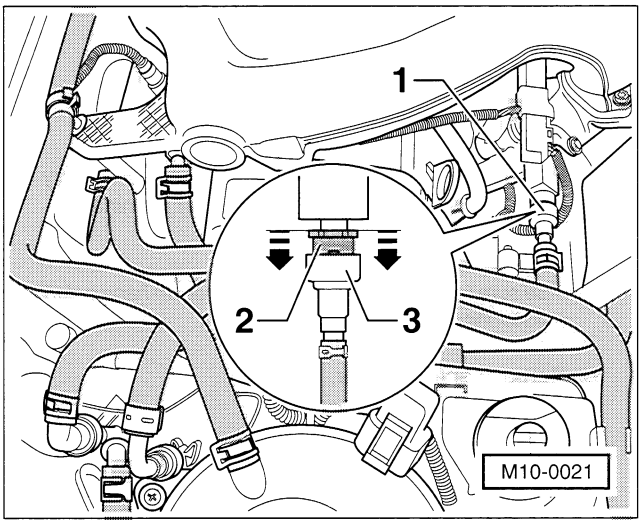
Engine codes AEG, AVH, AZG

– Disconnect accelerator cable where applicable.



➢ Disconnect vacuum hose (**3**) to Throttle Valve Control Module, fuel supply hose (**1** - marked with white) and return fuel hose (**2** - marked with blue). Collect fuel that leaks out.

> ***WARNING —***
> - *The fuel system is under pressure and fuel will be expelled when lines are opened! Before opening the system place a cloth around the connection and release the pressure by carefully loosening the connection.*
> - *Fire hazard! Do not smoke or work near heaters or other fire hazards. Have a fire extinguisher handy.*



Engine codes BBW, BEV

➢ Disconnect fuel supply line (**1**) from union by pressing locking ring (**2**) into union (**3**). Collect fuel that leaks out.

WARNING —

- *The fuel system is under pressure and fuel will be expelled when lines are opened! Before opening the system place a cloth around the connection and release the pressure by carefully loosening the connection.*
- *Fire hazard! Do not smoke or work near heaters or other fire hazards. Have a fire extinguisher handy.*

Continued for all vehicles

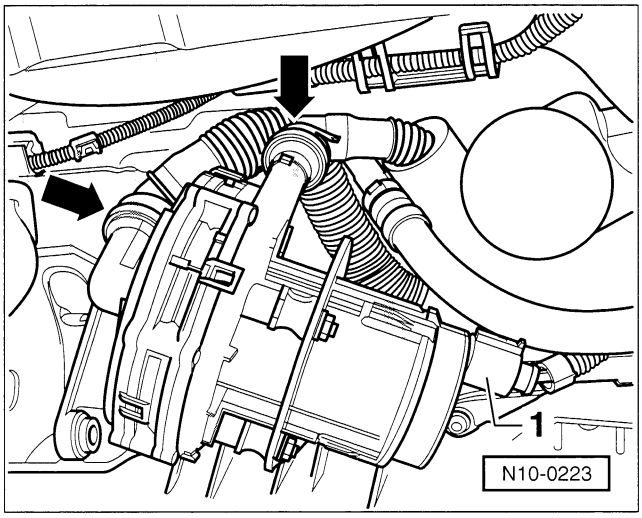
– Seal (plug) all lines so that fuel system is not contaminated by dirt, leaking fluids, etc. Seal off any open ports on manifold.

NOTE —

Press release tabs on hose couplings to remove connecting hoses.

– Disconnect, label and remove connectors for all electrical components on engine and transmission (**as applicable**) including:

- Camshaft Position Sensor, G40
- Fuel Injectors, N30 - N33
- Engine Coolant Temperature Sensor, G62
- Engine Speed Sensor, G28
- Knock Sensors G61 and G66
- Oil pressure switch, F1
- Throttle Valve Control Module, J338
- Air Conditioner thermal switch, F163
- Camshaft Position Actuator Valve, N205
- Ignition Coils with power output stages N, and N128, or, N70, N127, N291, N292
- Secondary Air Injection pump motor, V101
- Remaining electrical connections on engine, transmission, generator (alternator) and starter.



NOTE —

Move wiring aside to allow for clearance and avoid damage.

➢ On vehicles with secondary air system, remove connecting hoses (**arrows**) between secondary air injection pump/combi-valve and secondary air injection pump.

NOTE —

Press release tabs on hose couplings to remove connecting hoses.

– Remove secondary air injection pump and mounting bracket, where equipped.

– Remove air cleaner assembly and connecting hoses and ducts.

– Ensure that all coolant, vacuum, and intake hoses are removed.

– Remove upper intake manifold, see **15 Cylinder Head and Valvetrain**.

NOTE —
Seal intake manifold ports on the lower section with adhesive tape or cloth to prevent accidental ingress of dirt and debris.

Vehicles with manual transmission

– Disconnect selector mechanism from transmission, see **34 Manual Transmission**.

– Remove hydraulic slave cylinder.

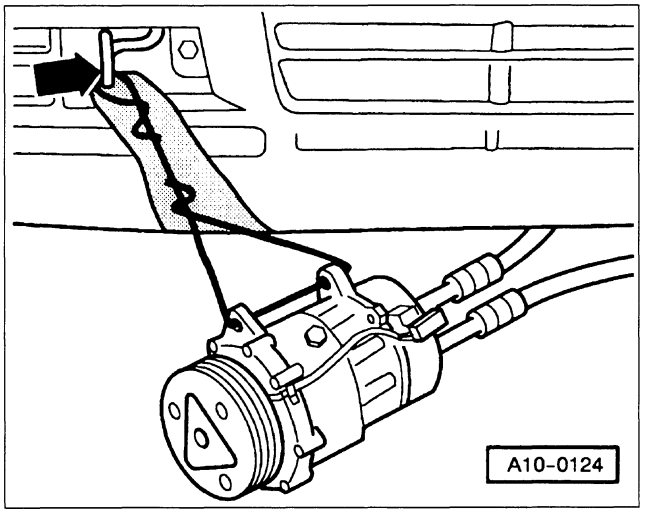
NOTE —
Do do depress clutch pedal with slave cylinder removed!

Vehicles with automatic transmission

– Remove selector cable from transmission, see **37 Automatic Transmission**.

Continued for all vehicles

– Mark running direction and remove ribbed V-belt, see **0 Maintenance**.



– Remove securing clamps for power steering pressure line.

– Remove power steering pump with bracket and hoses still attached and set to one side. See **48 Steering**.

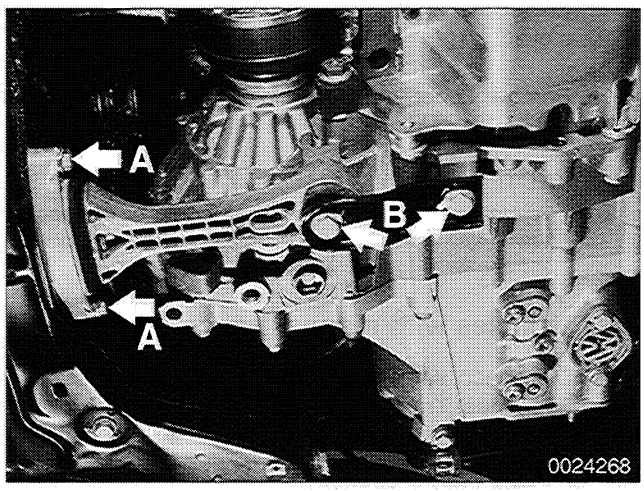
– Remove securing clamps from air conditioning refrigerant hoses/lines. Do not disconnect hoses/lines.

– Remove air conditioner compressor without disconnecting hoses/lines, see **87 Air Conditioning**.

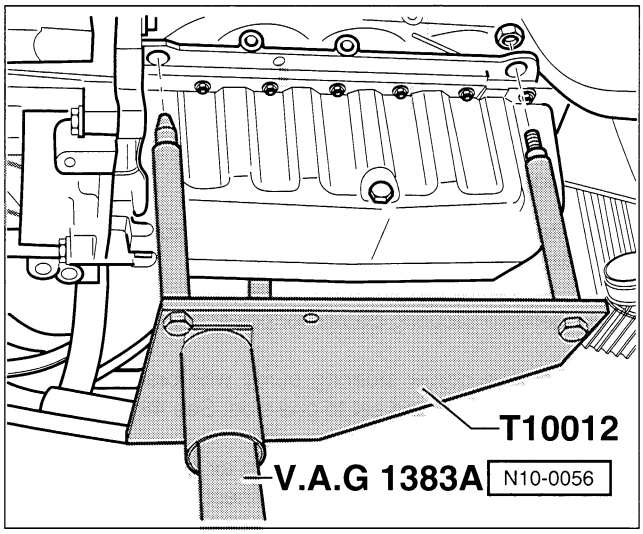
NOTE —
To avoid damage to condenser as well as to refrigerant lines and hoses, make sure that the lines and hoses are not stretched, kinked or bent.

➤ Secure air conditioner compressor to towing eye (**arrow**) so that refrigerant hoses/lines are not under tension.

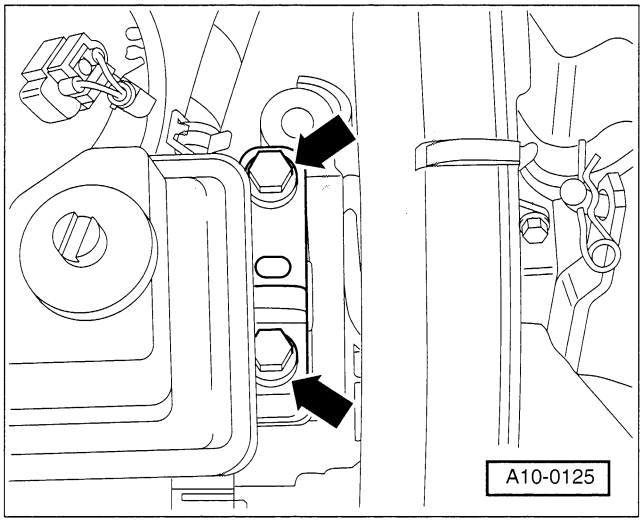
NOTE —
To prevent damage to lower bumper surface, protect with adhesive tape.



- Unbolt mounting bolts (**arrows A** and **B**) and remove pendulum support.
- Remove right side inner CV joint protective cover from engine if equipped.
- Remove right side drive shaft and disconnect left side driveshaft at the transmission. See **40 Front Suspension and Drive Axles**.
- Remove front exhaust pipe, see **26 Exhaust System and Emission Controls.**
- Disconnect connector for oxygen sensor before catalytic converter and free wiring, see **26 Exhaust System and Emission Controls.**
- Depending on engine code (version), remove oil pan protection shields and rubber bushings as needed.



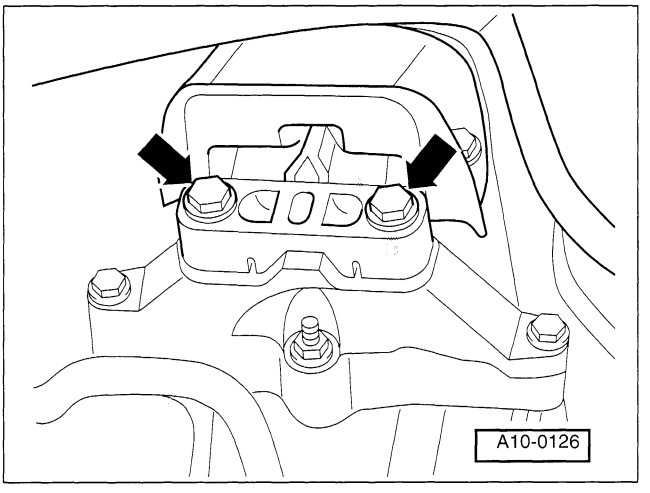
- Install engine support bracket T10012 onto cylinder block as shown. On front of block, secure with an M 10X25 8.8 bolt and nut. Tighten to 40 Nm (30 ft-lb). On rear, install M10 nuts and hand tighten.
- Install support T10012 onto engine/transmission jack VAG 1383A and lift engine and transmission slightly.



- Unbolt engine side of assembly mount from carrier at top (**arrows**).

NOTE —

To remove securing bolts while vehicle is supported on a lift, use Volkswagen special tool VAS 5085 (a ladder) or equivalent.



➤ Unbolt transmission side of assembly mount from transmission carrier at top (**arrows**).

– Carefully lower engine with transmission attached.

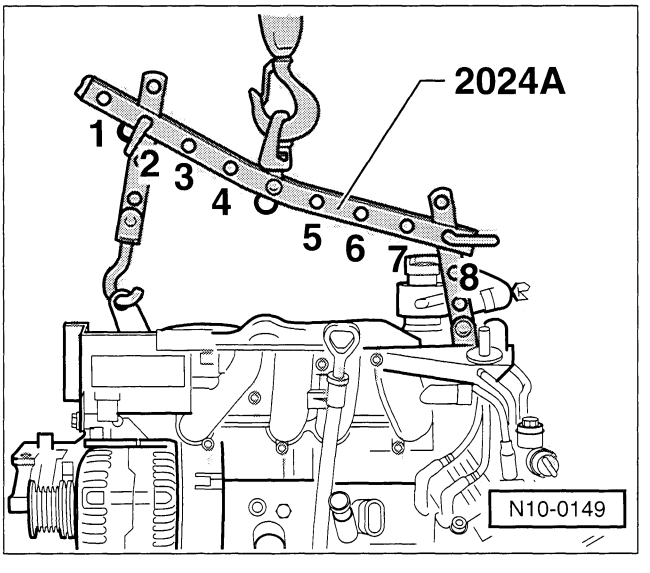
NOTE —
Engine with transmission attached must be guided carefully when lowering to prevent damage to the bodywork.

Engine/transmission, separating/transporting

When working on the engine/transmission assembly after removal, it should be transported to an assembly stand with a workshop crane and the appropriate lifting tackle. The two units should then be separated and the engine secured to the assembly stand support clamp VW 313 using the engine and transmission support VW 540 and VW 540/1B.

– Remove transmission from engine.

NOTE —
- *On cars with automatic transmissions, be sure the drive plate separates cleanly from the torque converter without pulling the torque converter off of its support. Once the engine and transmission are separated, install a suitable bar across the open bell bellhousing to keep the torque converter from falling out.*
- *On cars with manual transmissions, be sure that the weight of the transmission or the engine is never supported on the transmission mainshaft. Clutch or transmission damage will result.*



➤ Attach lifting support 2024A with as shown.

- Position number **1** on 2024A bracket should be at pulley end.
- Attach at pulley end: third (**3rd**) hole in hook, position two (**2**) in bracket.
- Attach at flywheel end: third (**3nd**) hole in hook, position eight (**8**) in bracket.

WARNING —
The hooks and locating pins must be secured with locking clips!

– Lift off of engine/transmission jack VAG 1383A with a workshop crane.

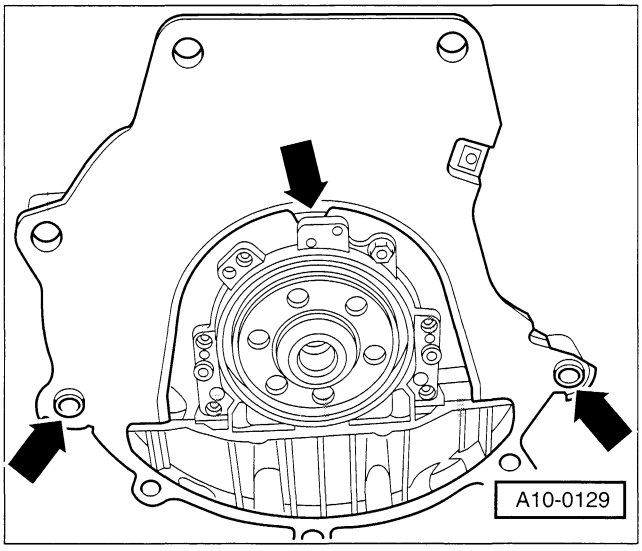
– Secure engine to bracket mounting VW 540 and VW 540/1B and attach to engine stand VW 313 or equivalent.

NOTE —
It is usually necessary to remove intermediate plate and dowel sleeves before attaching engine to VW 540.

Engine/transmission assembly, installing

WARNING —

- *When working in the engine compartment, due to the cramped, tight conditions, pay attention to the following points*
- *Route all lines (e.g. for fuel, hydraulics, EVAP system, coolant, refrigerant, brake fluid and vacuum, etc.) as well as electrical wiring so that the original positions are maintained. Ensure sufficient clearance to all moving or hot components.*
- *Make sure there is sufficient clearance to all moving or hot components.*
- *Be sure to replace all tie wraps cut during removal and install new ones to prevent lines and wiring harnesses from chaffing or contacting engine parts.*



➢ Install new dowel sleeves (**lower arrows**) for centering engine/transmission are in cylinder block, install/replace as necessary.

– Install intermediate plate onto rear sealing flange dowel (**upper arrow**) if removed.

– Before mating engine and transmission, observe the appropriate points depending on transmission type.

Vehicles with manual transmission

– Check centering of clutch drive plate as required.

– Check clutch release bearing and guide sleeve for wear.

– Lightly lubricate clutch release bearing, release bearing guide sleeve and splines on input shaft with G 000 100.

– Bolt engine and transmission together.

Vehicles with automatic transmission

– Remove any locking device used to secure torque converter to transmission.

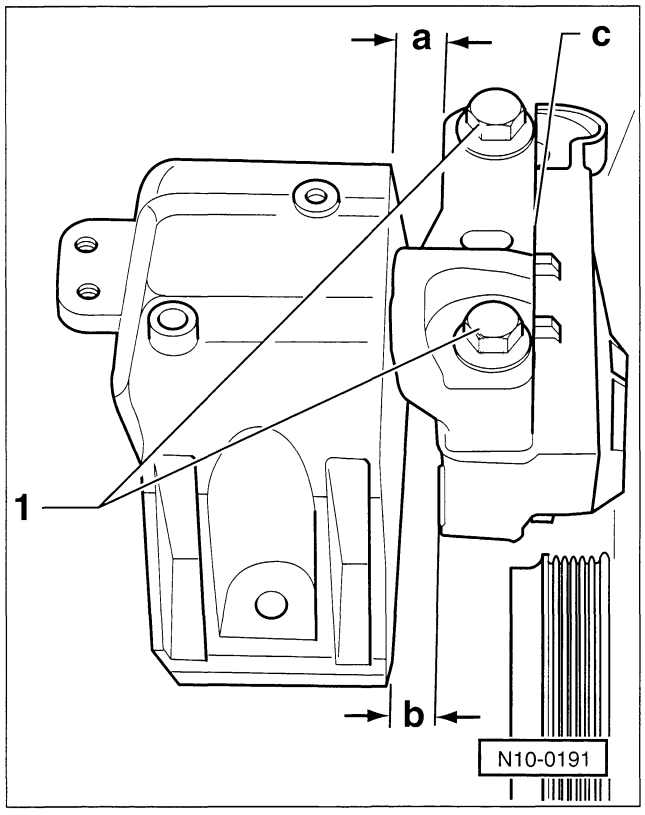
– Ensure proper seating of torque converter on transmission shafts.

– Bolt engine and transmission together.

– Bolt torque converter to drive plate with only approved/specified nuts.

Continued for all vehicles

Installation of engine/transmission is carried out in the reverse of removal.

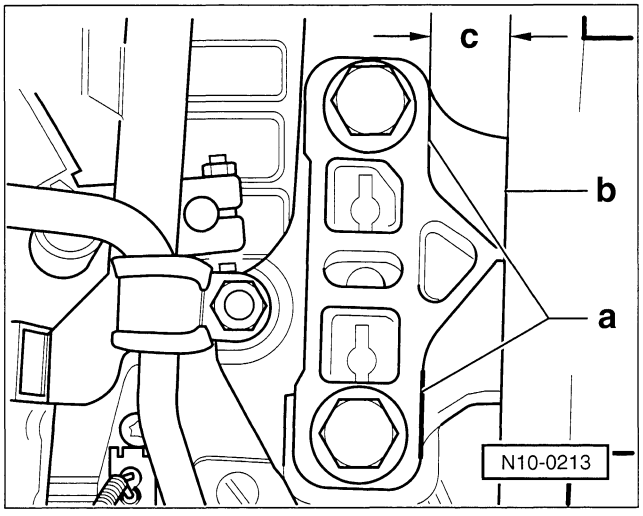


– With engine/transmission assembly on same devices as was used for removal, carefully raise assembly up and into position from below.
  - Ensure sufficient clearance for installation of left side drive axle.
  - Ensure sufficient clearance for installation of A/C compressor and lines.

➤ When engine/transmission assembly is in position, align engine mount as shown.

Gap **a** = 14.0 mm (0.55 in)
Gap **b** = at least 10.0 mm (0.40 in)
Both bolt head shoulders (**1**) must line up flush with edge (**c**).

> ***WARNING —***
> *Do not loosen engine mounting bolts if weight of engine is not fully supported by hoist, lift or support bridge.*



➤ Align transmission mount edges parallel to each other.
  - Ensure that edges **a** of left side transmission mount are parallel to **b**.
  - Gap **c** = 18.0 - 20.0 mm (0.71 - 0.79 in)

– Install engine, transmission and pendulum mounts with new bolts where indicated and torque to specification, see **Engine and Transmission Mounts**.

– Install and connect drive both axles, see **40 Front Suspension and Drive Axles**.

– Install right side inner CV joint protective cover from engine if equipped.

– Install oil pan protection shields and rubber bushings as needed.

– Install A/C compressor and secure A/C lines, see **87 Air Conditioning**.

– Install front exhaust pipe, see **26 Exhaust System/Emission Controls**.

– Connect connector for oxygen sensor before catalytic converter and secure wiring.

Vehicles with manual transmission

– Install hydraulic clutch slave cylinder, see **30 Clutch**.

– Install and adjust gear selector mechanism, see **34 Manual Transmission**.

Vehicles with automatic transmission

– Install and adjust gear selector cable and replace lock washer on selector cable mount. See **37 Automatic Transmission**.

Continued for all vehicles

– Install upper intake manifold, see **15 Cylinder Head and Valvetrain**.

NOTE —
Ensure that adhesive tape or cloth used to seal intake manifold ports is removed!

– On vehicles with secondary air injection system, install pump, mounting bracket, combi-valve, and connecting hoses.

– Note running direction and install poly-ribbed, see **0 Maintenance**.

– Install power steering pump and lines, see **48 Steering**.

– Install battery and hold-downs.

– Install air cleaner assembly, connecting hoses and ducts.

– Install fuel supply and return lines and connect vacuum hose to throttle valve control module.

NOTE —
Ensure that all sealing plugs, adhesive tape and cloth used to seal fuel and vacuum lines is removed before re-assembly.

– Connect accelerator cable as applicable.

– Connect coolant all hoses.

– Insure that all vacuum, fuel, intake and coolant hoses are properly connected.

– Connect all electrical wiring to engine, transmission, generator, and starter and check for clearance and proper routing.

– Reinstall fuel supply and return lines.

– Refill cooling system with appropriate ratio of distilled water and G12 coolant and check for leaks. See **19 Engine – Cooling System**.

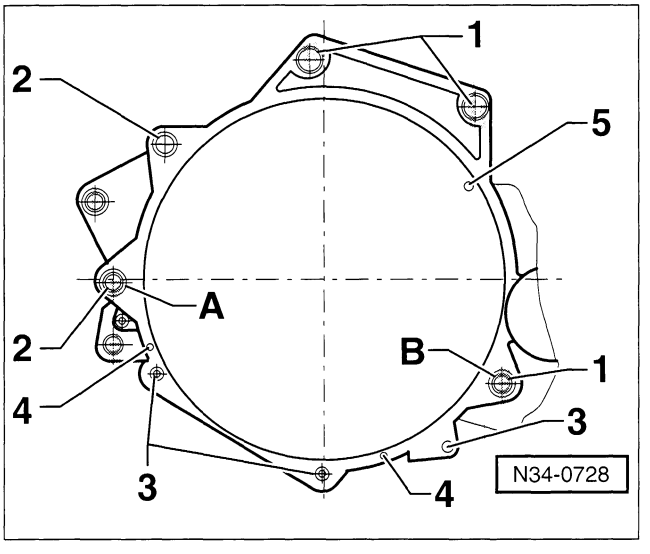
– If lock carrier was moved to the service position, return it to normal position and install front bumper.

– Connect battery cables.

- Ensure that all removed tie wraps are replaced, and that all electrical wiring and hoses are properly routed and secured.
- Ensure that engine oil and all fluids are at correct levels.
- Start engine and let it idle. Inspect for oil and coolant leaks. Check for smooth operation of shifter and clutch as required. Road test as required.
- Perform procedure following interruption of voltage supply, see **27 Engine Electrical**
- Adapt Transmission Control Module (TCM) to Basic Settings, see **37 Automatic Transmission**.
- Shut off engine and install lower sound absorber panel (belly pan) and upper engine cover.
- If DTC (Diagnostic Trouble Code) memory has been erased or engine control module separated from permanent positive supply, readiness code must be generated

Tightening torques

Transmission-to-engine bolt specifications and tightening torques are listed below.



Transmission to engine fasteners

Fastener	Size	Qty.	Tightening torque
1	M12 X 55	3	80 Nm (59 ft-lb)
2[1]	M12 X 150	2	80 Nm (59 ft-lb)
3[2]	M10 X 50	3	60 Nm (44 ft-lb)
4[3]	M7 X 12	2	10 Nm (7 ft-lb)
5[4]	M7 X 12	1	10 Nm (7 ft-lb)
A + B	Locating dowel sleeves	2	

1. Also starter to transmission
2. Only on engines with an aluminum oil pan
3. Large cover plate for flywheel, only on engines with sheet steel oil pan (painted black)
4. Small cover plate for flywheel

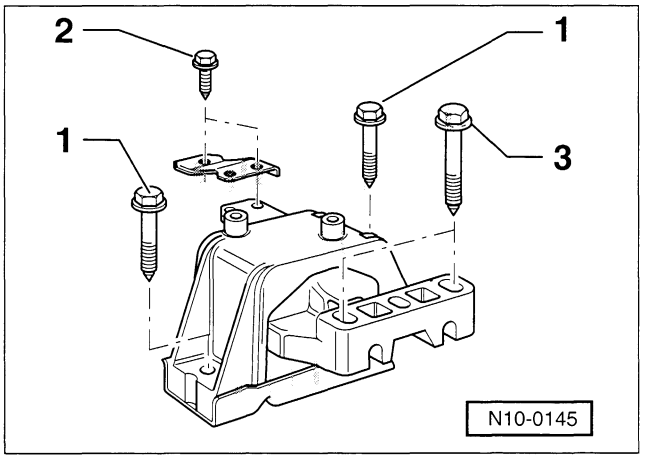
Additional tightening torque (2.0L 4-cylinder engines)

- Triple rotor/CV joint to transmission . 40 Nm (30 ft-lb)
- Torque converter to drive plate. . . . . 60 Nm (44 ft-lb)
- Bolts & nuts, not specifically listed

M6 . . . . . 10 Nm (7 ft-lb)
M7 . . . . . 15 Nm (11 ft-lb)
M8 . . . . . 25 Nm (18 ft-lb)
M10 . . . . . 40 Nm (30 ft-lb)
M12 . . . . . 60 Nm (44 ft-lb)

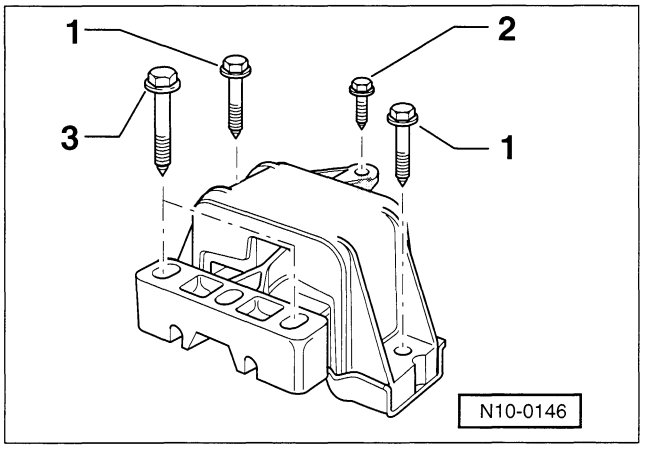
Engine/transmission, mounts

The engine/transmission assembly is suspended on its rotational axis by the engine mount on the right side and the transmission mount on the left side. Engine movement known as torque reaction is limited by the pendulum support mounted in the center underneath. Engine mounts differ slightly depending on transmission type (manual vs. automatic), but all are all similar.



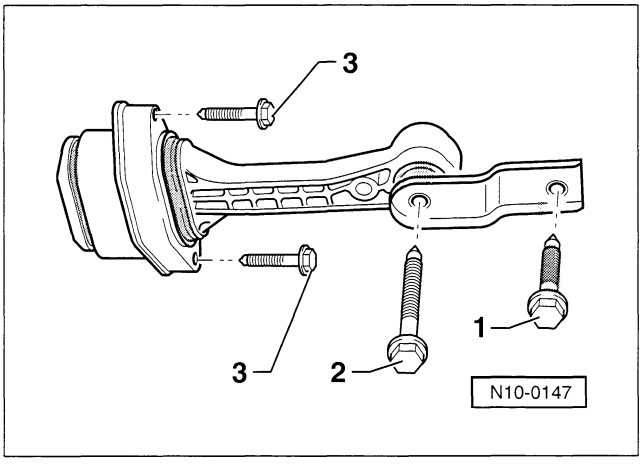
Engine mount, right side:

1. **Mount to body bolt**
   - 40 Nm (30 ft-lb) plus 90° (¼ turn)
   - always replace
2. **Mount bracket to body bolt**
   - 25 Nm (18 ft-lb)
3. **Mount to engine bracket bolt**
   - 100 Nm (74 ft-lb)



Transmission mount, left side

1. **Mount to body bolt**
   - 40 Nm (30 ft-lb) plus 90° (¼ turn)
   - always replace
2. **Mount bracket to body bolt**
   - 25 Nm (18 ft-lb)
3. **Mount to transmission bracket bolt**
   - 100 Nm (74 ft-lb)



Pendulum support, lower center

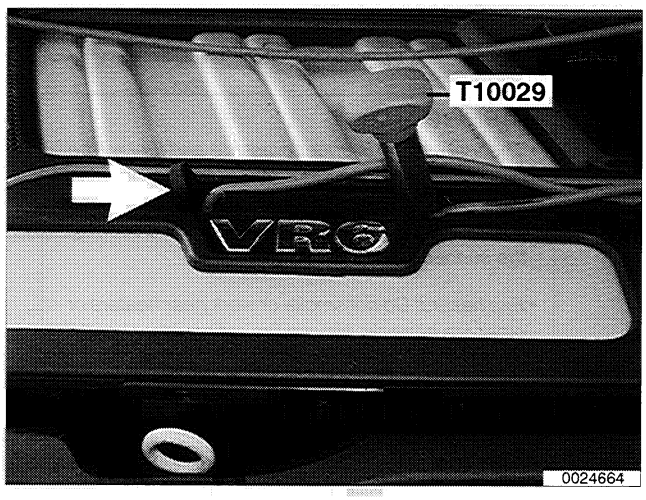
1. **Pendulum support to transmission bolt**
   - 40 Nm (30 ft-lb) plus 90° (¼ turn)
2. **Pendulum support to transmission bracket bolt**
   - 40 Nm (30 ft-lb) plus 90° (¼ turn)
3. **Pendulum support to subframe bolt**
   - 20 Nm (15 ft-lb) plus 90° (¼ turn)

ENGINE, REMOVING AND INSTALLING (2.8L 6-CYLINDER GASOLINE)

Engine/transmission assembly, removing

– Ensure ignition is switched off. Disconnect battery negative (–) terminal (ground strap).

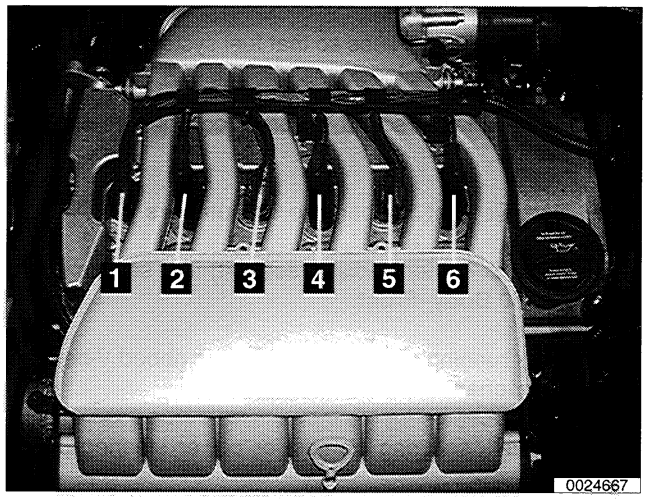
NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.



Engine code **AFP**:

- Disconnect spark plug wires from spark plugs with tool T10029 as shown. Disconnect other end of wire from ignition coil and remove wire.
- Remove upper engine cover.

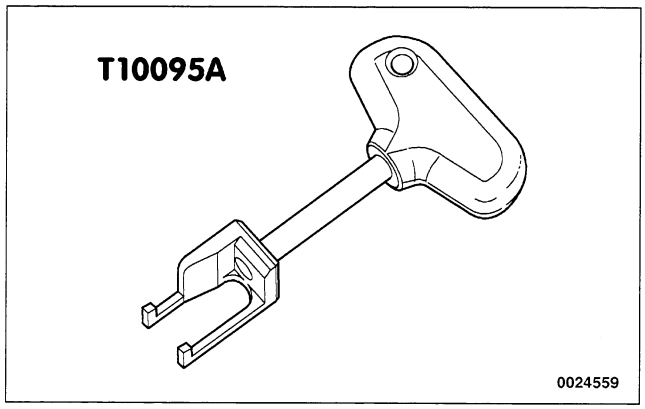
NOTE —
*It may not be necessary to use special tool T10029 if spark plug wires are equipped with removal loops (**arrow**) that allow the spark plug wires to be removed by hand.*



Engine code **BDF**:

- Remove upper engine cover.
- Label and disconnect connectors from ignition coils.

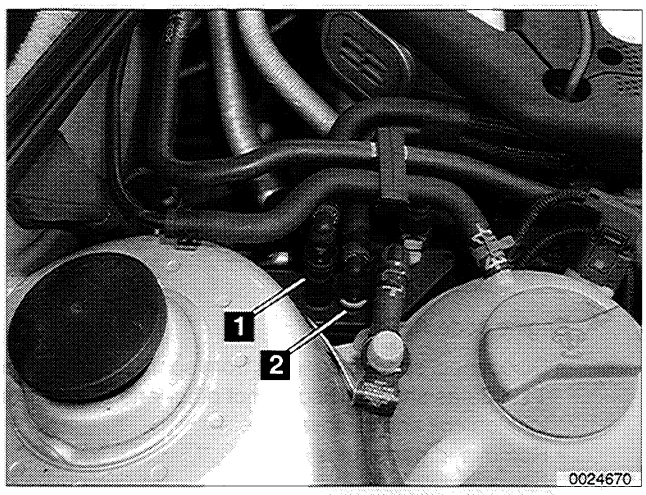
NOTE —
Label connector and component before disconnecting to facilitate later installation.



Engine code **BDF:** Remove ignition coils with final output stages for all cylinders using puller T10095a or equivalent.

– Remove battery and battery tray.

– Remove air cleaner assembly and connecting hoses.

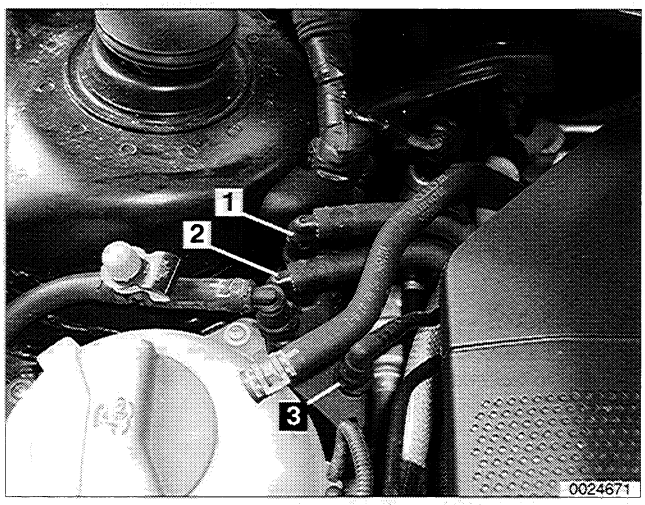


Engine code **AFP**:

- Pull off fuel supply line/hose (**1**) and return line/hose (**2**) (marked with blue) and collect fuel that leaks out.
- Press release tabs on hose couplings to remove connecting hoses.
- Seal (plug) all lines so that fuel system is not contaminated by dirt, leaking fluids, etc.

WARNING —

- *The fuel system is under pressure and fuel will be expelled when lines are opened! Before opening the system place a cloth around the connection and release the pressure by carefully loosening the connection.*
- *Fire hazard! Do not smoke or work near heaters or other fire hazards. Have a fire extinguisher handy.*



Engine code **BDF**:

- Disconnect vacuum hose to throttle valve control module (**3**), fuel supply line (**1**) (marked with white) and fuel return line (**2**) (marked with blue).
- Press release tabs on hose couplings to remove connecting hoses.
- Seal (plug) all lines so that fuel system is not contaminated by dirt, leaking fluids, etc.

– Remove lower sound absorber covers, see **50 Body - Front**.

– Remove front bumper, see **63 Bumpers**.

– Put lock carrier (radiator support) into service position, see **50 Body–Front**.

– Mark running direction and remove ribbed V-belt, see **0 Maintenance**.

– Remove securing clamps for power steering pressure line.

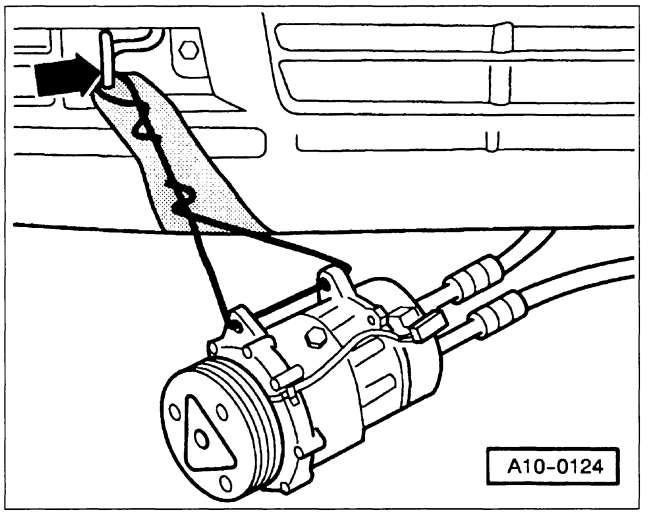
– Remove power steering pump with bracket and hoses still attached and set to one side. See **48 Steering**.

– Remove securing clamps from air conditioning refrigerant hoses/lines. Do not disconnect hoses/lines.

– Remove air conditioner compressor without disconnecting hoses/lines, see **87 Air Conditioning**.

NOTE —

To avoid damage to condenser as well as to refrigerant lines and hoses, make sure that the lines and hoses are not stretched, kinked or bent.



➤ Secure air conditioner compressor to towing eye (**arrow**) so that refrigerant hoses/lines are not under tension.

NOTE —
To prevent damage to lower bumper surface, protect with adhesive tape.

Vehicles with manual transmission

– Disconnect selector mechanism from transmission, see **34 Manual Transmission**.

– Remove hydraulic slave cylinder.

NOTE —
- *In some cases, it may be necessary to disconnect hydraulic line from slave cylinder for removal.*
- *Do do depress clutch pedal with slave cylinder removed!*

Vehicles with automatic transmission

– Remove selector cable from transmission, see **37 Automatic Transmission**.

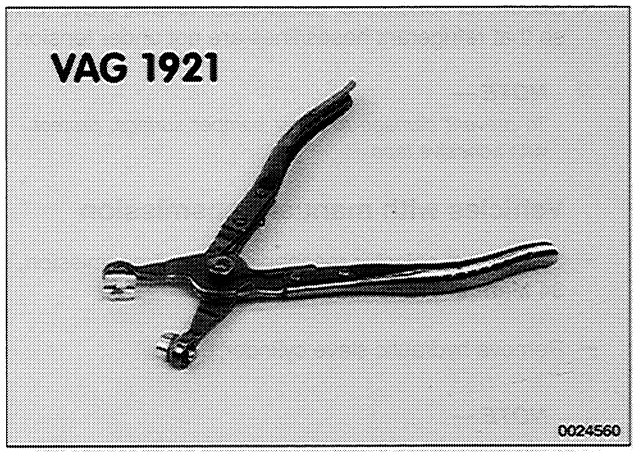
Continued for all vehicles

– Intake manifold access:
  - Engine code AFP: Remove upper section of intake manifold, see **15d Cylinder Head and Valvetrain**.
  - Engine code BDF: Remove intake manifold assembly, see **15d Cylinder Head and Valvetrain**.

– Disconnect remaining vacuum, breather and vent hoses from engine.

– Disconnect, label and remove connectors for all electrical components on engine and transmission (**as applicable**) including:
  - Camshaft Position Sensor, G40
  - Camshaft Position Sensor 2, G163
  - Fuel Injectors, N30 - N33, N84, N84
  - Engine Coolant Temperature Sensor, G62
  - Engine Speed Sensor, G28
  - Knock Sensors G61 and G66
  - Oil pressure switch, F1
  - After-Run Coolant Pump, V51
  - Camshaft Position Actuator Valves, N205 and N318
  - Ignition Coils with power output stage, N152
  - Heated Oxygen Sensors 1 and 2, G39 and G130
  - Remaining electrical connections on engine, transmission, generator (alternator) and starter.

NOTE —
Move wiring aside to allow for clearance and avoid damage.



– Drain coolant, see **19 Cooling System**.

> ***WARNING —***
> *Hot coolant can scald! Drain the coolant only with engine cold.*

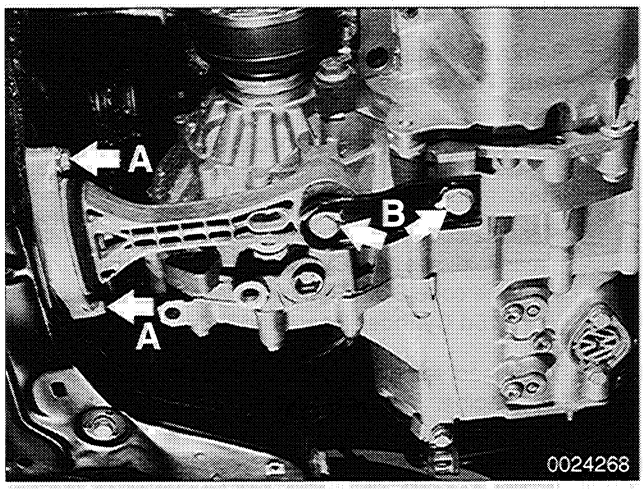
➢ Disconnect coolant hoses at radiator or engine using spring-type pliers or "quick-disconnect" couplings where equipped.

> ***NOTE —***
> *Spring-type hose clamps are used from the factory. Special pliers such as VAG 1921 or VAS 5024 or equivalent are recommended for ease of removal and installation.*

– Remove right side inner CV joint protective cover from engine if equipped.

– Remove right side drive shaft and disconnect left side driveshaft at the transmission. See **40 Front Suspension and Drive Axles**.

– Remove front exhaust pipe, see **26 Exhaust System and Emission Controls.**

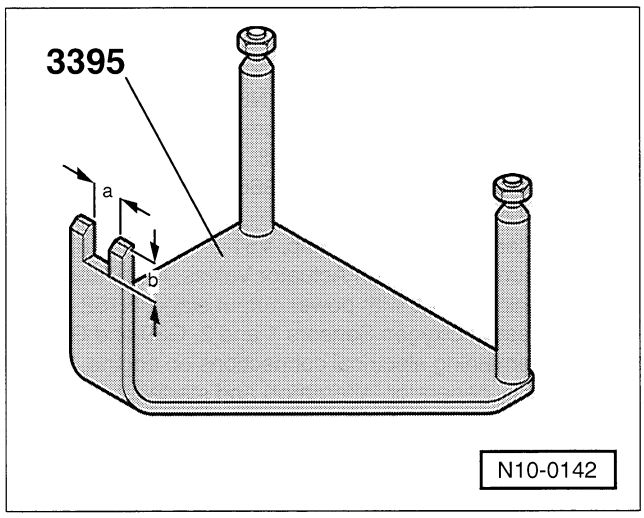


➢ Unbolt mounting bolts (**arrows A** and **B**) and remove pendulum support.

– Engine code **BDF**:

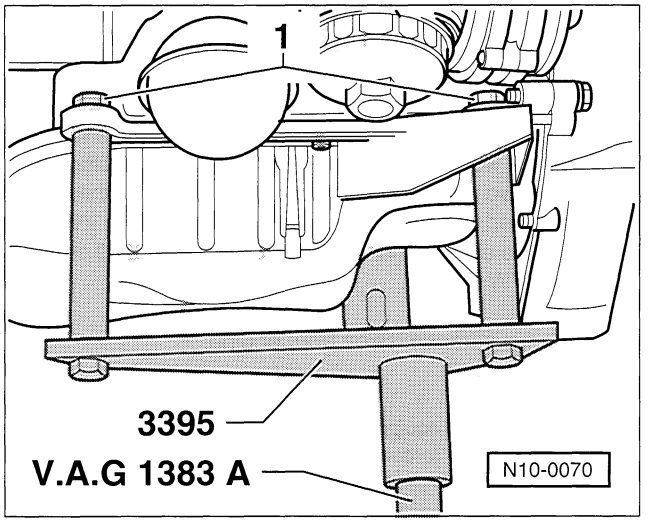
- Remove generator (alternator) and mounting bracket.
- Remove Secondary Air Injection pump motor bracket from oil pan and cylinder block.

> ***NOTE —***
> *The above step may also be needed for engine code AFP to obtain needed clearance.*



➢ Engine code: **AFP**:

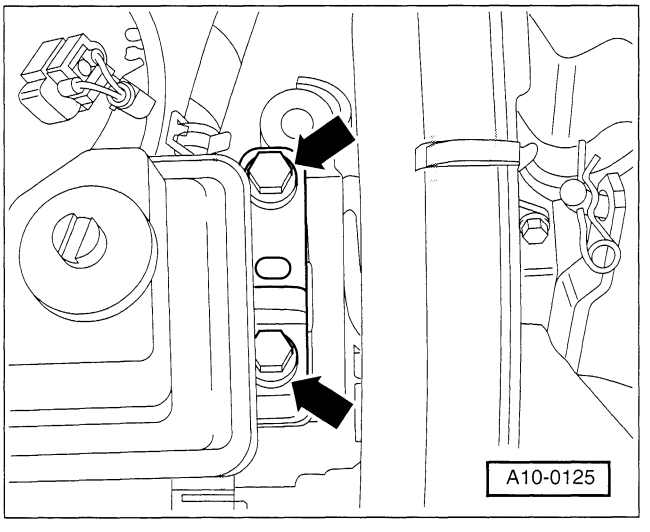
- Modify Volkswagen engine support tool 3395 to fit the bottom of the engine block.
- Deepen and widen slot to the following dimensions:
  a = 32 mm (1.26 in)
  b = 27 mm (1.06 in)



- Install engine support bracket 3395 onto cylinder block as shown. Install M10 nuts and tighten to 40 Nm (30 ft-lb).

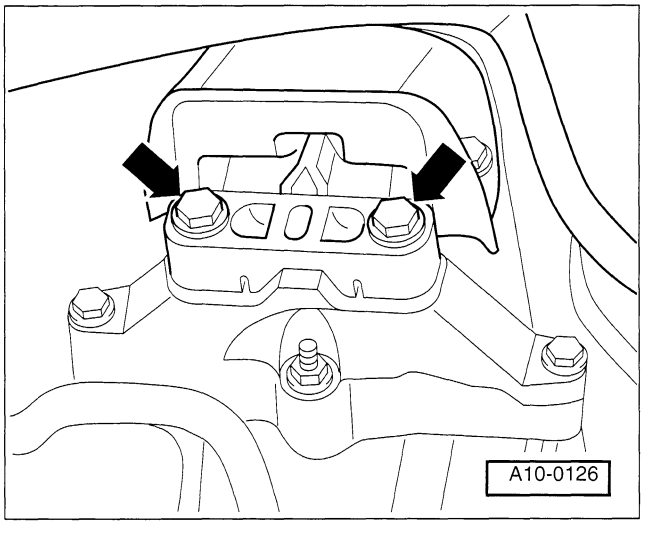
> ***WARNING —***
> *Use of engine support special tools as shown is necessary for proper weight distribution and safe support and removal of engine.*

- Install support 3395 onto engine/transmission jack VAG 1383A and lift engine and transmission slightly.



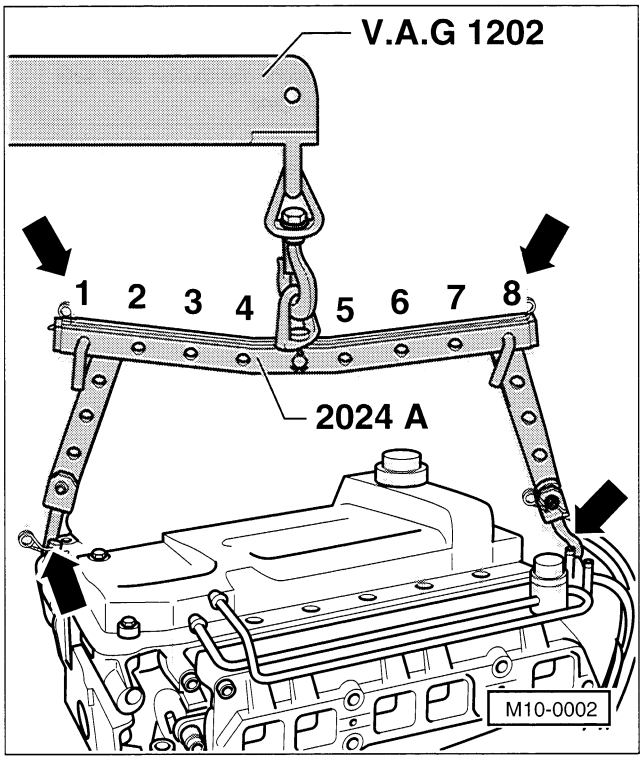
- Unbolt engine side of assembly mount from carrier at top (**arrows**).

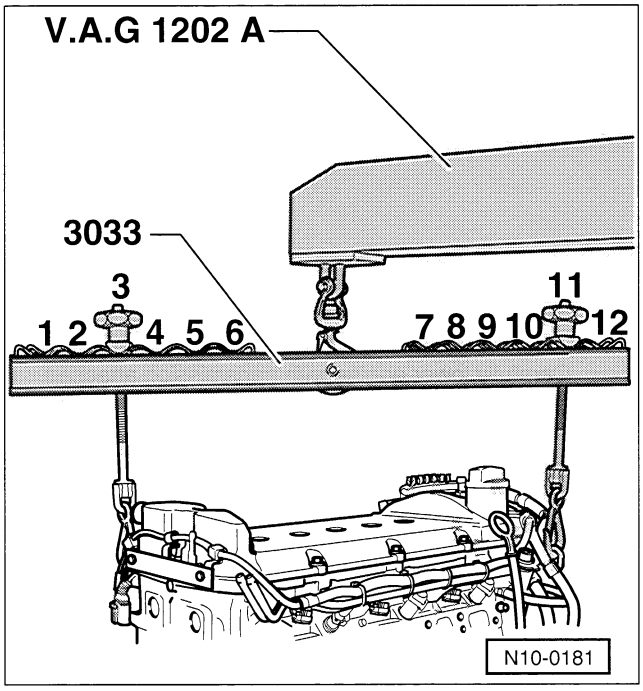
> ***NOTE —***
> *To remove securing bolts while vehicle is supported on a lift, use Volkswagen special tool VAS 5085 (a ladder) or equivalent.*



- Unbolt transmission side of assembly mount from transmission carrier at top (**arrows**).
- Carefully lower engine with transmission attached.

> ***NOTE —***
> *Engine with transmission attached must be guided carefully when lowering to prevent damage to the bodywork.*





Engine/transmission, separating/transporting

When working on the engine/transmission assembly after removal, it should be transported to an assembly stand with a workshop crane and the appropriate lifting tackle. The two units should then be separated and the engine secured to the assembly stand support clamp VW 313 using the engine and transmission support 3269 or VW 540 and VW 540/1B.

– Remove transmission from engine.

NOTE —
If engine is equipped with an automatic transmission, secure the torque converter against falling out after separating engine from transmission.

Engine code **AFP**: attach lifting support 2024A as shown.

- Position number **1** on 2024A bracket should be at pulley end.
- Attach at pulley end: fourth (**4th**) hole in hook, position one (**1**) in bracket.
- Attach at flywheel end: fourth (**4th**) hole in hook, position eight (**8**) in bracket.

WARNING —
The hooks and locating pins must be secured with locking clips!

Engine code **BDF**: attach lifting support 3033 as shown.

- Position number **1** on 2024A bracket should be at pulley end.
- Attach at pulley end: three (**3**).
- Attach at flywheel end: eleven (**11**).

WARNING —
The hooks and locating pins must be secured with locking clips!

Continued for both engines

– Lift off of engine/transmission jack VAG 1383A with a workshop crane.

– Secure engine to bracket mounting 3269 or VW 540 and VW 540/1B and attach to engine stand VW 313 or equivalent.

NOTE —
It is usually necessary to remove intermediate plate and dowel sleeves before attaching engine to VW 540.

Engine/transmission assembly, installing

WARNING —

• When working in the engine compartment, due to the cramped, tight conditions, pay attention to the following points

• Route all lines (e.g. for fuel, hydraulics, EVAP system, coolant, refrigerant, brake fluid and vacuum, etc.) as well as electrical wiring so that the original positions are maintained. Ensure sufficient clearance to all moving or hot components.

• Make sure there is sufficient clearance to all moving or hot components.

• Be sure to replace all tie wraps cut during removal and install new ones to prevent lines and wiring harnesses from chaffing or contacting engine parts.

– Install dowel sleeves for centering engine/transmission are in cylinder block, see **Tightening torques** for location.

– Before mating engine and transmission, observe the appropriate points depending on transmission type.

Vehicles with manual transmission

– Check centering of clutch drive plate as required.

– Check clutch release bearing and guide sleeve for wear.

– Lightly lubricate clutch release bearing, release bearing guide sleeve and splines on input shaft with G 000 100.

– Bolt engine and transmission together.

Vehicles with automatic transmission

– Remove any locking device used to secure torque converter to transmission.

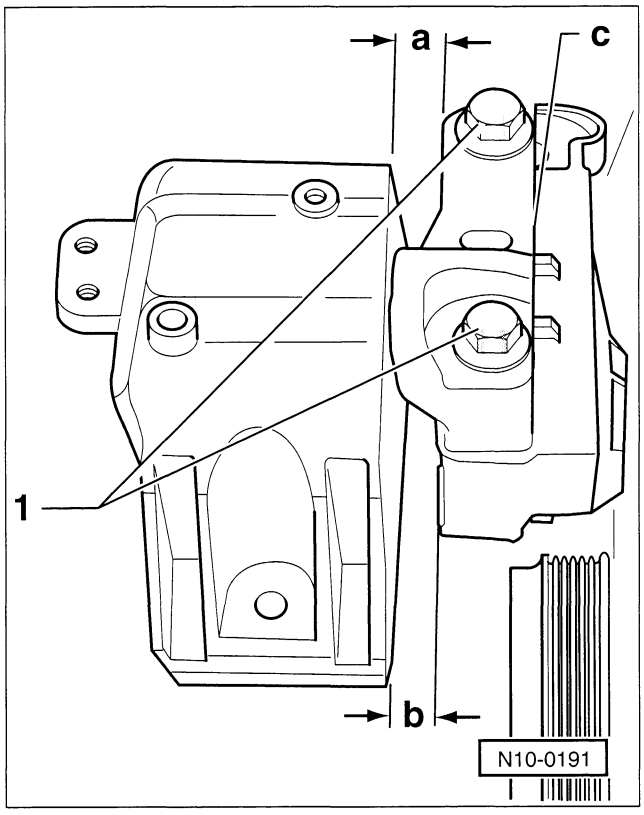
– Ensure proper seating of torque converter on transmission shafts.

– Bolt engine and transmission together.

– Bolt torque converter to drive plate with only approved/specified nuts.

Continued for all vehicles

Engine installation is generally carried out in the reverse of removal. Some steps and procedures may vary slightly due to individual equipment versions.



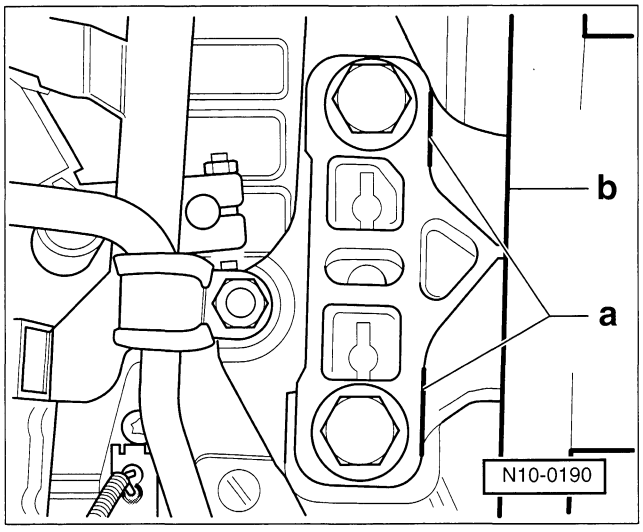
– With engine/transmission assembly on same devices as was used for removal, carefully raise assembly up and into position from below. Ensure sufficient clearance between engine/transmission assembly and the radiator and the mountings.

- Ensure sufficient clearance for installation of left side drive axle.
- Ensure sufficient clearance for installation of A/C compressor and lines.

➤ When engine/transmission assembly is in position, align engine mount as shown.

Gap **a** = 14.0 mm (0.55 in)
Gap **b** = at least 10.0 mm (0.40 in)
Both bolt head shoulders (**1**) must line up flush with edge (**c**).

> ***WARNING —***
> *Do not loosen engine mounting bolts if weight of engine is not fully supported by hoist, lift or support bridge.*



➤ Align transmission mount edges parallel to each other.

- Ensure that edges **a** of left side transmission mount are parallel to **b**.

– Install engine, transmission and pendulum mounts with new bolts where indicated and torque to specification, see **Engine and Transmission Mounts**.

Vehicles with manual transmission

– Install hydraulic clutch slave cylinder and attach hydraulic line if removed. Bleed slave cylinder as required. See **30 Clutch**.

– Install and adjust gear selector mechanism and adjust as required, see **34 Manual Transmission**.

Vehicles with automatic transmission

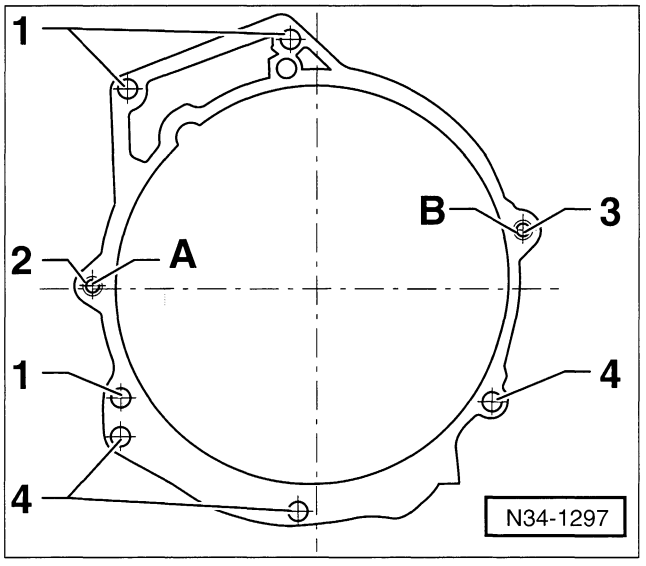
– Install and adjust gear selector cable and replace lock washer on selector cable mount. See **37 Automatic Transmission**.

Continued for all vehicles

– Install and connect drive both axles, see **40 Front Suspension and Drive Axles**.

– Install right side inner CV joint protective cover from engine if equipped.

- Install front exhaust pipe, see **26 Exhaust System/Emission Controls**.
- Install generator (alternator) and mounting bracket if previously removed.
- Install Secondary Air Injection pump motor bracket from oil pan and cylinder block if removed.
- Install power steering pump and lines, see **48 Steering**.
- Install intake manifold or upper section as required, see **15d Cylinder Head and Valvetrain**.
- Note running direction and install ribbed V-belt, see **0 Maintenance**.
- Insure that all vacuum, fuel, intake and coolant hoses are properly connected.
- Connect coolant hoses at radiator or engine using spring-type pliers or "quick-disconnect" couplings where applicable.
- Refill cooling system with appropriate ratio of distilled water and G12 coolant and check for leaks. See **19 Engine – Cooling System**.
- If lock carrier was moved to the service position, return it to normal position and install front bumper.
- Install air cleaner assembly, connecting hoses and ducts.
- Install battery and hold-downs.
- Connect battery cables.
- Ensure that engine oil and all fluids are at correct levels.
- Ensure that all removed tie wraps are replaced, and that all electrical wiring and hoses are properly routed and secured.
- Start engine and let it idle. Inspect for oil and coolant leaks. Check for smooth operation of shifter and clutch as required. Road test as required.
- Perform procedure following interruption of voltage supply, see **27 Engine Electrical**
- Adapt Transmission Control Module (TCM) to Basic Settings, see **37 Automatic Transmission**.
- Shut off engine and install lower sound absorber panel (belly pan) and upper engine cover.
- If DTC (Diagnostic Trouble Code) memory has been erased or engine control module separated from permanent positive supply, readiness code must be generated



– Check and/or adjust headlight aim as required.

Tightening torques

Transmission-to-engine bolt specifications and tightening torques are listed below.

Transmission to engine fasteners

Fastener	Size	Qty.	Tightening torque
1	M12 X 55	3	80 Nm (59 ft-lb)
2[1]	M12 X 150	2	80 Nm (59 ft-lb)
3[2]	M10 X 50	3	60 Nm (44 ft-lb)
4[3]	M7 X 12	2	10 Nm (7 ft-lb)
5[4]	M7 X 12	1	10 Nm (7 ft-lb)
A + B	Locating dowel sleeves	2	

1. Also starter to transmission. Except engine code BDF; starter to engine and transmission 45 Nm (33 ft-lb)
2. Only on engines with an aluminum oil pan
3. Large cover plate for flywheel, only on engines with sheet steel oil pan (painted black)
4. Small cover plate for flywheel

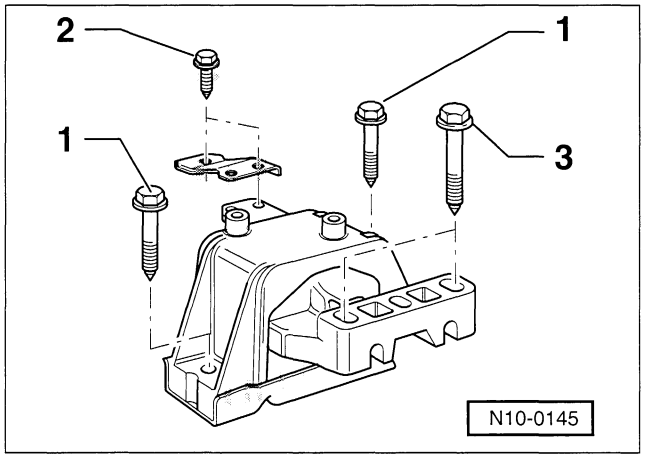
Additional tightening torque (2.8L 6-cylinder engines)

- Triple rotor/CV joint to transmission . 40 Nm (30 ft-lb)
- Torque converter to drive plate. . . . . 60 Nm (44 ft-lb)
- Bolts & nuts, not specifically listed

M6 . . . . . 10 Nm (7 ft-lb)
M7 . . . . . 15 Nm (11 ft-lb)
M8 (engine code AFP) . . . . . 20 Nm (15 ft-lb)
M8 (engine code BDF) . . . . . 25 Nm (18 ft-lb)
M10 (engine code AFP) . . . . . 40 Nm (30 ft-lb)
M10 (engine code AFP) . . . . . 45 Nm (33 ft-lb)
M12 . . . . . 60 Nm (44 ft-lb)

Engine/transmission, mounts

The engine/transmission assembly is suspended on its rotational axis by the engine mount on the right side and the transmission mount on the left side. Engine movement known as torque reaction is limited by the pendulum support mounted in the center underneath. Engine mounts differ slightly depending on transmission type (manual vs. automatic), but all are similar.



Engine mount, right side:

AFP engines:

1. Mount to body bolt
- 40 Nm (30 ft-lb) plus 90° (¼ turn)
- always replace

2. Mount bracket to body bolt
- 25 Nm (18 ft-lb)

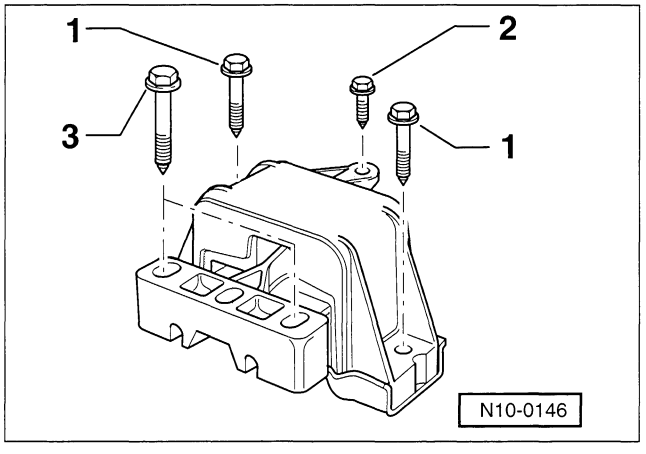
3. Mount to engine bracket bolt
- 60 Nm (44 ft-lb) plus 90° (¼ turn)
- always replace

BDF engines:

1. Mount to body bolt
- 40 Nm (30 ft-lb) plus 90° (¼ turn)
- always replace

2. Mount bracket to body bolt
- 20 Nm (15 ft-lb) plus 90° (¼ turn)
- always replace

3. Mount to engine bracket bolt
- 100Nm (74 ft-lb)



Transmission mount, left side

AFP engines:

1. Mount to body bolt
- 40 Nm (30 ft-lb) plus 90° (¼ turn)
- always replace

2. Mount bracket to body bolt
- 25 Nm (18 ft-lb)

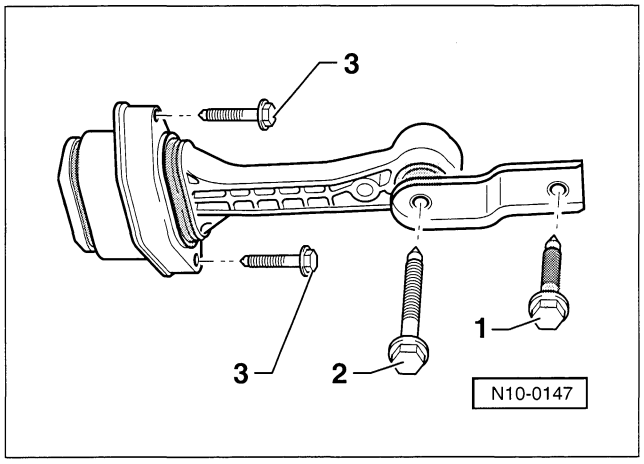
3. Mount to transmission bracket bolt
- 60 Nm (44 ft-lb) plus 90° (¼ turn)
- always replace

BDF engines:

1. Mount to body bolt
- 40 Nm (30 ft-lb) plus 90° (¼ turn)
- always replace

2. Mount bracket to body bolt
- 20 Nm (15 ft-lb) plus 90° (¼ turn)
- always replace

3. Mount to transmission bracket bolt
- 100 Nm (74 ft-lb)



Pendulum support, lower center

AFP engines:

1. **Pendulum support to transmission bolt**
   - 40 Nm (30 ft-lb) plus 90° (¼ turn)
   - always replace
2. **Pendulum support to transmission bracket bolt**
   - 40 Nm (30 ft-lb) plus 90° (¼ turn)
   - always replace
3. **Pendulum support to subframe bolt**
   - 20 Nm (15 ft-lb) plus 90° (¼ turn)
   - always replace

BDF engines:

1. **Pendulum support to transmission bolt**
   - 50 Nm (37 ft-lb)
2. **Pendulum support to transmission bracket bolt**
   - 50 Nm (37 ft-lb)
3. **Pendulum support to subframe bolt**
   - 25 Nm (18 ft-lb)

QUALITY REVIEW

When you have finished working under the hood and around other areas of the vehicle it is advisable to take a moment to quality check or review your work. This helps to ensure that the operation or repair has been completed properly with all affected systems functioning within normal parameters. This may include the following:

- Make sure that the radiator fan cycles properly and that the coolant level and concentration are correct.
- Ensure that all cable ties and hose clamps that were removed as part of the repair are replaced.
- Check and adjust all other applicable fluid levels.
- Make sure that there are no fluid leaks.
- Make sure there are no air, vacuum or exhaust leaks.
- Make sure that all components involved in the repair are positioned correctly and function properly.
- Male sure all tools, shop cloths, fender covers, and protective tape are removed.
- Clean grease from painted surfaces and steering wheel.

In addition to the above noted points, the ECM and TCM will need to be checked and reset using the Volkswagen supplied VAG 1551 or 1552 scan tool, VAS 5051 or 5052 diagnostic computer, or equivalent scan tool or computer diagnostic program as mentioned at the start of this repair.

13a Crankshaft/Cylinder Block (4-Cylinder)

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GENERAL

This repair group provides the special reconditioning information necessary to repair the Volkswagen 4-cylinder short block. The information contained here is intended to be used as a reconditioning guide for the professional or experienced automotive technician. Most of the operations and specifications listed require precision measuring equipment.

Engine Codes

- AWD, AWW, AWP . . . 1.8L 4-cylinder turbo gasoline
- ALH . . . . . 1.9L 4-cylinder turbo diesel
- BEW . . . . . 1.9L 4-cylinder PD turbo diesel
- AEG, AVH, AZG, BBW, BEV . . . . . 2.0L 4-cylinder gasoline

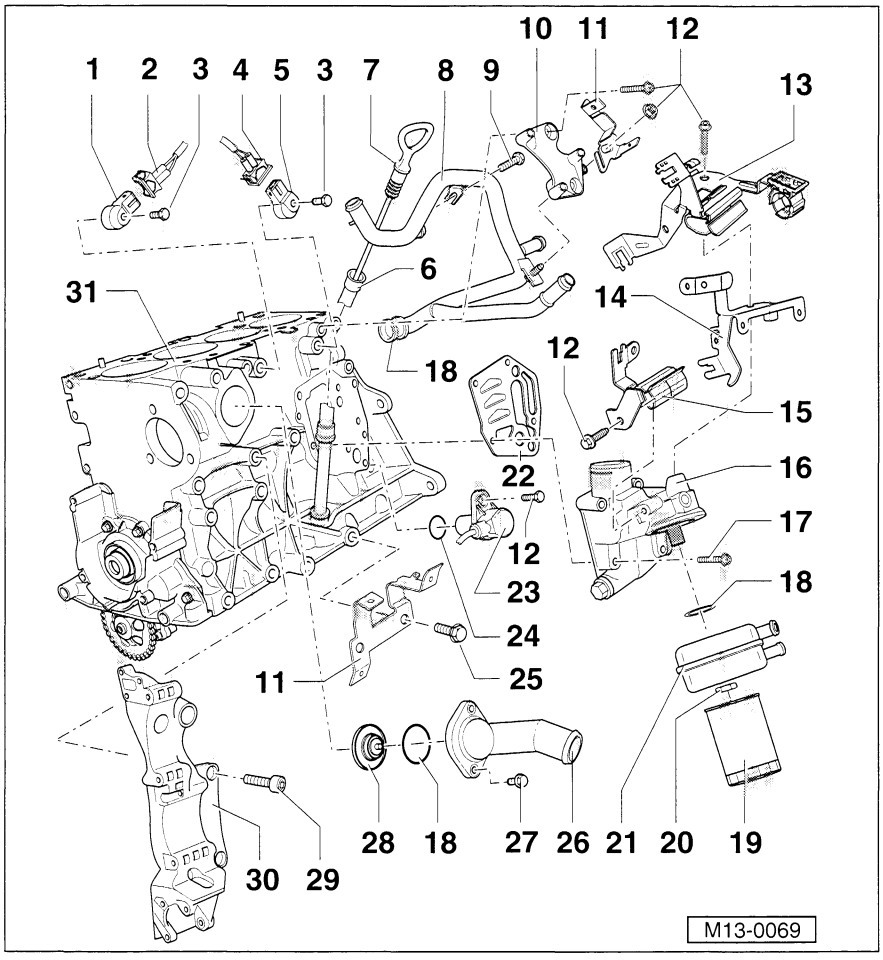
NOTE —

- *For 6-cylinder crankshaft and cylinder block, see* **13b Crankshaft/Cylinder Block (6-cylinder)**.
- *Volkswagen part numbers are given for reference only. Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.*

Cylinder block, (1.8L and 2.0L gas engines)

NOTE —

- *If during engine repairs, metal shavings or large quantities of small metal particles are found in the engine oil, the oil passages in the cylinder block must be thoroughly cleaned out and the oil cooler replaced.*
- *Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See* **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*

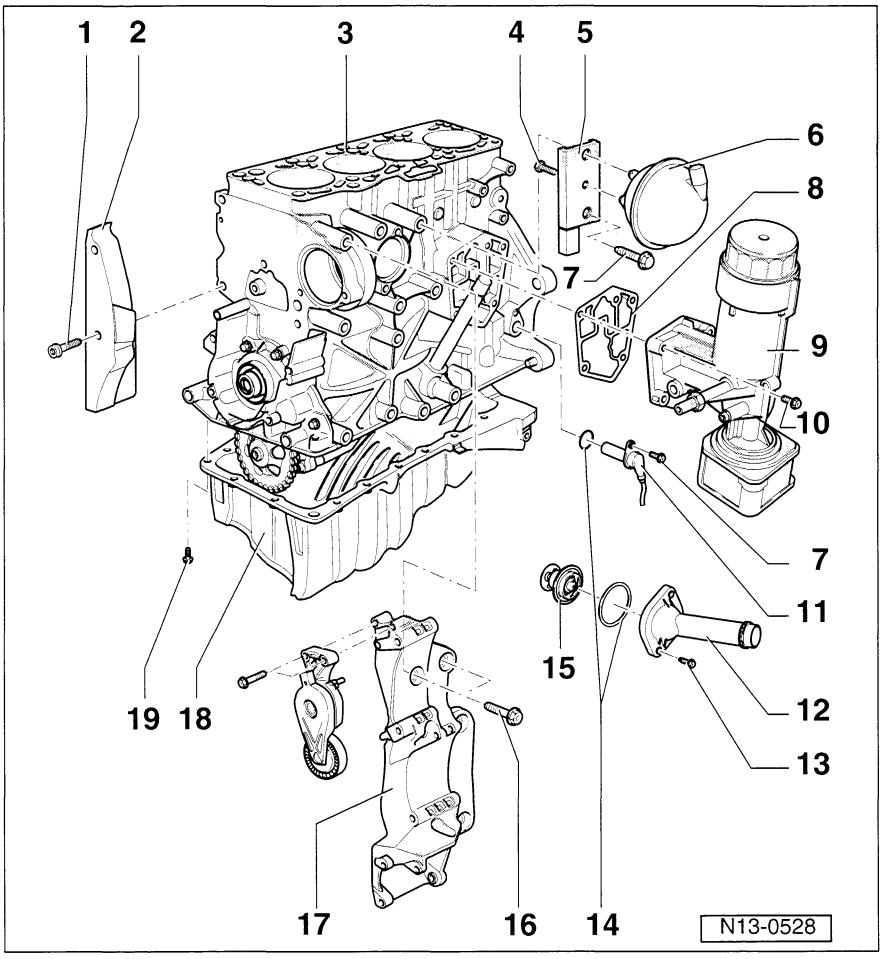


1. **Knock sensor 1 (G61)**
   - Gold plated contacts
2. **2-pin harness connector**
   - Gold plated contacts
   - For knock sensor 1 (G61)
3. **Bolt**
   - Tighten to 20 Nm (15 ft-lb)
   - Tightening torque influences knock sensor function
4. **2-pin harness connector**
   - Gold plated contacts
   - For knock sensor 2 (G66)
5. **Knock sensor 2 (G66)**
   - Gold plated contacts
6. **Oil dipstick tube**
7. **Dipstick**
   - Oil level must not be above MAX. mark
8. **Coolant pipe**
   - Coolant hose diagram, see **19 Engine–Cooling System**
   - Pipe configuration varies with engine application
9. **Bolt**
   - 2.0L shown, 1.8L similar
   - 1.8L: tighten to 20 Nm (15 ft-lb)
   - 2.0L: tighten to 25 Nm (18 ft-lb)
10. **Bracket**
    - For ignition coils (as applicable)
11. **Bracket** (as applicable)
12. **Bolts, nut**
    - Tighten to 10 Nm (7 ft-lb)
13. **Bracket** (as applicable)
14. **Bracket** (as applicable)
15. **Bracket** (as applicable)
16. **Oil filter bracket**
17. **Bolt**
    - Tighten to 15 Nm (11 ft-lb) + ¼ turn (90°)
    - Always replace
18. **O-ring seal**
    - Always replace
19. **Oil filter**
    - Loosen with strap wrench
    - Tighten by hand
    - Note instructions on filter when installing
20. **Nut**
    - Tighten to 25 Nm (18 ft-lb)
21. **Oil cooler**
    - Coat contact area to flange, outside the seal, with Volkswagen sealant (part # AMV 188 100 02)
    - Ensure sufficient clearance to adjacent components
22. **Seal**
    - Always replace
23. **Engine speed sensor (G28)**
24. **O-ring seal**
    - Always replace
25. **Bolt**
    - Tighten to 40 Nm (30 ft-lb)
26. **Coolant outlet connection**
27. **Bolt**
    - Tighten to 15 Nm (11 ft-lb)
28. **Coolant thermostat**
    - Heat-up in water to check
    - Opening starts approx. 86°C (187°F)
      Ends approx. 102°C (216°F)
    - Opening lift: 7 mm (0.28 in.) minimum
    - Note installed position; outer shaft support must be vertical
29. **Bolt, hex socket head**
    - Tighten to 45 Nm (33 ft-lb)
30. **Compact bracket**
    - For ribbed belt tensioning roller, generator, power steering pump, and A/C compressor
    - For removal and installation, see **87 Air Conditioning**
31. **Cylinder block**

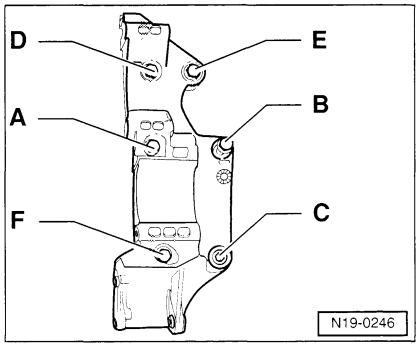
Cylinder block (1.9L PD diesel engines)

NOTE —

- *If during engine repairs, metal shavings or large quantities of small metal particles are found in the engine oil, the oil passages in the cylinder block must be thoroughly cleaned out and the oil cooler replaced.*
- *Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See* **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*



1. **Bolt, hex socket head**
   - Tighten to 45 Nm (33 ft-lb)
2. **Shield** (as applicable)
3. **Cylinder block**
4. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
5. **Bracket**
   - For vacuum reservoir
6. **Vacuum reservoir**
7. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
8. **Seal**
   - Always replace
9. **Oil filter bracket**
10. **Bolt**
    - Tighten to 15 Nm (11 ft-lb) + ¼ turn (90°)
    - Always replace
    - Observe installation sequence: left upper and then right lower, then remainder.
    - Observe tightening sequence: tighten diagonally
11. **Engine speed sensor (G28)**
12. **Coolant outlet connection**
13. **Bolt**
    - Tighten to 15 Nm (11 ft-lb)
14. **O-ring seal**
    - Always replace
15. **Coolant thermostat**
    - Heat-up in water to check
    - Opening starts approx. 85°C (185°F)
      Ends approx. 105°C (221°F)
    - Opening lift: 7 mm (0.28 in.) minimum
    - Note installed position; outer shaft support must be vertical
16. **Bolt, hex socket head**
    - Tighten to 45 Nm (33 ft-lb)



17. **Compact bracket**
    - Observe tightening sequence, see **Compact bracket to cylinder block, tightening sequence**
    - For ribbed belt tensioning roller, generator, power steering pump, and A/C compressor
18. **Oil pan**
    - Clean sealing surface before installing
    - Install with silicone sealant D 176 404 A2
    - See **17 Engine Lubrication System**
19. **Bolt**
    - Tighten to 15 Nm

Compact bracket to cylinder block, tightening sequence:

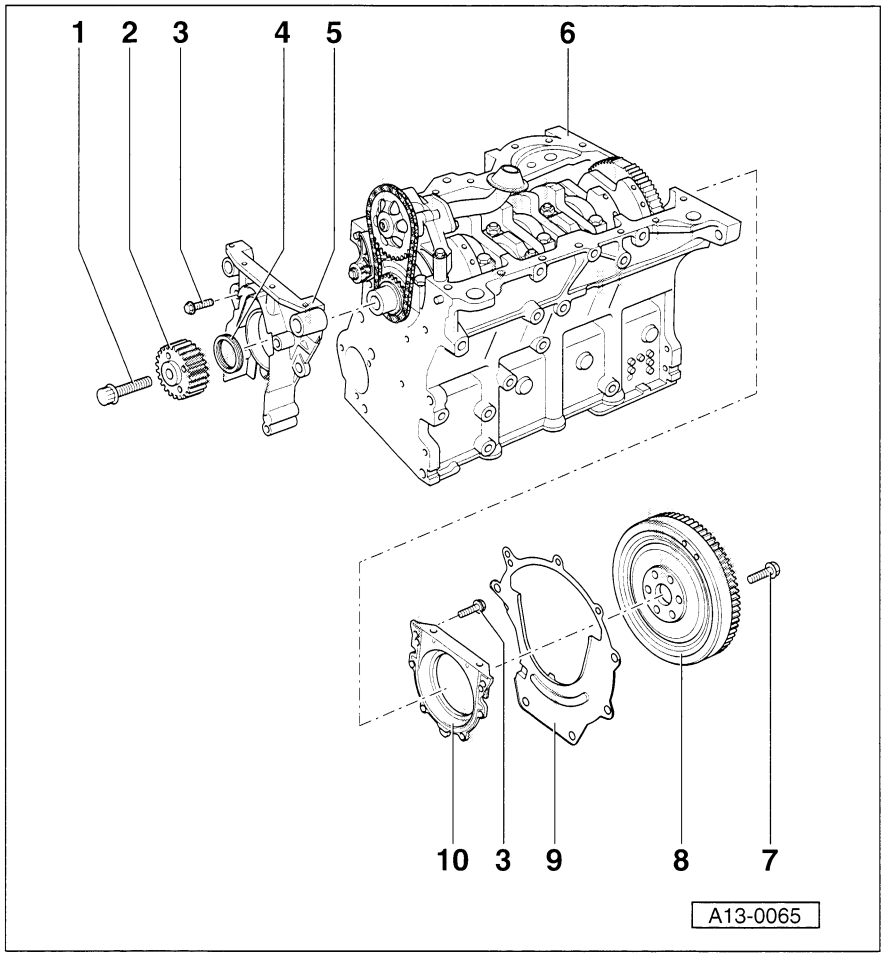
1 Tighten **A** to 45 Nm (33 ft-lb)
2 Tighten **B** to 45 Nm (33 ft-lb)
3 Tighten **C** to 45 Nm (33 ft-lb)
4 Tighten **D** to 45 Nm (33 ft-lb)
5 Tighten **E** to 45 Nm (33 ft-lb)
6 Tighten **F** to 45 Nm (33 ft-lb)

CYLINDER BLOCK OIL SEALS

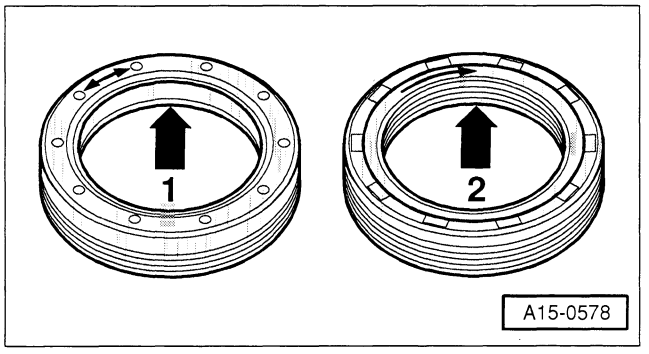
The front crankshaft oil seal can be replaced with the engine installed. Replacement of the rear crankshaft oil seal requires that the engine be separated from the transmission.

NOTE —
In some instances, individual seals may not be available separately. Be sure to install seals of correct construction. See an authorized Volkswagen parts dealer, or an aftermarket parts specialist, for the latest in parts information.

Cylinder block oil seals, assembly



1. **Bolt**
   - Always replace
   - All threads and shoulder contact surfaces must be clean and free from oil and grease. Do not oil threads
   - **2.0L** and **1.8L**:
     Tighten to:
     90 Nm (66 ft-lb) + ¼ turn (90°)
     counterhold with tool 3145
   - **1.9L** diesel:
     Tighten to:
     120 Nm (89 ft-lb) + ¼ turn (90°)
     counterhold with tool 3145
   - **1.9L PD** diesel:
     Tighten to:
     120 Nm (89 ft-lb) + ¼ turn (90°)
     counterhold with tool 3099
2. **Crankshaft toothed belt drive sprocket**
   - Sprocket is specific to individual engine type
3. **Bolt**
   - Tighten to 15 Nm (11 ft-lb)
4. **Front crankshaft oil seal**
   - If original seal is constructed of PTFE (Teflon ®), only replace with new seal of same material. Install this type of seal dry. Do not oil or grease sealing lips.
   - If original seal is spring-type, either spring-type or PTFE-type seal can be used. Lightly lubricate sealing lip of spring-type seal before installing.
   - See **Oil seal type identification**
5. **Front oil seal flange**
   - Located by dowel pins/sleeves
   - Clean sealing surfaces before installing
   - Install with silicone sealant D 176 404 A2
   - To remove, remove oil pan. See **17 Engine Lubrication System**
6. **Engine block**
7. **Bolt**
   - Tighten to 60 Nm (44 ft-lb) + ¼ turn (90°)
   - Always replace
8. **Flywheel/driveplate**
   - Flywheel: remove and install with 3067 counterholder
9. **Intermediate plate**
   - Located by dowel pins/sleeves
   - Do not damage or bend when assembling
10. **Rear oil seal flange**
    - May need to replace as complete unit (integral with new oil seal)
    - Original seal is constructed of PTFE (Teflon ®), only replace with new seal of same material. Install this type of seal dry. Do not oil or grease sealing lips.
    - See **Oil seal type identification**
    - Whether replacing seal or flange, only install PTFE seals
    - Install new sealing flange with guide sleeve
    - Guide sleeve protects seal during installation
    - Clean sealing surfaces before installing
    - Install with silicone sealant D 176 404 A2



Oil seal type identification

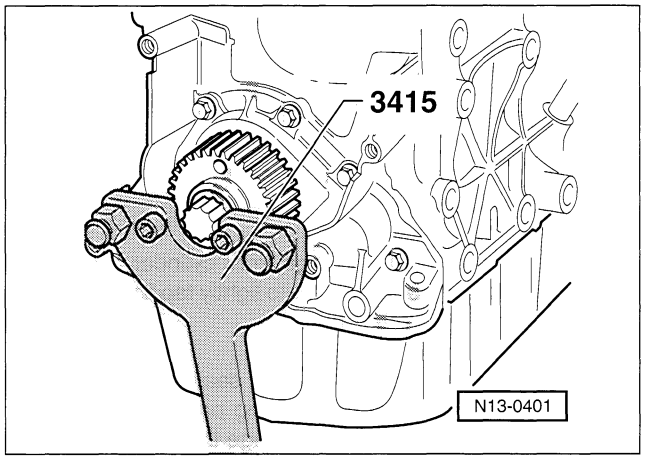
An oil seal constructed of PTFE (Teflon ®) was phased-in gradually during production of some engine types. PTFE oil seals replace the older spring-type seals, but spring-type seals should never be used in place of the PTFE type.

- PTFE (Teflon ®) seals (**right**) can be identified by the wider sealing lip (**arrow 2**). These seals are installed without lubricant of any kind on the seal.
- Spring-type seals (**left**) can be identified by the narrower sealing lip (**arrow 1**) and a tensioning spring behind the lip seal.

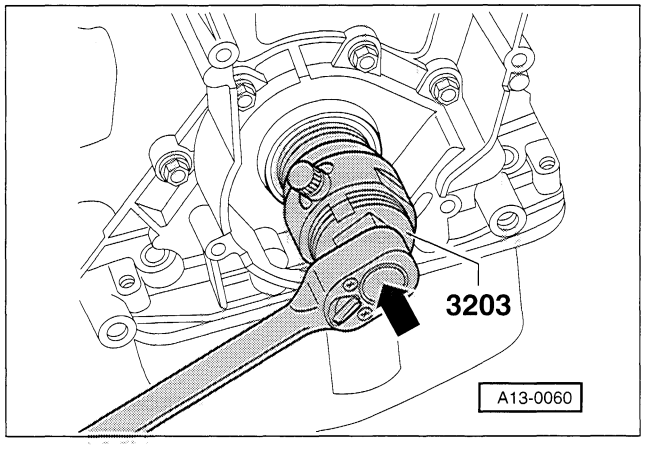
Front crankshaft oil seal, replacing

– Remove ribbed V-belt and tensioner, see **0 Maintenance**.

– Remove camshaft drive belt, see **15 Cylinder Head and Valvetrain**.



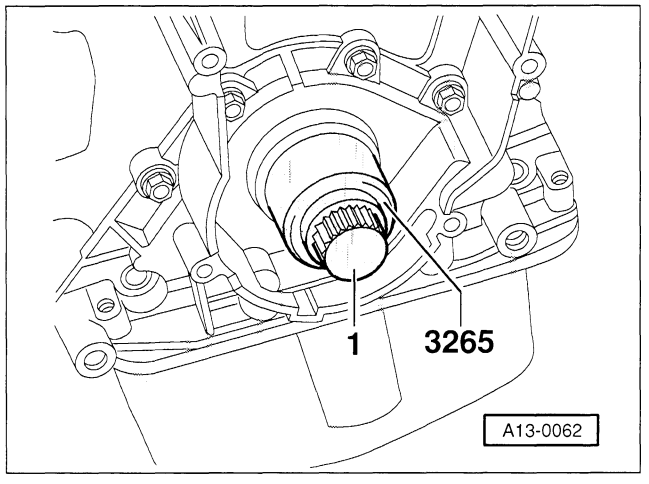
Hold the crankshaft stationary with a suitable counterholder (**3415** shown) and loosen the crankshaft sprocket (hub) center bolt. Remove the bolt and sprocket.



Reinstall removed bolt into crankshaft to prevent damage to end of the crankshaft when using seal extractor. Remove the oil seal from the flange using an appropriate seal extractor (**3203** shown) or by carefully prying it out. Remove bolt from crankshaft.

– Install new seal, with closed side facing out. Use a guide sleeve to protect seal from sharp edges of the crankshaft as necessary. PTFE (Teflon ®) seals require the following:

- For 1.8L,1.9L PD, and 2.0L engines, press in with special tools T10053 and T10053/2. Use guide sleeve T10053/1.
- For 1.9L non-PD engines, press in with special tool 3265. Use guide sleeve 2080A.
- If using spring-type seals on a 2.0L engine, press in with special tool 3265. Use guide sleeve 2080A.



Use appropriate seal installation tool and original crankshaft sprocket bolt (**1**) to carefully press seal into place until it is fully seated.

– Align locating key on sprocket with cutout on the end of crankshaft and install sprocket onto the crankshaft with a new bolt. Hold the crankshaft with the counterholder and torque to specification.

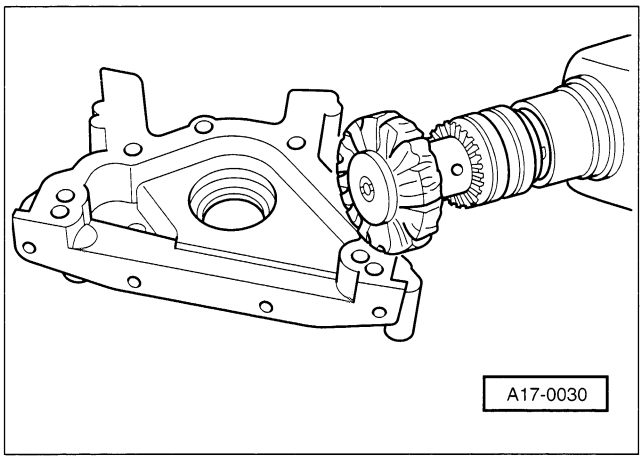
– Install remaining removed components.

CAUTION —
Always replace the crankshaft sprocket bolt. It is a stretch bolt designed to be used only once.

Tightening torques

- Crankshaft sprocket bolt, 4-cylinder gasoline engine (stretch bolt - always replace)
  stage I . . . . . 90 Nm (66 ft-lb)
  stage II . . . . . additional ¼ turn (90°)
- Crankshaft sprocket bolt, 4-cylinder diesel engine (stretch bolt - always replace)
  stage I . . . . . 120 Nm (89 ft-lb)
  stage II . . . . . additional ¼ turn (90°)

Front oil seal flange, removing and installing



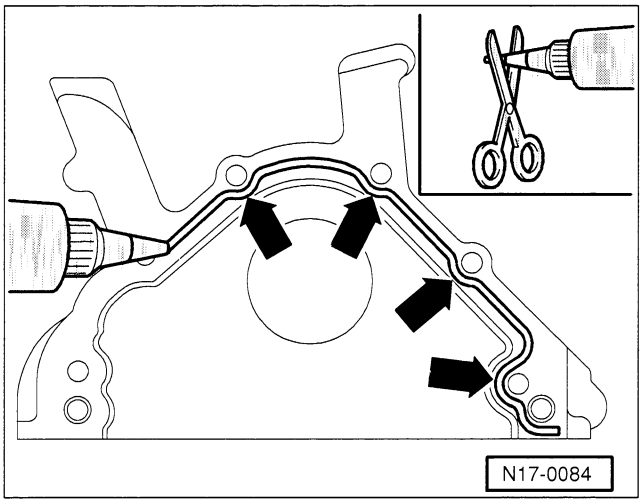
– Remove crankshaft drive sprocket as described earlier.

– Drain engine oil and remove oil pan. See **17 Engine–Lubrication System**.

– Unbolt front oil seal flange from cylinder block and remove. It may be necessary to lightly tap flange with a soft faced mallet to remove it.

➤ Thoroughly remove all the old sealant residue from the oil seal flange using a cleaning pad attached to a drill. Use care not to scratch or gouge the aluminum housing.

NOTE —
The front oil seal flange does not use a paper gasket. Special silicone sealant is used instead. Surface must be clean and free from oil and grease before sealant is applied.



➤ Cut tube nozzle at forward marking to give an opening size of approximately 3 mm. Apply a 2 to 3 mm (slightly less than $^1/_8$ inch) bead of new sealant (**arrows**) to oil seal flange.

– Front flange is shown; sealant is applied to the rear seal flange in a similar manner.

NOTE —
- *Observe the "use buy" date on sealant tube.*
- *Cover the sealing surface of the oil seal with a clean cloth before applying the sealant.*
- *Flange must be installed within 5 minutes of applying sealant.*

CAUTION —
The sealing compound bead thickness must not be wider than 3 mm (slightly less than 1/8 inch). If this width is exceeded, excess sealing compound will enter the oil pan and could block the oil pump pick-up tube strainer.

– Use the appropriate guide sleeve to protect the oil seal and install the flange on the guide pins of the cylinder block. Torque the bolts in a staggered pattern.

– Install the oil pan.

– Install remaining removed components.

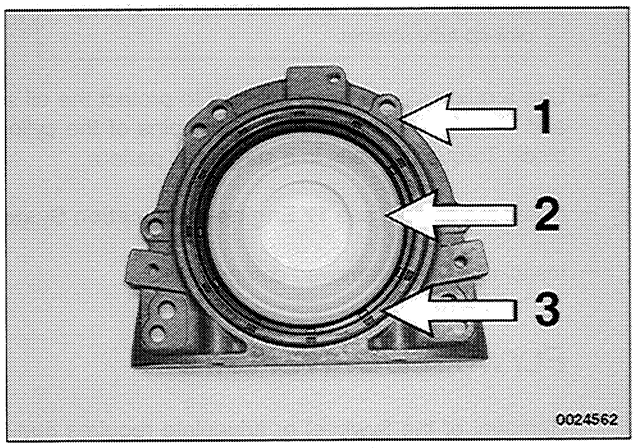
Tightening torques

- Front or rear flange to cylinder block (M7)15 Nm (11 ft-lb)
- Oil pan to cylinder block (M7). . . . . 15 Nm (11 ft-lb)
- Oil pan to transmission (M10) . . . . . 45 Nm (33 ft-lb)

Rear crankshaft oil seal, replacing

NOTE —

The rear crankshaft oil seal may not be available separately from the rear seal flange. See an authorized Volkswagen parts dealer, or an aftermarket parts specialist for the latest parts information.



➤ Crankshaft seal assembly available from authorized Volkswagen Dealers in the USA and Canada.

1 - Rear oil seal flange with pre-installed seal.
2 - Seal protector. No other seal protector required
3 - Rear crankshaft (rear main) seal.

– If engine is still in car, remove transmission as described in **34 Manual Transmission** or **37 Automatic Transmission**, as applicable.

– If engine and transmission are out of car, separate engine from transmission as described in **10 Engine–Removing and Installing**.

– Remove flywheel or driveplate as described later.

– Remove seal from flange by carefully prying it out.

– Install the new seal, lubricated with clean engine oil, with closed side facing out using a suitable seal installation tool.

– Install remaining removed components.

Rear oil seal flange, removing and installing

– If engine is still in car, remove transmission as described in **34 Manual Transmission** or **37 Automatic Transmission**, as applicable.

– If engine and transmission are out of car, separate engine from transmission as described in **10 Engine– Removing and Installing**.

– Remove flywheel or drive plate as described later.

– Drain engine oil and remove oil pan, see **17 Engine–Lubrication System**.

– Unbolt rear oil seal flange from cylinder block and remove. It may be necessary to lightly tap the flange with a soft faced mallet to remove it.

– The rear oil seal flange does not use a paper gasket. Special silicone sealant is used instead.
  • Apply a 2 to 3 mm (slightly less than $^1/_8$ inch) bead of new sealant to the flange as shown earlier.

NOTE —
• Observe the "use buy" date on sealant tube.
• Cover the sealing surface of the oil seal with a clean cloth before applying the sealant.
• Flange must be installed within 5 minutes of applying sealant.

CAUTION —
The sealing compound bead thickness must not be wider than 3 mm (slightly less than 1/8 inch). If this width is exceeded, excess sealing compound will enter the oil pan and could block the oil pump pick-up tube strainer.

– Use a guide sleeve as necessary to protect the oil seal and install the flange on the guide pins of the cylinder block. Torque the bolts in a staggered pattern.

– Install the oil pan, see **17 Engine–Lubrication System**.

– Install remaining removed components.

FLYWHEEL/DRIVEPLATE

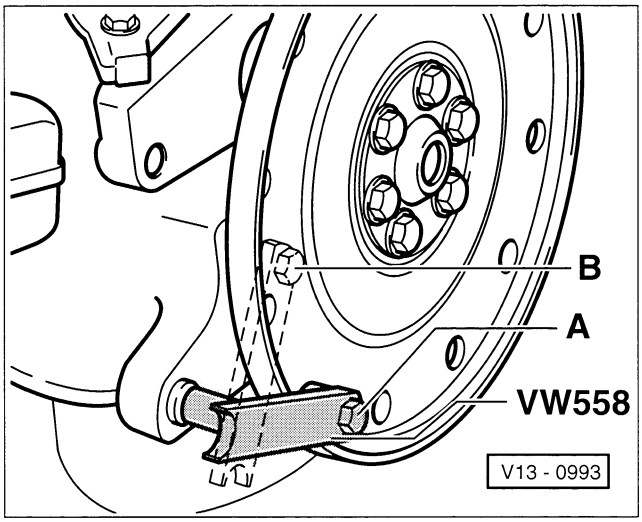
Removal of the flywheel or driveplate requires that the engine be separated from the transmission. Remove the clutch on manual transmission vehicles, see **30 Clutch**.

CAUTION —
• On vehicles with automatic transmissions, special mounting and measuring procedures are required when installing the driveplate.
• The flywheel on manual transmission vehicles and the driveplate on automatic transmission vehicles are mounted to the crankshaft using stretch bolts that are designed to be used only once. Always replace.

Flywheel/driveplate, removing and installing

Attach a suitable holder (**VW558** shown) to the engine and flywheel on manual transmission vehicles or the engine and driveplate on automatic transmission vehicles.
  • Position **A** is for loosening
  • Position **B** is for tightening

– Loosen securing bolts diagonally and remove flywheel or drive plate and any shims.

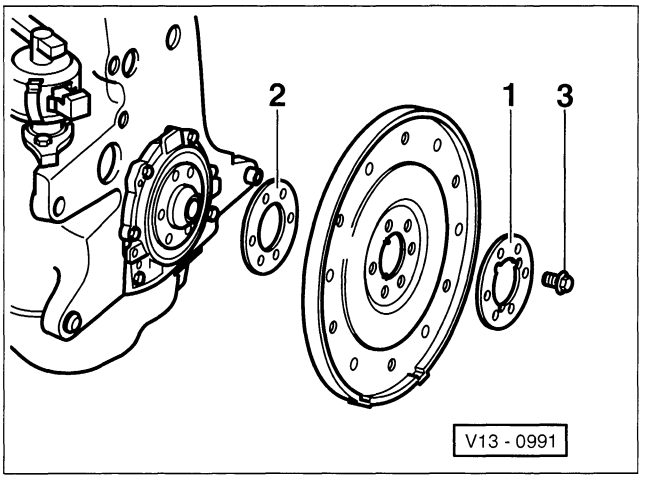


– Installation is the reverse of removal observing the following points:

- Install any removed shims and mount the flywheel or drive plate with new bolts.
- Check driveplate clearance (as applicable) as described later.
- Attach the holder and torque diagonally to specifications.

Tightening torques

- Flywheel or driveplate to crankshaft (stretch bolt, always replace)
  stage I . . . . . 30 Nm (22 ft-lb)
  stage II . . . . . 60 Nm (44 ft-lb)
  stage III . . . . . additional ¼ turn (90°)



Driveplate clearance, adjusting (cars with automatic transmission)

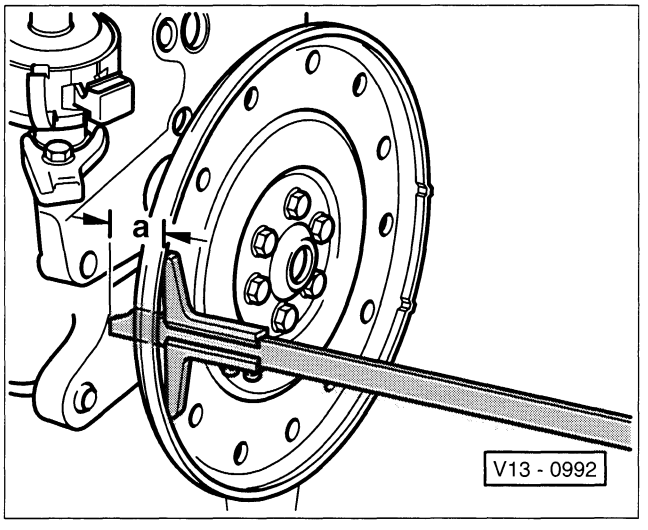
Component replacement or other circumstances may necessitate adjustment of the driveplate clearance. Incorrect clearance may result in premature starter wear.

➢ Install drive plate with new bolts and backing plate, but without shim(s) (**2**).

- Locking plate (**1**) is used only with automatic transmission driveplate.
- Shim(s) (**2**) may or may not be present.

Tightening Torque

- Driveplate checking torque. . . . . 30 Nm (22 ft-lb)



➢ Measure distance from machined surface on cylinder block to outer edge of driveplate with a measuring tool at three points. Measuring tool must fit through hole in driveplate.

– Average the three readings to get **dimension a**.

Specification

- Cylinder block to outer edge of driveplate (automatic transmission only), **dimension a** . . 19.5 mm – 21.1mm (0.77 – 0.83 in.)

– If specification is not obtained, remove driveplate add shim(s) and recheck.

– When specification is obtained, attach holding fixture and torque to final specification.

Tightening torques

- Flywheel or driveplate to crankshaft (stretch bolt, always replace)
  stage I . . . . . 30 Nm (22 ft-lb)
  stage II . . . . . 60 Nm (44 ft-lb)
  stage III . . . . . additional ¼ turn (90°)

CYLINDER BLOCK INTERNAL COMPONENTS

During engine block disassembly, be sure to mark the position and orientation of all parts as they are removed. This includes connecting rods, rod bearings and caps, piston pins, pistons, main bearings and caps. This ensures that re-used parts are put back in to service in the location where they have been "run-in". Certain cylinder block components such as connecting rod caps and main bearing caps are matched to another part during manufacture and will not fit properly to any other part. Knowing which components came from which location can also be a used to diagnose internal engine problems.

To minimize wear during initial engine start-up, clean engine oil should be used to lubricate all friction surfaces during assembly.

Pistons and Connecting Rods

Pistons, piston pins, piston rings, connecting rods, and bearings should never be interchanged if they are to be reused. Mark cylinder number and installation orientation on pistons, connecting rods and connecting rod bearing caps before removal.

Components of one piston and connecting rod assembly are shown on the following page. Pistons for ALH engines are not all the same. Valve relief pockets machined into the piston crown for cylinders 1 and 2 are the same. Pockets in cylinders 3 and 4 are also the same, but are different from cylinders 1 and 2.

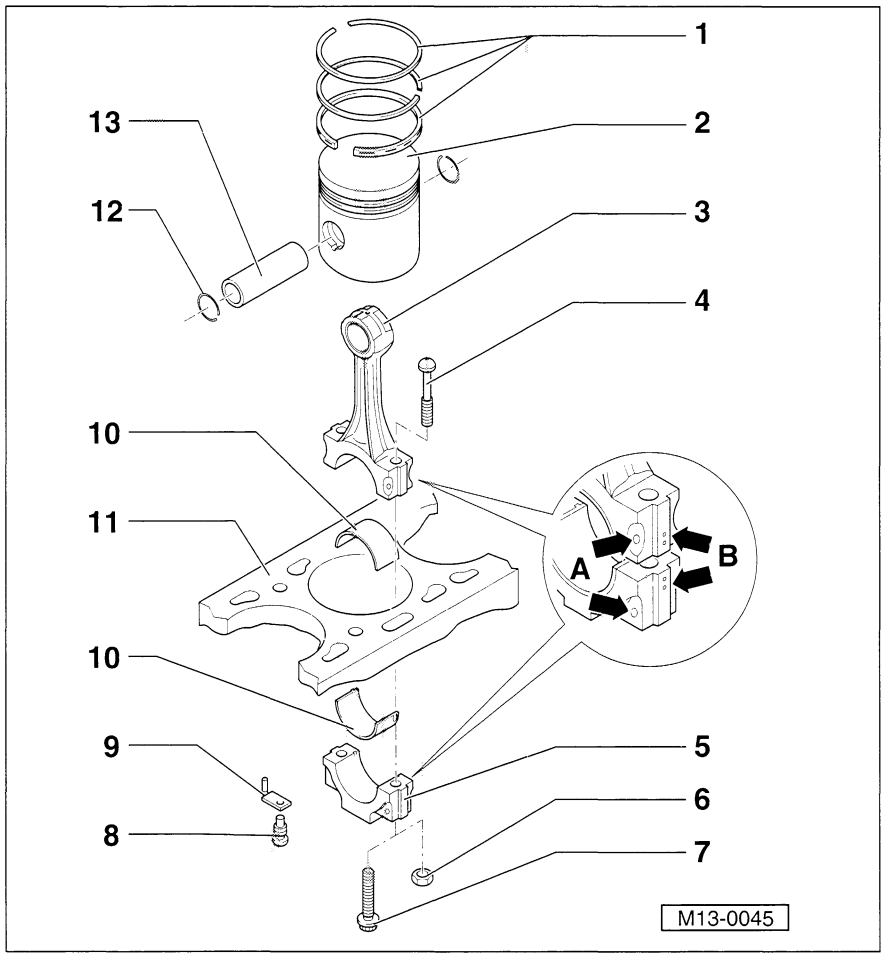
The piston pin should require only a slight push to remove or install. If difficult, heat the piston to approximately 60°C (160°F). Replace the piston and the pin if fit is excessively loose.

Inspect the connecting rod for any bending, distortion, heat damage or other visual damage. Connecting rod specifications are listed in **Table a**. Connecting rods should always be replaced in complete sets due to weight and dimensional considerations.

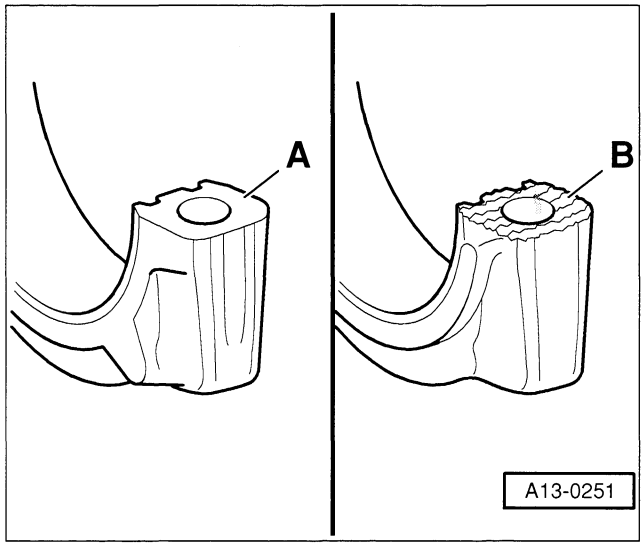
NOTE —

- *When checking radial clearance, reuse the old bolt or nut, and lubricate the contact surface of the nut or bolt before tightening. Tighten the nut or bolt only to the 30 Nm (22 ft-lb) specification and not the additional ¼ turn.*
- *If connecting rod radial clearance is excessive, the crankshaft connecting rod journals should be checked. If crankshaft journal diameters are within specifications, recheck radial clearance using new bearing shells.*

Piston and connecting rod, assembly



1. **Piston rings**
   - Offset gaps by 120°
   - "TOP" or "OBEN" faces piston crown
   - 2 or 3 piece oil control ring
   - Check gap and ring groove clearance, see **Piston Rings**
2. **Piston**
   - Mark installation position and cylinder number
   - Arrow on crown points to pulley
   - Install using piston ring clamp
   - Diesel engines: replace piston if skirt is cracked
   - Diesel engines use left and right (front and rear) pistons, see **Piston Orientation (diesel engine)**
3. **Connecting rod**
   - Only replace as a set
   - Mark cylinder number (**B**)
   - Installation position: mark (**A**) faces toward pulley end
   - Some engines use "industrially cracked" technology. See **Connecting rod identification characteristics**
   - ALH diesels use locating dowel in connecting rod, ensure that it is not in the connecting rod bearing cap.
4. **Connecting rod bolt**
   - Configuration depends on engine type and version. See items **6** and **7**
   - 1.8L in this configuration, always replace
5. **Connecting rod bearing cap**
   - Note installation position
6. **Connecting rod nut**
   - Gas engine configuration
   - Always replace
   - Tighten to 30 Nm (22 ft-lb) + ¼ turn (90°)
   - Oil threads and contact surfaces prior to installation
   - To measure radial clearance tighten to 30 Nm (22 ft-lb), but no further
7. **Connecting rod bolt**
   - Gas and diesel engine configuration
   - Always replace
   - "Industrially cracked" connecting rods use Torx E10 bolts
   - Tightening torque: 30 Nm + ¼ turn (90°)
   - Oil threads and contact surfaces prior to installation
   - To measure radial clearance, use old bolts and tighten to 30 Nm (22 ft-lb), but no further
8. **Oil spray jet securing bolt**
   - On 1.8L engine, integral with pressure control valve. Tighten to 27 Nm (20 ft-lb) Opening pressure: 1.3 to 1.6 bar (19 to 23 psi)
   - On 1.9L engines, tighten to 25 Nm (18 ft-lb) Do not use sealant
9. **Oil spray jet**
   - 1.8L and 1.9L engines only
   - For piston cooling
10. **Bearing shells**
    - Note installation position
    - See **Bearing shell installation position**
    - Do not interchange used bearing shells
    - Ensure retaining lugs fit tightly in recesses
    - Do not rotate crankshaft when checking radial clearance
    - Diesel engines use special material in upper bearing shell (connecting rod side) identified by black line on running surface near joint.
11. **Engine block**
12. **Circlip**
13. **Piston pin**
    - If difficult to remove, heat piston to 60°C (140°F)
    - Remove and install with VW 222a

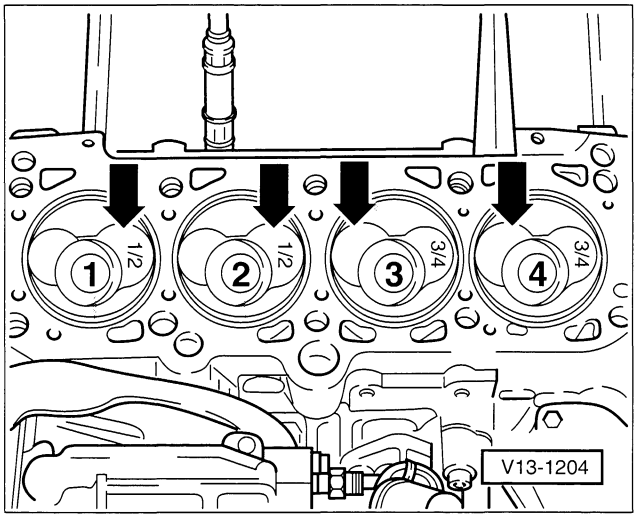


Connecting rod identification characteristics

Introduction of industrially cracked connecting rods is being gradually phased into production for some engine types due to stronger joint. Identification characteristics are:

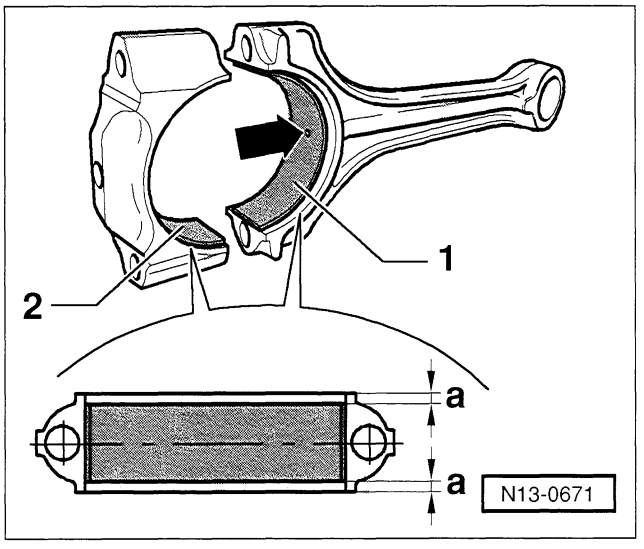
A - Conventional connecting rods (polished/machined parting/joining surfaces).

B - Industrially cracked connecting rods (rough parting/joining surfaces, no machining).



Piston orientation (diesel engines)

- Intake valve relief pocket is larger and points to flywheel for cylinders **1** and **2**.
- Larger valve relief pocket points to belt pulley side for cylinders **3** and **4**.
- Pistons are factory marked for proper location.

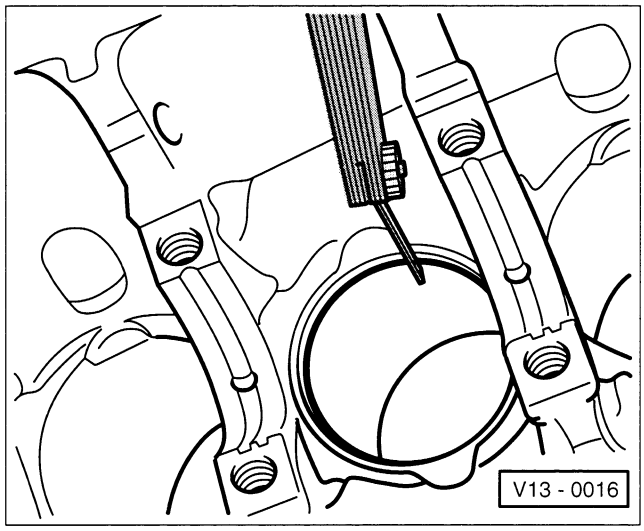


Bearing shells, installation position (as applicable)

- Bearing shell (**1**) for connecting rod (with hole **arrow** for oil channel).
- Bearing shell (**2**) for bearing cap (without hole for oil channel).
- Insert bearing shell centered in connecting rod and bearing cap.
- Dimension (**a**) must be the same on left and right. Max. deviation: 0.2 mm.

Table a. Connecting Rod Specifications

Radial clearance (Plastigage®)	
new	
2.0L, 1.9L	0.01–0.06 mm (0.0004–0.0024 in.)
1.8L, 2.0L ("cracked rod")	0.01–0.05 mm (0.0004–0.0020 in.)
wear limit	
2.0L	0.12 mm (0.0047 in.)
1.9L	0.08 mm (0.0031 in.)
1.8L, 2.0L (cracked rod)	0.09 mm (0.0035 in.)
Axial (side) clearance	
new	
2.0L, 1.9L	0.10–0.31 mm (0.0039–0.0122 in.)
2.0 ("cracked rod")	0.10-0.35 mm (0.0039–0.0138 in.)
1.8L	0.10–0.31 mm (0.0028–0.0122 in.)
wear limit	
2.0L, 1.9L,	0.37 mm (0.0145 in.)
1.8L, 2.0L (cracked rod)	0.40 mm (0.0157 in.)
Checking torque	30 Nm (22 ft-lb)
Assembly torque	30 Nm (22 ft-lb) plus ¼ turn (90°)

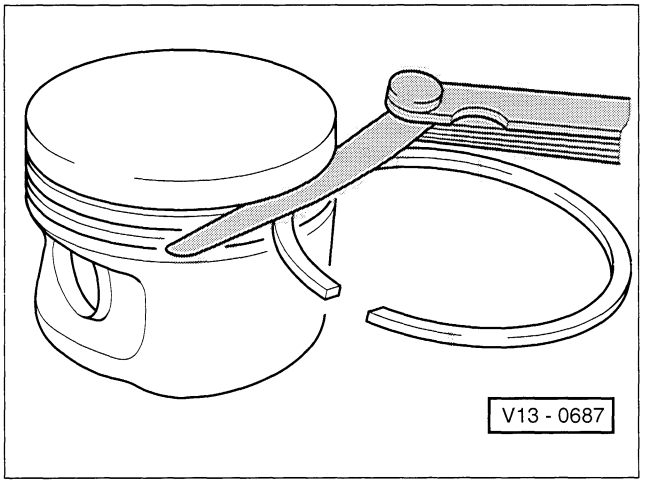


Piston Rings and Piston

Use a feeler gauge to check piston ring end gaps. Pistons are checked with the piston rings inserted evenly approximately 15 mm (5/8 in.) from the bottom of the cylinder. This is because wear in this area of the cylinder is negligible. **Table b** lists piston ring end gap specifications.

Table b. Piston Ring End Gaps

	New	Wear limit
Top compression ring		
2.0L engines	0.20–0.40 mm (.0079–.0157 in.)	0.8 mm (.0315 in.)
1.9L diesel engines	0.20–0.40 mm (.0079–.0157 in.)	1.0 mm (.0394 in.)
1.8L engine (AWD)	0.15–0.40 mm (.0059–.0157 in.)	0.8 mm (.0315 in.)
1.8L engines (AWW, AWP)	0.20–0.40 mm (.0079–.0157 in.)	0.8 mm (.0315 in.)
Bottom compression ring		
2.0L engines	0.20–0.40 mm (.0079–.0157 in.)	0.8 mm (.0315 in.)
1.9L diesel engines	0.20–0.40 mm (.0079–.0157 in.)	1.0 mm (.0394 in.)
1.8L engine (AWD)	0.15–0.40 mm (.0059–.0157 in.)	0.8 mm (.0315 in.)
1.8L engines (AWW, AWP)	0.20–0.40 mm (.0079–.0157 in.)	0.8 mm (.0315 in.)
Oil scraper ring		
2.0L engines	0.25–0.50 mm (.0098–.0197 in.)	0.8 mm (.0315 in.)
1.9L diesel engines	0.25–0.50 mm (.0098–.0197 in.)	1.0 mm (.0394 in.)
1.8L engine (AWD)	0.25–0.50 mm (.0098–.0197 in.)	1.0 mm (.0394 in.)
1.8L engines (AWW, AWP)	0.25–0.50 mm (.0098–.0197 in.)	0.8 mm (.0315 in.)

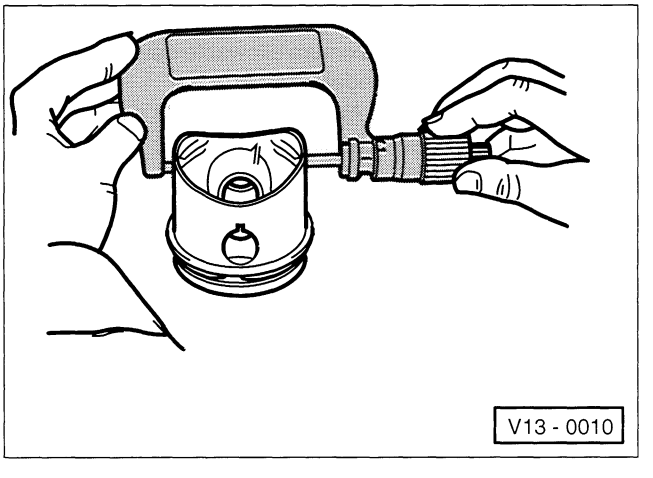


Piston ring side clearance (ring to groove clearance) is checked using feeler gauges. Measure each ring in its original groove. Piston ring side clearance specifications are listed in **Table c**.

NOTE —
Piston ring groove should be thoroughly cleaned before checking ring side clearance.

Table c. Piston Ring Side Clearances

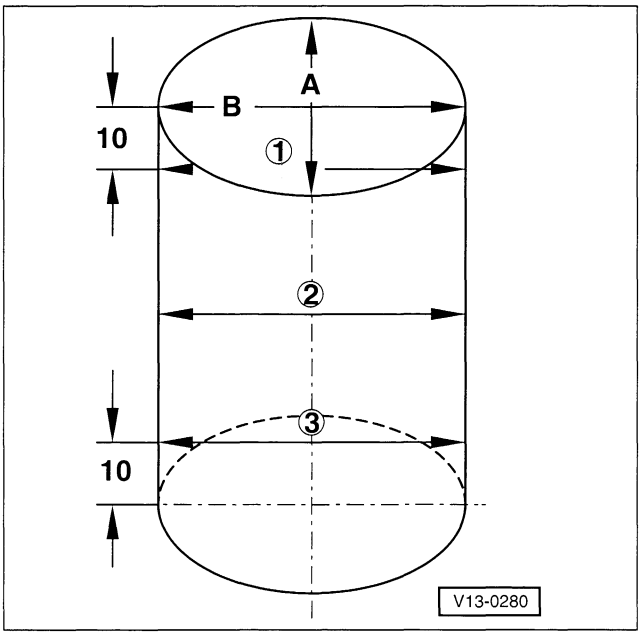
	New	Wear limit
Top compression ring		
2.0L engines	0.06–0.09 mm (.0024–.0035 in.)	0.20 mm (.0079 in.)
1.9L diesel engines	0.06–0.09 mm (.0024–.0035 in.)	0.25 mm (.0098 in.)
1.8L engines (AWD)	0.02–0.07 mm (.0008–.0027 in.)	0.12 mm .0047 in.)
1.8L engines (AWP, AWW)	0.06–0.09 mm (.0024–.0035 in.)	0.20 mm (.0079 in.)
Bottom compression ring		
2.0L engines	0.06–0.09 mm (.0024–.0035 in.)	0.20 mm (.0079 in.)
1.9L diesel engines	0.05–0.08 mm (.0020–.0031 in.)	0.25 mm (.0098 in.)
1.8L engines (AWD)	0.02–0.07 mm (.0008–.0027 in.)	0.12 mm (.0047 in.)
1.8L engines (AWP, AWW)	0.06–0.09 mm (.0024–.0035 in.)	0.20 mm (.0079 in.)
Oil scraper ring		
2.0L engines	0.03–0.06 mm (.0012–.0024 in.)	0.15 mm (.0059 in.)
1.9L diesel engines	0.03–0.06 mm (.0012–.0024 in.)	0.15 mm (.0059 in.)
1.8L engines	0.02–0.06 mm (.0008–.0024 in.)	0.12 mm (.0047 in.)
1.8L engines (AWP, AWW)	0.03–0.06 mm (.0012–.0024 in.)	0.15 mm (.0059 in.)



Measure piston diameter approximately 10 mm (0.394 in.) from bottom of skirt at right angle (90°) to piston pin. If piston is graphite coated, (dark gray color) allow up to 0.02 mm (0.0008 in.) additional, as the graphite coating will wear away.

Specification

- Piston wear–maximum allowable deviation from nominal dimension. . . . . 0.04 mm (.0016 in.)



Cylinder bore dimensions

Measure cylinder bores at three places (**1**, **2**, **3**); approximately at the top, the middle and the bottom. The top and bottom measurements should be made approximately **10** mm (3/8 in.) from the ends of the cylinder. Measure cylinder bore in directions both perpendicular to the crankshaft (**A**) and parallel to crankshaft (**B**).

> ***CAUTION —***
> *Mounting the bare cylinder block to an engine stand will distort its shape and cause inaccurate cylinder bore measurement. Always check cylinder bores with the block resting unstressed and without mounting brackets on a flat surface.*

Nominal piston and cylinder bore diameter specifications are given in **Table d**. Nominal piston diameters are also marked on the piston crowns.

Table d. Piston and Cylinder Diameters

Engine code	Piston diameter in mm (in.)	Cylinder bore in mm (in.)
AEG, AVH, AZG		
standard	82.465* (3.2466)	82.51 (3.2484)
1st oversize	82.965* (3.2663)	83.01 (3.2681)
ALH, BEW		
standard	79.47 (3.1287)	79.51 (3.1303)
1st oversize	79.72 (3.1386)	79.76 (3.1401)
2nd oversize	79.97 (3.1484)	80.01 (3.1500)
AWD, AWW, AWP		
standard	80.965* (3.1876)	81.01 (3.1894)
1st oversize	81.465* (3.2073)	81.51 (3.2090)

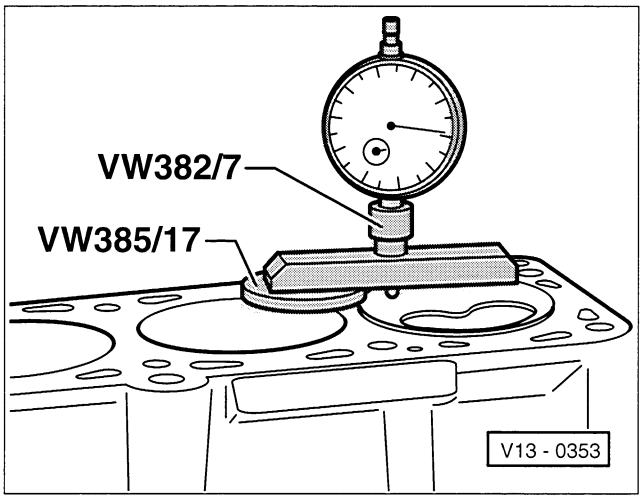
* Dimension without graphite coating (thickness 0.02 mm (.0008 in.). The graphite coating wears away.

Specification

- Cylinder wear–maximum allowable deviation from nominal cylinder bore
  AEG, AVH, AZG, AWW, AWP . . 0.08 mm (.0031 in.)
  ALH, AWD, BEW engines . . . . . 0.10 mm (.0039 in.)

Piston Projection at TDC (diesel engines)

Diesel engine pistons protrude slightly out of the block at TDC due to design considerations. The amount of piston protrusion (projection) varies slightly between engines as a result of production tolerances. In order to achieve proper compression ratios, one of three different thickness head gaskets are used to adjust compression height and therefore, compression ratio. Piston projection must be measured and adjusted any time components that affect it are replaced. These components include: crankshaft, piston, connecting rod and block.

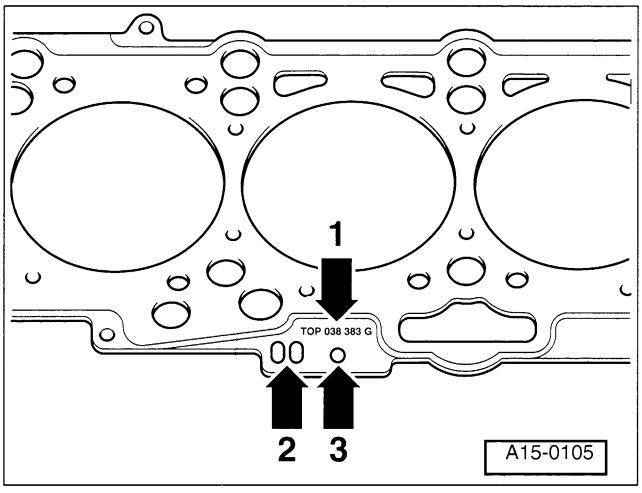


➤ Measure piston height (projection) on all 4 cylinders using a dial gauge with suitable adapters. VW 385/17 is part of a transmission tool set, however, old-style valve shims can also be used.

NOTE —

- *It is important to measure piston projection on all 4 cylinders, especially if cylinder head gasket is being replaced as a result of coolant leakage. Water (coolant) in the combustion chambers can bend connecting rods.*
- *Cylinder measurements that differ substantially from each other are an indication of internal engine damage.*

Select a suitable head gasket based on the highest reading obtained as described above from the available head gaskets listed in **Table e**.



➤ The different gaskets are identified by the number of holes punched in an identification tab (**arrow 3**) on the front of the gasket.

- **arrow 1** = part number
- **arrow 2** = production information (disregard)
- **arrow 3** = identification holes

NOTE —

Cylinder head gaskets are generally vacuum packaged and should not be removed from packaging until just prior to use.

Table e. Diesel Cylinder Head Gasket Selection

Measured piston projection at TDC	Gasket identification	Thickness, code ALH	Thickness, code BEW
0.91 – 1.00 mm (.0358 – .0394 in.)	1 hole	1.55 mm (.0610 in.)	1.45 mm (.0571 in.)
1.01 – 1.10 mm (.0398 – .0433 in.)	2 holes	1.63 mm (.0642 in.)	1.53 mm (.0602 in.)
1.11 – 1.20 mm (.0437 – .0472 in.)	3 holes	1.71 mm (.0673 in.)	1.61 mm (.0634 in.)

Crankshaft

The crankshaft assemblies and related components for 4-cylinder engines are shown on the following pages. Observe the installation notes for any components that are to be reused. The crankshaft mounts a sensor wheel for the engine management system that will only fit on the crankshaft in one position. The sensor wheel on diesel engines uses a dowel pin.

Crankshaft bearing specifications are listed in **Table f** and journal diameters are listed in **Table g**. If a crankshaft must be replaced, a Volkswagen remanufactured crankshaft is available from an authorized Volkswagen Dealer.

CAUTION —
Many of the fasteners used in the cylinder block are stretch bolts that must be replaced once loosened. Review the repair information to identify all bolts and nuts that must be replaced during cylinder block repairs or reconditioning.

NOTE —
- *On cars with an automatic transmission, see* **Flywheel or Driveplate** *given earlier when reinstalling the driveplate. Special installation procedures apply.*
- *Attach engine to suitable engine stand when disassembling and assembling.*

Table f. Crankshaft Bearing Specifications

Main bearing radial clearance (Plastigage®)	
new parts	
gasoline engines	0.01–0.04 mm (.0004–.0016 in.)
diesel engines	0.03–0.08 mm (.0012–.0031 in.)
wear limit	
gasoline engines	0.15 mm (.0059 in.)
diesel engine	0.17 mm (.0067 in.)
Crankshaft axial play (side clearance, "end play")	
new parts	
gasoline engines	0.07–0.23 mm (.0028–.0091 in.)
diesel engines	0.07–0.17 mm (.0028–.0067 in.)
wear limit	
gasoline engines	0.30 mm (.0118 in.)
diesel engine	0.37 mm (.0146 in.)

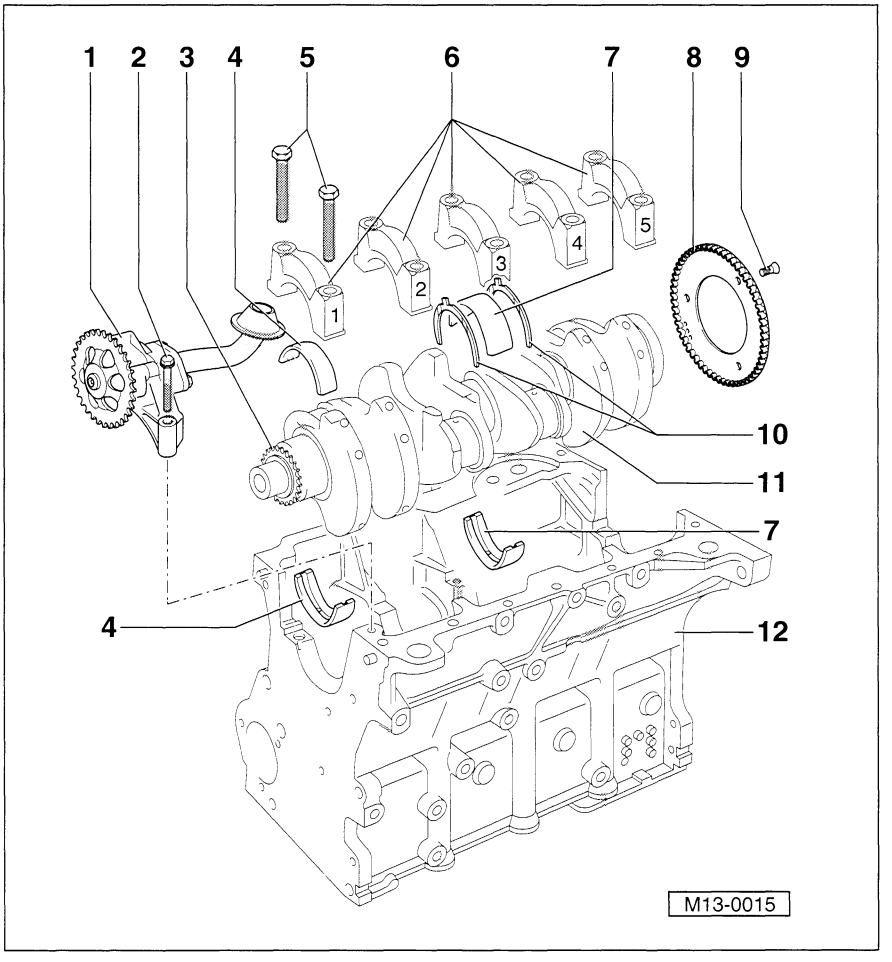
Table g. Crankshaft Journal Diameters, gasoline engines

Journal diameters (nominal)	mm (in.)
Basic dimension	
main	54.00 (2.1260) $^{-0.017\ (0.00067)}_{-0.037\ (0.00146)}$
connecting rod	47.80 (1.8819) $^{-0.022\ (0.00087)}_{-0.042\ (0.00165)}$
1st undersize (0.25 mm)	
main	53.75 (2.1161) $^{-0.017\ (0.00067)}_{-0.037\ (0.00146)}$
connecting rod	47.55 (1.8720) $^{-0.022\ (0.00087)}_{-0.042\ (0.00165)}$
2nd undersize (0.50 mm)	
main	53.50 (2.1063) $^{-0.017\ (0.00067)}_{-0.037\ (0.00146)}$
connecting rod	47.30 (1.8622) $^{-0.022\ (0.00087)}_{-0.042\ (0.00165)}$
3rd undersize (0.75 mm)	
main	53.25 (2.0965) $^{-0.017\ (0.00067)}_{-0.037\ (0.00146)}$
connecting rod	47.05 (1.8524) $^{-0.022\ (0.00087)}_{-0.042\ (0.00165)}$

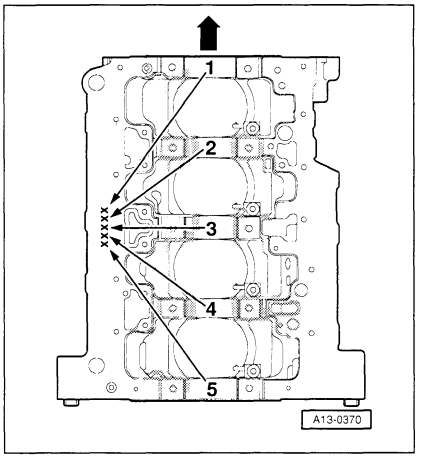
Table h. Crankshaft Journal Diameters, diesel engines

Journal diameters (nominal)	mm (in.)
Basic dimension	
main	54.00 (2.1260) $^{-0.022\ (0.00087)}_{-0.042\ (0.00165)}$
connecting rod	47.80 (1.8819) $^{-0.022\ (0.00087)}_{-0.042\ (0.00165)}$
1st undersize (0.25 mm)	
main	53.75 (2.1161) $^{-0.022\ (0.00087)}_{-0.042\ (0.00165)}$
connecting rod	47.55 (1.8720) $^{-0.022\ (0.00087)}_{-0.042\ (0.00165)}$
2nd undersize (0.50 mm)	
main	53.50 (2.1063) $^{-0.022\ (0.00087)}_{-0.042\ (0.00165)}$
connecting rod	47.30 (1.8622) $^{-0.022\ (0.00087)}_{-0.042\ (0.00165)}$
3rd undersize (0.75 mm)	
main	53.25 (2.0965) $^{-0.022\ (0.00087)}_{-0.042\ (0.00165)}$
connecting rod	47.05 (1.8524) $^{-0.022\ (0.00087)}_{-0.042\ (0.00165)}$

Crankshaft assembly (gasoline engines)



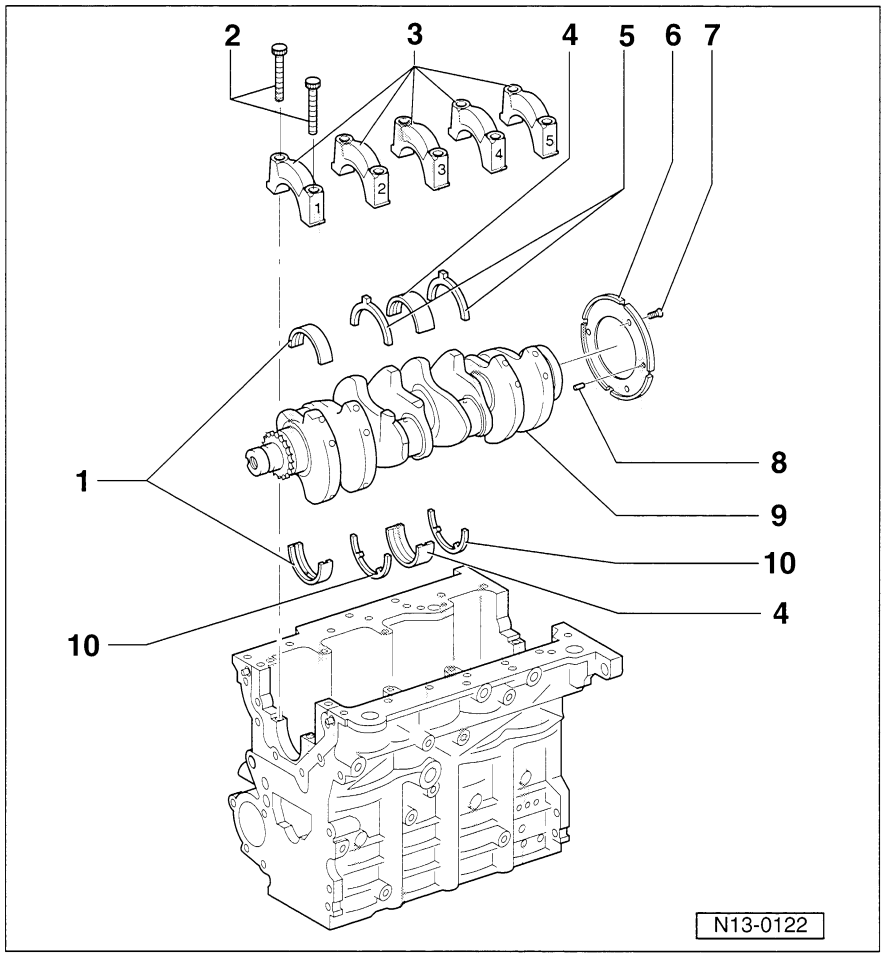
1. **Oil pump with sprocket**
   - With 12 bar (174 psi) upper pressure check valve
   - Check that both positioning sleeves are in place
2. **Bolt**
   - Tighten to 15 Nm (11 ft-lb)
3. **Chain sprocket**
   - For oil pump drive
   - Check for wear
4. **Bearing shells 1, 2, 3, 4 and 5**
   - For bearing cap without oil groove
   - For cylinder block with oil groove
   - Do not interchange used bearing shells (mark)
   - See **Upper crankshaft bearing identification**
5. **Bolts, full thread**
   - Tighten to 65 Nm (48 ft-lb) + ¼ turn (90°)
   - Always replace
   - Tighten to 65 Nm (48 ft-lb) only to measure radial clearance
6. **Bearing cap**
   - Bearing cap 1: pulley end
   - Bearing cap 3: with grooves for thrust washers
   - Bearing shell retaining lugs engine block/bearing cap must be on the same side
7. **Bearing shell 3**
   - Reference item **4**
   - Crankshaft thrust taken at this bearing
8. **Sensor wheel**
   - Always replace if removed
   - For engine speed (RPM) sensor (G28)
   - Can only be installed in one position due to hole offset
9. **Bolt**
   - Tighten to 10 Nm (7 ft-lb) + ¼ turn (90°)
   - Always replace
10. **Thrust washer**
    - For bearing 3 bearing cap
    - Note installation position
    - Arrangement may differ slightly from illustration
11. **Crankshaft**
    - Check radial clearance with Plastigage
    - Do not rotate crankshaft when checking radial clearance
12. **Cylinder block**



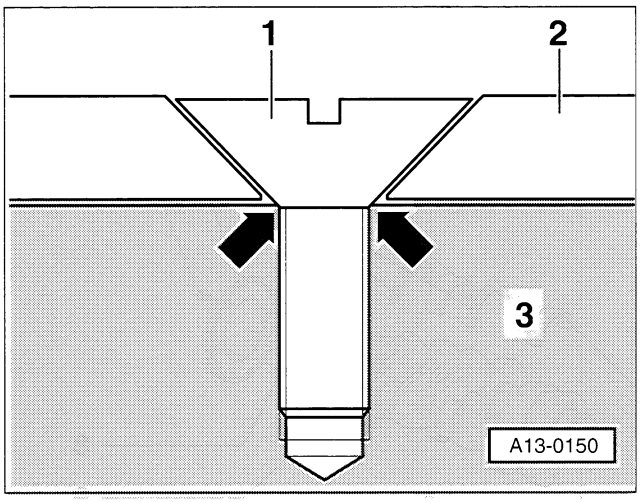
Upper crankshaft bearing identification (from 05.00 prod.)

- Upper bearing shells of the proper thickness are assigned to the cylinder block at the factory. Color markings are used to identify the bearing shell thickness.
  S = black (schwarz)
  R = red (rot)
  G = yellow (gelb)
- Letters on lower sealing surface of cylinder block identify which bearing thickness must be inserted and position.
- Arrow points to pulley end.

Crankshaft assembly (diesel engines)

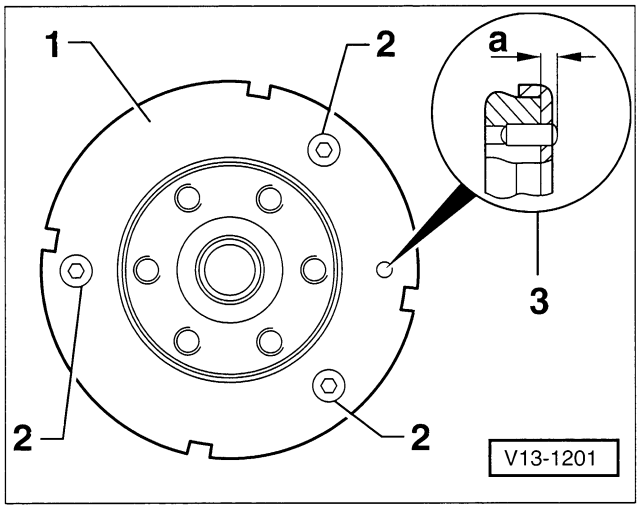


1. **Bearing shells 1, 2, 4 and 5**
   - For bearing caps without oil groove
   - For engine block with oil groove
   - Do not interchange used bearing shells (mark)
2. **Bolt, full thread**
   - Tighten to 65 Nm (48 ft-lb) + ¼ turn (90°)
   - Always replace
   - Tighten to 65 Nm (48 ft-lb) only to measure radial clearance
3. **Bearing cap**
   - Bearing cap 1: pulley end
   - Bearing cap 3 with recesses for thrust washers
   - Bearing shell retaining lugs engine block/bearing cap must be on the same side
4. **Bearing shell 3**
   - Bearing cap without oil groove
   - For engine block with oil groove
   - Do not interchange used bearing shells (mark)
5. **Thrust washer**
   - For bearing 3 bearing cap
   - Note installation position
   - Arrangement may differ slightly from illustration
6. **Sensor wheel**
   - For engine speed sensor (G28)
   - Can only be installed in one position due to hole offset and dowel pin
   - Engine code BEW: always replace if removed. See **Removing and installing sender wheel, engine code BEW**
7. **Bolt**
   - Tighten to 10 Nm (7 ft-lb) + ¼ turn (90°)
   - Always replace
8. **Dowel pin**
   - Note installed position
   - Checking installed position, see **Checking dowel pin projection and sensor wheel**
9. **Crankshaft**
   - Check radial clearance with Plastigage
   - Do not rotate crankshaft when checking radial clearance
10. **Thrust washer**
    - For engine block, bearing 3
    - Note installation position
    - Arrangement may differ slightly from illustration



Removing and installing sender wheel (engine code BEW)

- Replace sender wheel (**2**) any time bolts (**1**) are loosened.
- Tighten to 10 Nm (7 ft-lb) + ¼ turn (90°)
- Always replace
- If bolts were to be re-used, the second time the bolts are tightened, the contact point of the countersunk head, in the sender wheel, is deformed sufficiently to allow the bolt head to seat (**arrows**) on the crankshaft (**3**), thus allowing the sender wheel to remain loose under the bolts.



Checking dowel pin projection and sensor wheel

- ALH sensor wheel shown, BEW measurement procedure and specification are the same.
- Sensor wheel (**1**) is mounted on crankshaft at flywheel end with screws (**2**).
- A single dowel pin (**3**) locates sensor wheel.
- Dowel pin projection (**a**) measurement from crankshaft flange end: 2.5 – 3.0 mm (.098 – 118 in.).

13b Crankshaft/Cylinder Block (6-cylinder)

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Cylinder block 13b-1
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GENERAL

This repair group provides the special reconditioning information necessary to repair the Volkswagen 6-cylinder short block. The information contained here is intended to be used as a reconditioning guide for the professional or experienced automotive technician. Most of the operations and specifications listed require precision measuring equipment.

Engine Codes

- AFP . . . . . 12-valve, 2.8L 6-cylinder gasoline
- BDF . . . . . 24-valve, 2.8L 6-cylinder gasoline

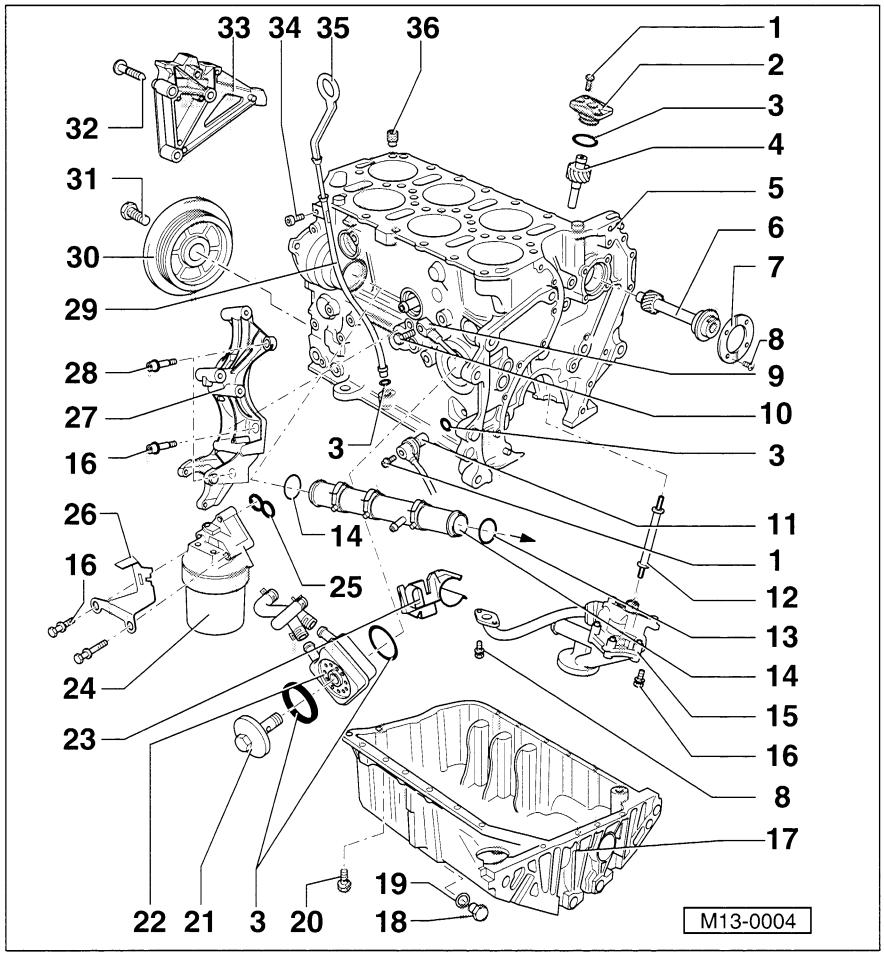
CYLINDER BLOCK

The 6-cylinder engine block and related components are shown on the following pages.

NOTE —

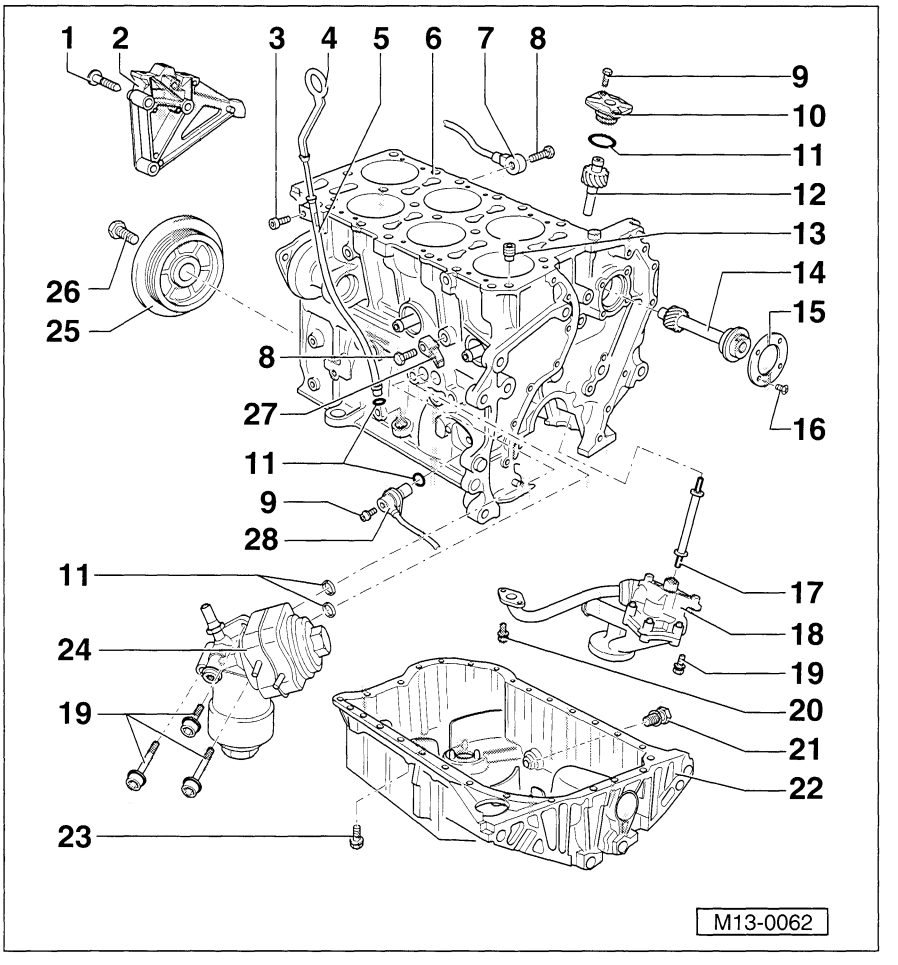
- *If during engine repairs, metal shavings or large quantities of small metal particles are found in the engine oil, the oil passages in the cylinder block must be thoroughly cleaned and the following components replaced: all oil splash nozzles, oil return barrier, oil cooler, and oil filter.*
- *Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See* **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*

Cylinder block components (code: AFP)



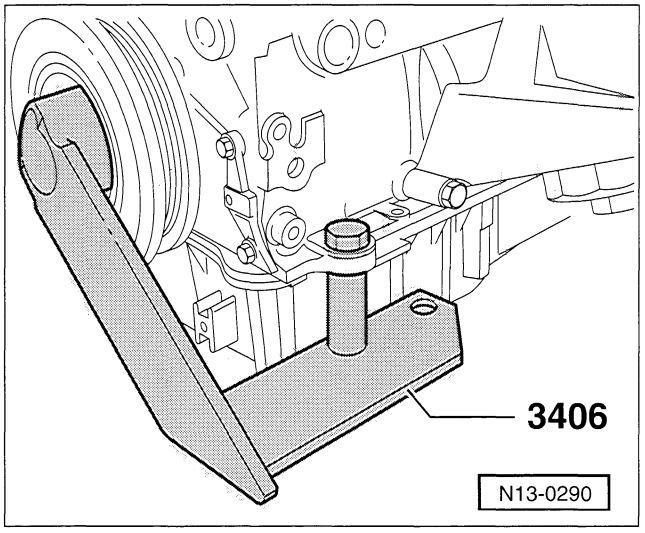
1. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
2. **Oil pump drive cover**
3. **O-ring**
   - Always replace
   - Coat with oil before assembly
4. **Oil pump drive**
5. **Cylinder block**
6. **Intermediate shaft**
7. **Thrust washer**
8. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
   - Install with D6 locking compound
9. **Knock sensor (KS) 2 (G66)**
   - Knock sensor (KS) 1 (G61) on opposite side of block
10. **Bolt**
    - Tighten to 20 Nm (15 ft-lb)
    - Tightening torque influences function of sensor
11. **Engine speed (RPM) sensor (G28)**
12. **Drive shaft**
    - For oil pump drive
13. **O-ring**
    - Always replace
14. **Coolant pipe**
15. **Oil pump**
    - Coat oil pressure pipe on engine block and oil pump housing with VW sealant AMV 188 001 02
16. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
17. **Oil pan**
18. **Oil drain plug**
    - Always replace
    - Tighten to 30 Nm (22 ft-lb)
19. **Drain plug seal**
    - Integral with new drain plug
    - See **0 Maintenance**
20. **Bolt**
    - Tighten to 15 Nm (11 ft-lb)
21. **Oil cooler cover**
    - Tighten to 25 Nm (18 ft-lb)
22. **Oil cooler**
    - Check for adequate clearance with adjacent components
    - Coat contact surfaces outside oil seal with VW sealant AMV 188 001 02
    - Replace if metal shavings are found in engine block upon disassembly
23. **Bracket**
24. **Oil filter housing**
25. **Gasket**
    - Always replace
    - Note installation position
    - Coat with oil before installing
26. **Bracket**
    - For intake manifold change-over valve (N156)
27. **Compact bracket**
    - For generator, A/C compressor and power steering pump
28. **Guide bolt**
    - Tighten to 25 Nm (18 ft-lb)
29. **Guide tube**
    - For oil dipstick
    - Attached to intake pipe-top section with bolt
30. **Vibration damper**
    - See **Vibration damper, removing and installing**
31. **Bolt**
    - Tighten to 100 Nm (74 ft-lb) + ¼ turn (90°)
    - Always replace
    - Use locking bracket 3406 for loosening and tightening
32. **Bolt**
    - Tighten to 45 Nm (33 ft-lb)
33. **Engine bracket**
34. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
35. **Oil dipstick**
    - Oil level must not exceed the max. mark (Do not overfill!)
36. **Oil non-return (check) valve**
    - Tighten to 5 Nm (44 in-lb)
    - Note installation position
    - Clean if severely contaminated
    - Replace if metal shavings are found in engine block upon disassembly

Cylinder block components (code: BDF)



1. **Bolt**
   - Tighten to 45 Nm (33 ft-lb)
2. **Engine bracket**
3. **Bolt**
   - Tighten to 8 Nm (71 in-lb)
   - Secures dipstick guide tube to intake manifold
4. **Dipstick**
   - Oil level must not exceed the max. mark (Do not overfill!)
5. **Guide tube**
   - For oil dipstick
   - Attached to intake pipe-top section with bolt
6. **Cylinder block**
7. **Knock sensor (KS) 1 (G61)**
   - 3-pin connector
   - Installed between cyl. 1 and 3
   - Contact surfaces between sensor and cylinder block must be clean and grease-free
8. **Bolt**
   - Tighten to 20 Nm (15 ft-lb)
   - Torque setting influences function of knock sensor
9. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
   - Tightening torque influences function of sensor
10. **Oil pump drive cover**
11. **O-ring**
    - Always replace
    - Coat with oil before assembly
12. **Oil pump drive**
13. **Oil non-return (check) valve**
    - Tighten to 5 Nm (44 in-lb)
    - Note installation position
    - Clean if severely contaminated
    - Replace if metal shavings are found in engine block upon disassembly
14. **Intermediate shaft**
15. **Thrust washer**
16. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
    - Install with D6 locking compound
17. **Drive shaft**
    - For oil pump drive
18. **Oil pump**
    - Coat oil pressure pipe on engine block and oil pump housing with VW sealant AMV 188 001 02
19. **Bolt**
    - Tighten to 23 Nm (17 ft-lb)
20. **Bolt**
    - Tighten to 8 Nm (71 in-lb)
    - Install with locking compound D6
21. **Oil drain plug**
    - Always replace
    - Tighten to 30 Nm (22 ft-lb)
22. **Oil pan**
23. **Bolt**
    - Tighten to 12 Nm (71 in-lb)
24. **Oil filter housing**
    - With oil cooler
    - See **17 Engine-Lubrication System** for disassembly
    - Replace if metal shavings are found in engine block upon disassembly
25. **Vibration damper**
    - See **Vibration damper, removing and installing**
26. **Bolt**
    - Tighten to 100 Nm (74 ft-lb) + ¼ turn (90°)
    - Always replace
    - Use counter support T10069 for loosening and tightening
27. **Knock sensor (KS) 2 (G66)**
    - 2-pin connector
    - Installed between cyl. 4 and 6
    - Contact surfaces between sensor and cylinder block must be clean and grease-free
28. **Engine speed (RPM) sensor (G28)**

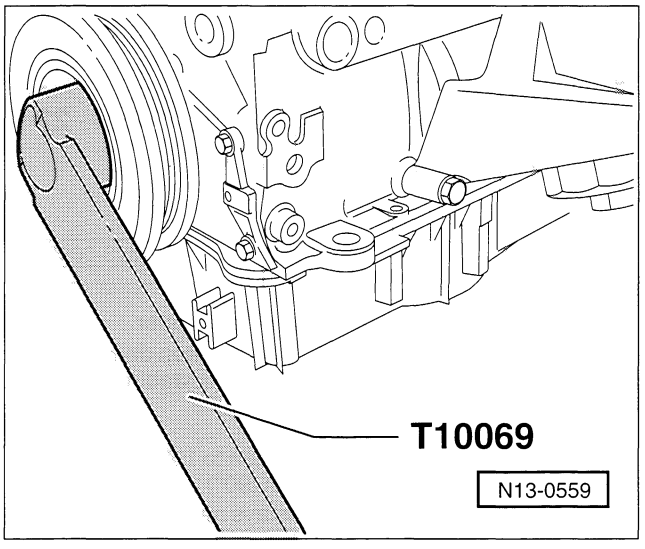
Vibration damper, removing and installing



Engine code: AFP

– Lock vibration damper in place with locking bracket 3406.

– Remove vibration damper mounting bolt and damper.
  • Always replace vibration damper mounting bolt



Engine code: BDF

– Lock vibration damper in place with counter support T10069.

– Remove vibration damper mounting bolt and damper.
  • Always replace vibration damper mounting bolt

– Install vibration damper in reverse order of removal.

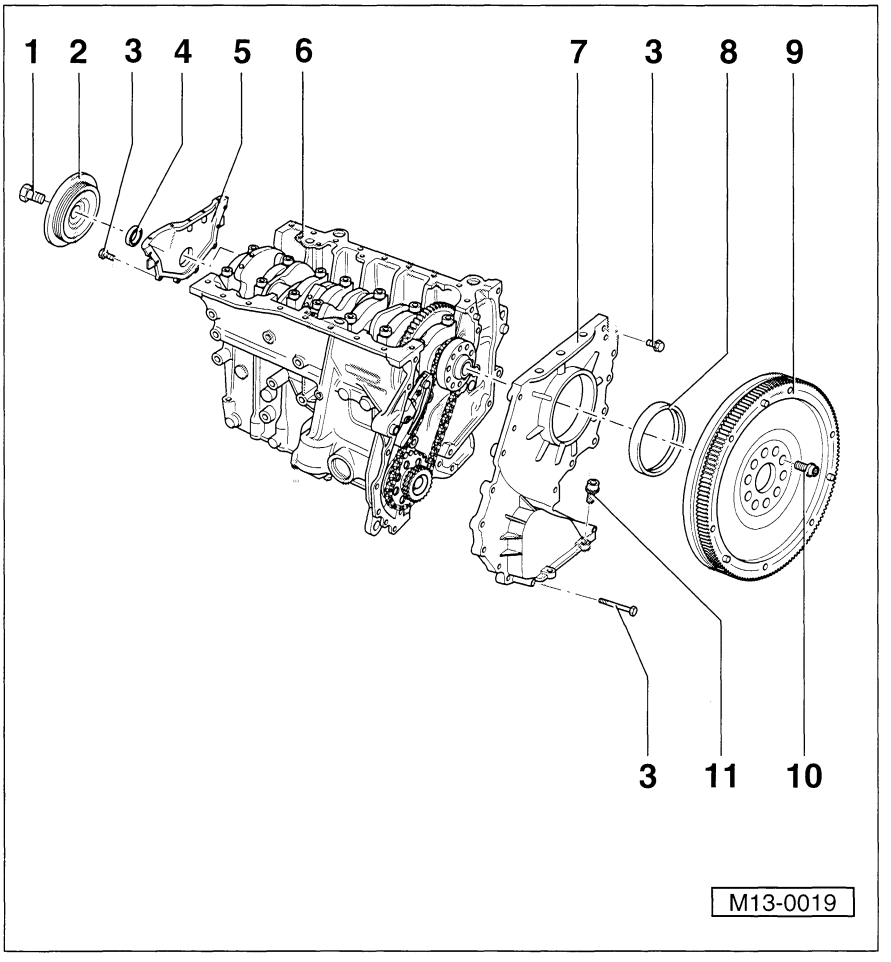
Tightening torques

• Vibration damper bolt, (stretch bolt - always replace)
  stage I . . . . . 100 Nm (74 ft-lb)
  stage II . . . . . additional ¼ turn (90°)

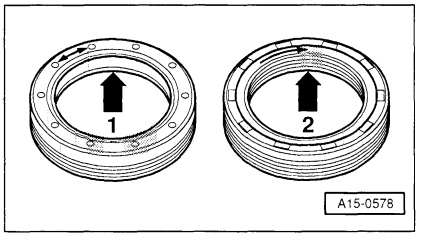
CYLINDER BLOCK OIL SEALS

Cylinder block oil seals, assembly

NOTE —
The engine must be attached to an engine stand with bracket 3269 to carry out assembly work.



1. **Bolt**
   - Tighten to 100 Nm (74 ft-lb) + ¼ turn (90°)
   - Always replace
   - AFP: use locking bracket 3406 to loosen and tighten
   - BDE: use counter support T10069 to loosen and tighten
2. **Vibration damper**
   - See **Vibration damper, removing and installing**, above
3. **Bolt**
   - AFP: tighten to 10 Nm (7 ft-lb)
   - BDE: tighten to 8 Nm (6 ft-lb)
4. **Front crankshaft oil seal**
   - See **Oil seal type identification**
5. **Front oil seal flange**
   - Clean sealing surfaces before installing
   - Install with silicone sealant D 176 404 A2
6. **Cylinder block**
7. **Rear oil seal flange**
   - Clean sealing surfaces before installing
   - Install with silicone sealant D 176 404 A2
8. **Rear oil seal**
   - Original seal is constructed of PTFE (Teflon ®), only replace with new seal of same material. Install this type of seal dry. Do not oil or grease sealing lips.
   - See **Oil seal type identification**
   - Install new seal with guide sleeve to protect seal during installation
   - Remove with seal puller 2086
   - Install seal with special tools from kit 2003
9. **Flywheel/driveplate**
   - Single or dual-mass flywheel
   - Single-mass shown
   - Remove and install with vibration damper locked in place as shown previously
10. **Bolt**
    - Tighten to 60 Nm (44 ft-lb) + ¼ turn (90°)
    - Always replace
11. **Bolt**
    - AFP: tighten to 25 Nm (18 ft-lb)
    - BDE: tighten to 23 Nm (17 ft-lb)

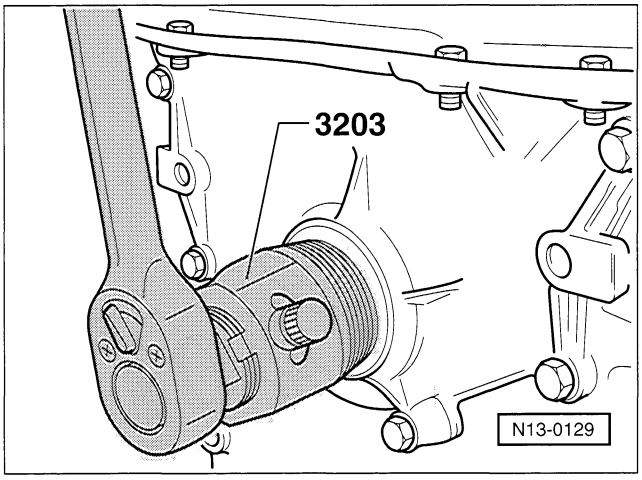


Oil seal type identification

An oil seal constructed of PTFE (Teflon ®) was phased-in gradually during production of some engine types. PTFE oil seals replace the older spring-type seals, but spring-type seals should never be used in place of the PTFE type.

- PTFE (Teflon ®) seals (**right**) can be identified by the wider sealing lip (**arrow 2**). These seals are installed without lubricant of any kind on the seal.
- Spring-type seals (**left**) can be identified by the narrower sealing lip (**arrow 1**) and a tensioning spring behind the lip seal.

Front crankshaft oil seal, replacing



– Remove ribbed V-belt, see **0 Maintenance**.

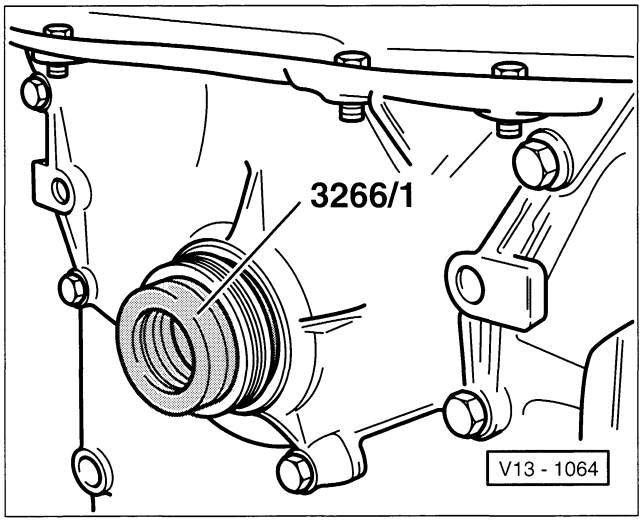
– Remove the vibration damper as shown previously.

➢ Turn the inner section of oil seal extractor tool 3203 three turns (approx. 4 mm) out from the outer section of the extractor and lock into position with knurled screw.

– Coat the threaded head of oil seal removal tool with oil, set in place and with heavy pressure, screw it as far as possible into the seal.

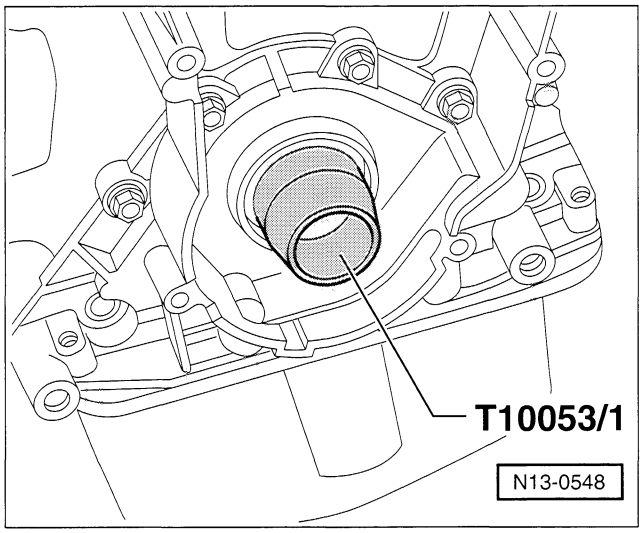
– Loosen the knurled screw and turn the inner part against the crankshaft until the seal is removed.

– Lightly coat the sealing lip of the seal with clean oil.



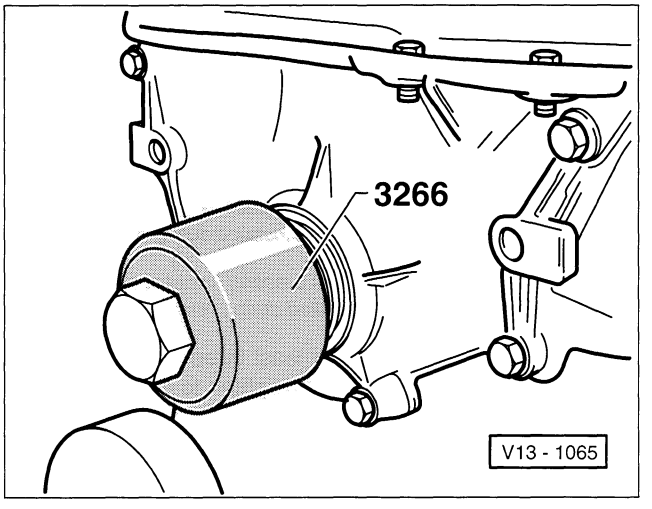
➢ **Engine code: AFP**

– Place a guide sleeve 3266/1 as shown, on the crankshaft nose.



➢ **Engine code: BDF**

– Place a guide sleeve T10053/1 as shown, on the crankshaft nose.



(continued for all engines)

➤ Press the seal in with a 3266 as shown using the original vibration dampener bolt. Continue pressing to final installation position until 3266 reaches the stop.

– Install vibration damper with new mounting bolt and lock in place as shown previously. Tighten to final torque.

– Install remaining removed components.

Tightening torques

- Vibration damper bolt, (stretch bolt - always replace)
  stage I . . . . . 100 Nm (74 ft-lb)
  stage II . . . . . additional ¼ turn (90°)

FLYWHEEL/DRIVEPLATE

Removal of the flywheel or driveplate requires that the engine be separated from the transmission. Remove the clutch on manual transmission vehicles, see **30 Clutch**.

CAUTION —

- *On vehicles with automatic transmissions, special mounting and measuring procedures are required when installing the driveplate.*
- *The flywheel on manual transmission vehicles and the driveplate on automatic transmission vehicles are mounted to the crankshaft using stretch bolts that are designed to be used only once. Always replace.*

Flywheel/driveplate, removing and installing

– Lock the vibration damper in place as shown earlier.

– Loosen securing bolts diagonally and remove flywheel or drive plate and any shims.

– Installation is the reverse of removal observing the following points:

- Install any removed shims and mount the flywheel or drive plate with new bolts.
- Check driveplate clearance (as applicable) as described later.
- Attach the holder to the vibration damper and tighten the flywheel /driveplate mounting bolts diagonally.

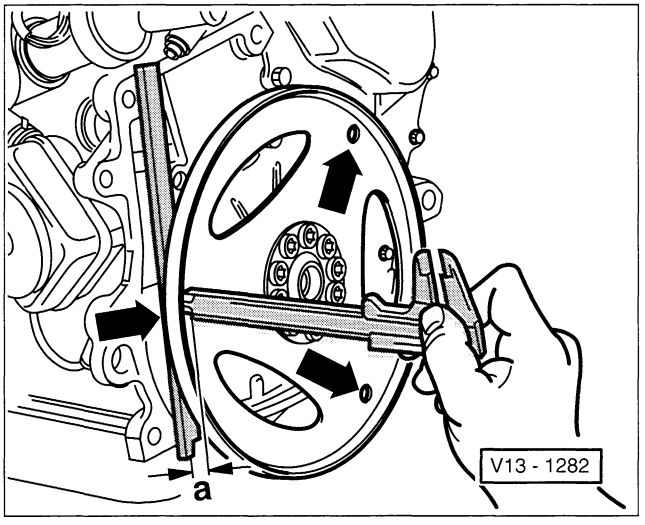
Tightening torque

- Flywheel or driveplate to crankshaft
  (stretch bolt, always replace)
  stage I . . . . . 60 Nm (44 ft-lb)
  stage II . . . . . additional ¼ turn (90°)

Driveplate clearance, adjusting (vehicles with automatic transmission)

NOTE —

- *Incorrect clearance may result in premature starter wear.*
- *On some BDF engines, a thick spacer block may be used on the end of the crankshaft. Spacer remains in place for measurements and must be installed during re-assembly.*
- *Lock plate under bolts (if present), is not considered a shim and must be installed during re-assembly.*



– Install drive plate with at least three of the old mounting bolts, but without shim and tighten to checking torque.

Tightening Torque

- Driveplate checking torque. . . . . 30 Nm (22 ft-lb)

➢ Place a straightedge on machined surface of block and measure distance from outer edge of driveplate down to straightedge at three points. Measuring tool must fit through hole in driveplate (**arrows**).

– Average the three readings (plus the thickness of the straightedge) to get **dimension a**.

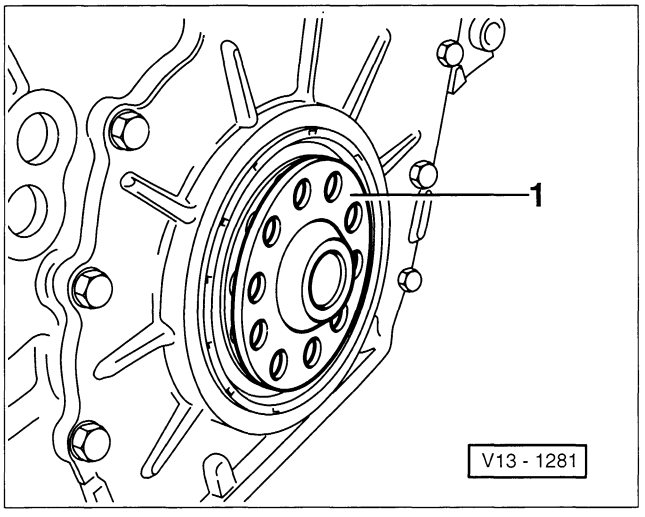
Specification

- Cylinder block to outer edge of driveplate (automatic transmission only)
  dimension a . .15.7 mm – 16.5 mm (0.62 – 0.65 in.)

– If specification is not obtained, remove driveplate, install appropriate shim and recheck. Use only 1 shim. See **Table a**.

Table a. Driveplate Shims

VW part number	Thickness (mm)
021 105 303	0.4
021 105 303 A	0.8
021 105 303 B	1.2
021 105 303 C	1.6
021 105 303 D	2.0
021 105 303 E	2.4



➢ Only one shim (**1**) of the appropriate thickness may be used. Thick spacer on some BDF engines is not considered a shim.

– When specification is obtained, install lock plate (if equipped) with new bolts and attach driveplate torque.

Tightening torque

- Driveplate to crankshaft (stretch bolt, always replace)
  stage I . . . . . 60 Nm (44 ft-lb)
  stage II . . . . . additional ¼ turn (90°)

CYLINDER BLOCK INTERNAL COMPONENTS

During engine block disassembly, be sure to mark the position and orientation of all parts as they are removed. This includes connecting rods, rod bearings and caps, piston pins, pistons, main bearings and caps. This ensures that re-used parts are put back in to service in the location where they have been "run-in". Certain cylinder block components such as connecting rod caps and main bearing caps are matched to another part during manufacture and will not fit properly to any other part. Knowing which components came from which location can also be a used to diagnose internal engine problems.

To minimize wear during initial engine start-up, use clean engine oil to lubricate all friction surfaces during assembly.

Pistons and Connecting Rods

Pistons, piston pins, piston rings, connecting rods, and bearings should never be interchanged if they are to be re-used. Mark cylinder number and installation orientation on pistons, connecting rods and connecting rod bearing caps before removal.

The piston pin should require only a slight push to remove or install. If difficult, heat the piston to approximately 60°C (160°F). Replace piston and pin if fit is excessively loose.

Inspect the connecting rod for any bending, distortion, heat damage or other visual damage. Connecting rod specifications are listed in **Table b**. Connecting rods should always be replaced in complete sets due to weight and dimensional considerations.

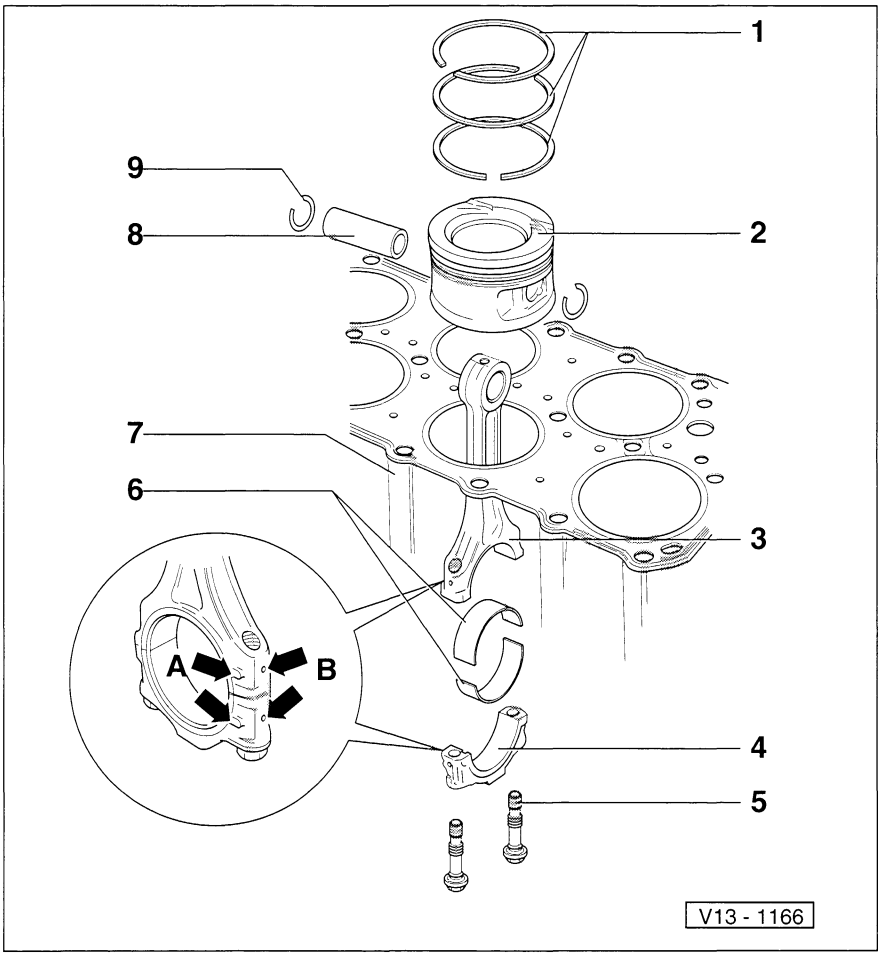
NOTE —

- *When checking radial clearance, reuse the old bolt or nut, and lubricate the contact surface of the nut or bolt before tightening. Tighten the nut or bolt only to the 30 Nm (22 ft-lb) specification and not the additional ¼ turn.*
- *If connecting rod radial clearance is excessive, the crankshaft connecting rod journals should be checked. If crankshaft journal diameters are within specifications, recheck radial clearance using new bearing shells.*

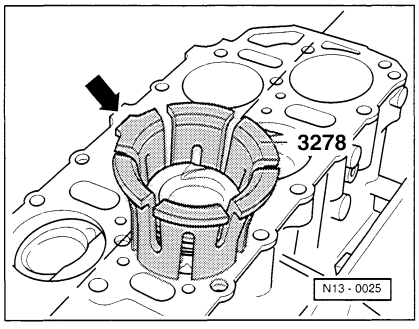
Table b. Connecting Rod Specifications

Radial clearance	**check with (Plastigage®)**
new	0.02–0.07 mm (0.0008–0.0028 in.)
wear limit	0.10 mm (0.0039 in.)
Axial (side) clearance	
new (code: AFP)	0.05–0.31 mm (0.0020–0.0122 in.)
new (code: BDF)	0.05–0.35 mm (0.0020–0.0138 in.)
wear limit (all)	0.40 mm (0.0157 in.)
Checking torque	30 Nm (22 ft-lb)
Assembly torque	30 Nm (22 ft-lb) plus ¼ turn (90°)

Piston and connecting rod, assembly



1. **Piston ring**
   - Offset gaps by 120°
   - "TOP" or "OBEN" faces piston crown
   - Check gap and ring groove clearance, see **Piston Rings**
2. **Piston**
   - Mark installation position and cylinder number
   - Piston crown is different between AFP and BDF engines (AFP shown)
   - AFP: tall side of piston top points toward center of cylinder block
   - BDF: flatter side of piston crown faces toward center of cylinder block
   - Install using piston funnel 3278, see **Piston Installation** below
3. **Connecting rod**
   - Only replace as a set
   - Mark cylinder number (**B**)
   - Installation position: mark (**A**) must be positioned on top of each other
4. **Connecting rod bearing cap**
   - Note installation position
5. **Bolts**
   - Tighten to 30 Nm (22 ft-lb) + ¼ turn (90°)
   - Always replace
   - Oil threads and contact surfaces
   - To measure radial clearance tighten to 30 Nm (22 ft-lb), but no further
6. **Bearing shell**
   - Note installation position
   - Do not interchange used bearing shells
   - Ensure retaining lugs fit tightly in recesses
   - Do not rotate crankshaft when checking radial clearance
7. **Engine block**
8. **Piston pins**
   - If difficult to remove, heat piston to 60°C (140°F)
   - Remove and install with VW 222a
9. **Circlip (snap-ring)**

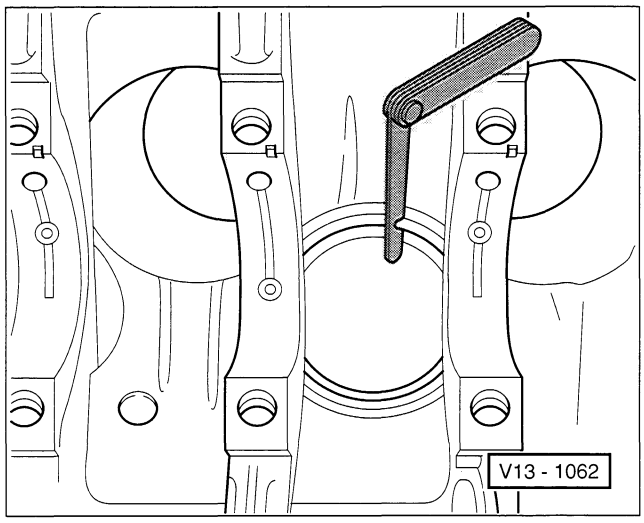


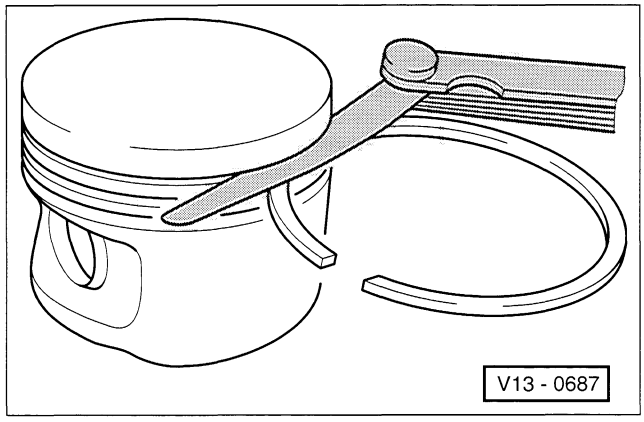
Piston Installation

NOTE —

If using a new funnel, guide the piston with oiled piston rings through the funnel twice and, if necessary, remove the resulting shavings. Only then should you install the piston with piston rings into the block.

- Manually push piston into oiled funnel. The tall side of piston top must point toward funnel spout (**arrow**).
- Hold funnel (with inserted piston) at the upper edge and push piston in with both hands.
- Push piston in until it protrudes approx. 15mm (5/8 in.) below bottom edge of funnel.
- Start piston in its respective cylinder bore. The funnel spout (**arrow**) must point toward the middle of the engine block.
- Firmly place funnel on cylinder block and push piston in place.





Piston Rings and Pistons

Use a feeler gauge to check piston ring end gaps. Pistons are checked with the piston rings inserted evenly approximately 15 mm (5/8 in.) from the bottom of the cylinder. This is because wear in this area of the cylinder is negligible. Use a piston without piston rings installed to push ring into cylinder. **Table c** lists piston ring end gap specifications.

Table c. Piston Ring End Gaps

	New	Wear limit
Top (plain compression ring)	0.20–0.40 mm (.0079–.0157 in.)	1.0 mm (.0394 in.)
Middle (tapered compression ring)	0.20–0.40 mm (.0079–.0157 in.)	1.0 mm (.0394 in.)
Bottom (oil control ring)	0.25–0.50 mm (.0098–.0197 in.)	1.0 mm (.0394 in.)

Piston ring side clearance (ring to groove clearance) is checked using feeler gauges. Measure each ring in its original groove. Piston ring side clearance specifications are listed in **Tables d and e**.

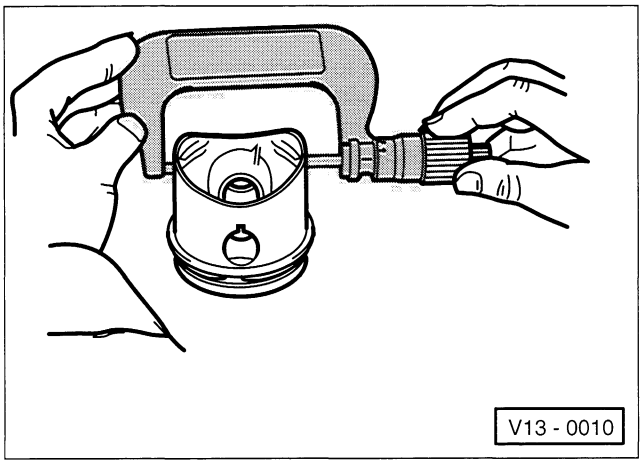
NOTE —
Piston ring groove should be thoroughly cleaned before checking ring side clearance.

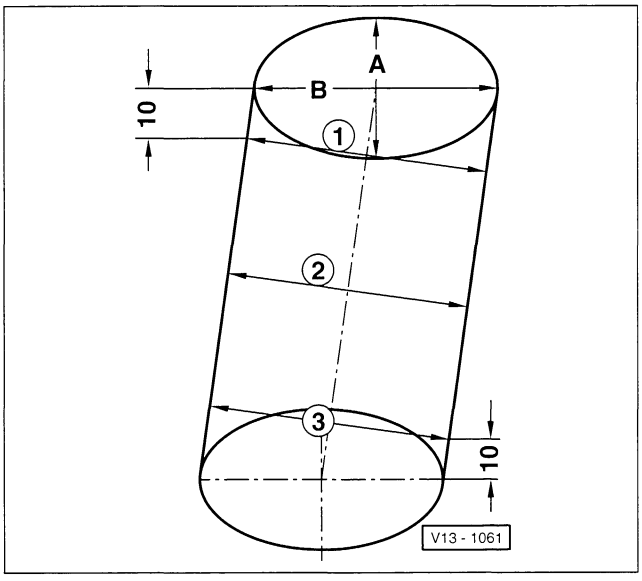
Table d. Piston Ring Side Clearances - AFP

AFP engine code	AFP new	AFP wear limit
Top (plain compression ring)	0.04–0.09 mm (.0016–.0035 in.)	0.15 mm (.0059 in.)
Middle (tapered compression ring)	0.03–0.06 mm (.0012–.0024 in.)	0.15 mm (.0059 in.)
Bottom (oil control ring)	0.02–0.06 mm (.0008–.0024 in.)	0.15 mm (.0059 in.)

Table e. Piston Ring Side Clearances - BDF

BDF engine code	BDF new	BDF wear limit
Top (plain compression ring)	0.04–0.08 mm (.0016–.0031 in.)	0.15 mm (.0059 in.)
Middle (tapered compression ring)	0.02–0.06 mm (.0008–.0024 in.)	0.15 mm (.0059 in.)
Bottom (oil control ring)	0.03–0.06 mm (.0012–.0024 in.)	0.15 mm (.0059 in.)





Measure piston diameter approximately 6 mm (0.24 in.) from bottom of skirt at right angle (90°) to piston pin. If piston is graphite coated, (dark gray color) allow up to 0.02 mm (0.0008 in.) additional, as the graphite coating will wear away. Piston and cylinder bore diameter specifications are given in **Table f**. Nominal piston diameters are also marked on the piston crown.

Specifications

- Piston wear–maximum allowable deviation from nominal piston diameter. . . 0.04 mm (.0016 in.)

Cylinder bore dimensions

Measure cylinder bores at three places (**1**, **2**, **3**); approximately the top, the middle and the bottom. The top and bottom measurements should be made approximately **10** mm (3/8 in.) from the ends of the cylinder. Measure cylinder bore in directions both perpendicular to the crankshaft (**A**) and parallel to crankshaft (**B**).

CAUTION —
Mounting the bare cylinder block to an engine stand will distort its shape and cause inaccurate cylinder bore measurement. Always check cylinder bores with the block resting unstressed and without mounting brackets on a flat surface.

Nominal piston and cylinder bore diameter specifications are given in **Table f**. Nominal piston diameters are also marked on the piston crowns.

Table f. Piston and Cylinder Diameters

2.8L engine (code: AFP)	Piston diameter in mm (in.)	Cylinder bore in mm (in.)
standard	80.985 (3.1884)	81.01 (3.1894)
1st oversize	81.485 (3.2081)	81.51 (3.2090)
2nd oversize	81.985 (3.2277)	82.01 (3.2287)
2.8L engine (code: BDF)		
standard	80.965 (3.1875)	81.01 (3.1894)
1st oversize	81.465 (3.2072)	81.51 (3.2090)
2nd oversize	81.965 (3.2270)	82.01 (3.2287)

NOTE —
If piston is graphite coated, (dark gray color) allow up to 0.02 mm (0.0008 in.) additional, as the graphite coating will wear away.

Specifications

- Cylinder wear–maximum allowable deviation from nominal cylinder bore. . . . . 0.08 mm (.0031 in.)

Crankshaft

The crankshaft assemblies and related components are shown on the following page. Observe the installation notes for any components that are to be reused.

Crankshaft specifications are listed in **Table g**. If a crankshaft must be replaced, a Volkswagen remanufactured crankshaft may be available from an authorized Volkswagen Dealer.

> ***CAUTION —***
> *Many of the fasteners used in the cylinder block are stretch bolts that must be replaced once loosened. Review the repair information to identify all bolts and nuts that must be replaced during cylinder block repairs or reconditioning.*

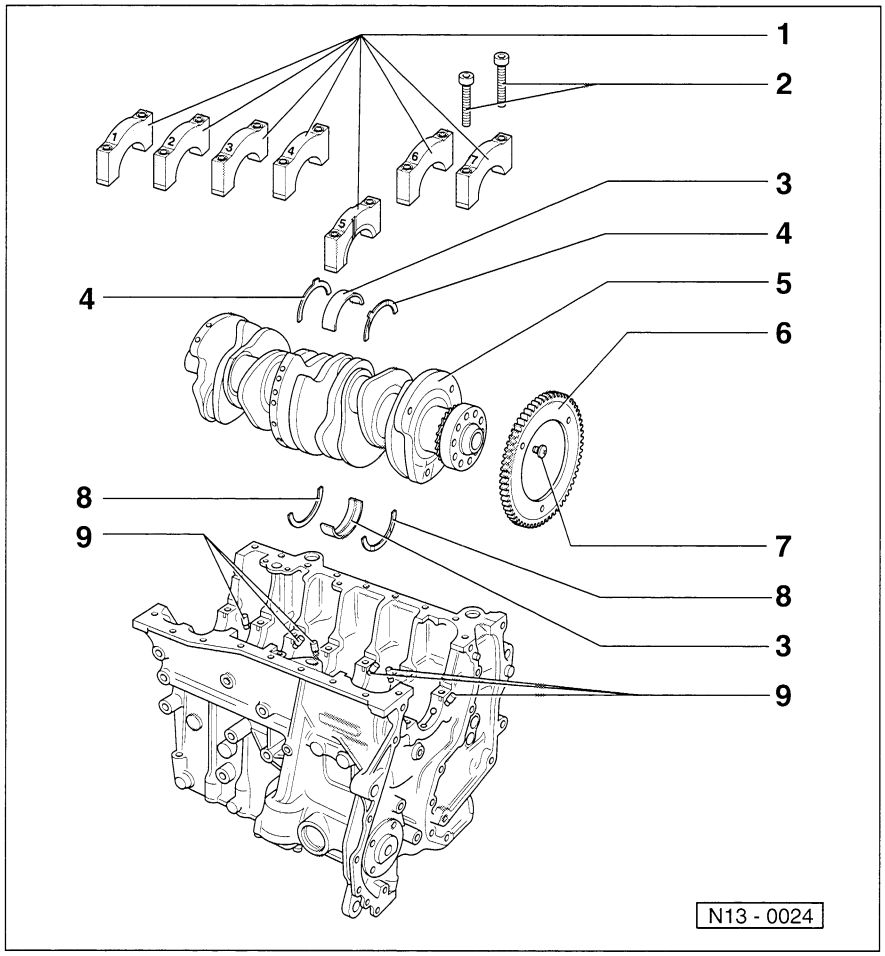
NOTE —

- *On cars with an automatic transmission, see* **Flywheel or Driveplate** *given earlier when reinstalling the driveplate. Special installation procedures apply.*
- *Attach engine to suitable engine stand when disassembling and assembling.*
- *Make sure that prior to removing the crankshaft you have provided a suitable place to put it so that the engine speed sensor wheel does not rest on anything or become damaged.*
- *When replacing bearing shells, use only bearing shells with the same color coding.*

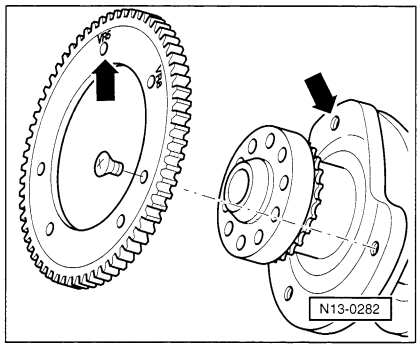
Table g. Crankshaft Specifications

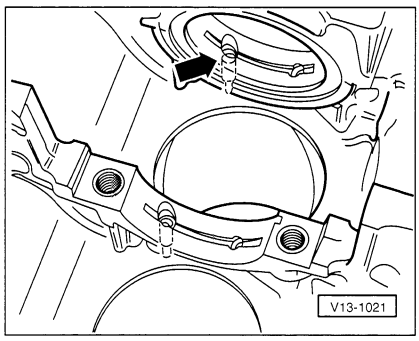
Main bearing radial clearance (Plastigage®)	
new parts	0.02–0.06 mm (.0008–.0024 in.)
wear limit	0.10 mm (.0039 in.)
Crankshaft axial play (side clearance)	
new parts (engine code AFP)	0.07–0.23 mm (.0028–.0091 in.)
new parts (engine code BDF)	0.07–0.24 mm (.0028–.0094 in.)
wear limit	0.30 mm (.0118 in.)
Crankshaft measurements	
main bearing	59.958–59.978 mm (2.3606–2.3613 in.)
connecting rod bearing	53.958–53.978 mm (2.1243–2.1251 in.)

Crankshaft assembly



1. **Bearing caps**
   - Bearing cap 1: vibration damper side
   - Bearing cap 5 with recesses for thrust bearings
   - Bearing shell retaining lugs engine block/bearing cap must be placed on the same side (on top of each other)
2. **Bolt**
   - Tighten to 30 Nm (22 ft-lb) + ½ turn (180°). Two ¼ turns (90° each) are permissible
   - Always replace
3. **Bearing shells 1-7**
   - For bearing caps without oil groove
   - For cylinder block with oil groove
   - Do not interchange used bearing shells (mark)
4. **Thrust bearing**
   - For bearing cap 5
   - Ensure proper positioning of lugs in bearing cap and block
5. **Crankshaft**
   - Regrinding not allowable
6. **Engine speed sensor wheel**
   - For engine speed (RPM) sensor (G28)
   - 58 teeth plus 2 missing for reference point (60 positions total)
   - Always replace if removed
   - Installing, see **Engine speed sensor wheel, installing**
7. **Bolt**
   - Tighten to 10 Nm (7 ft-lb) + ¼ turn (90°)
   - Always replace
8. **Thrust bearing**
   - For cylinder block, bearing 5
   - Note installation position
9. **Oil spray nozzles**
   - At crankshaft bearing positions 2 through 7
   - For piston cooling
   - Opening pressure: 2.0 bar (29 psi)
   - Removing and installing, see **Oil spray nozzles, removing and installing**





Engine speed sensor wheel, installing

- Make sure crankshaft connecting surface is free of grease.
- Apply a light coat of adhesive D 000 600 A2 to back of sensor wheel.
- Align "VR6" mark on sensor wheel (**left arrow**) with single threaded hole on crankshaft as shown (**right arrow**). Disregard "VR5" mark and corresponding holes on sensor wheel
- Ligthly install all mounting screws by hand.
- Torque screw at "VR6" mark first
- Tighten to 10 Nm plus + ¼ turn (90°).

Oil spray nozzles, removing and installing

- Use a 4 mm (5/32 in.) drift from behind to drive nozzles out
- Install nozzles using a 6 mm (7/32 in.) drift.

15a Cylinder Head and Valvetrain (1.8L Engine)

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15a

GENERAL

This section covers cylinder head and valvetrain service and repair work for the 4-cylinder, 5 valve per cylinder, turbo-charged 1.8 liter gasoline engine. For information on short block engine rebuilding and internal engine specifications, see **13a Crankshaft/Cylinder Block (4-cylinder)**.

Most of the operations described in this repair group require special equipment and experience. If you lack the skills, tools, or a suitable workplace for servicing or repairing the cylinder head, we suggest that you leave these repairs to an authorized Volkswagen dealer or other qualified shop.

Engine Code

- AWD, AWW, AWP . . . 1.8L 4-cylinder turbo gasoline

1.8 liter engines with codes AWW and AWP use a camshaft adjuster unit with an electronically operated solenoid to adjust camshaft timing. The engine control module (ECM) will signal the solenoid to adjust camshaft timing based upon engine load and RPM. This allows for variable valve timing, resulting in cleaner emissions.

DIAGNOSTIC TESTING

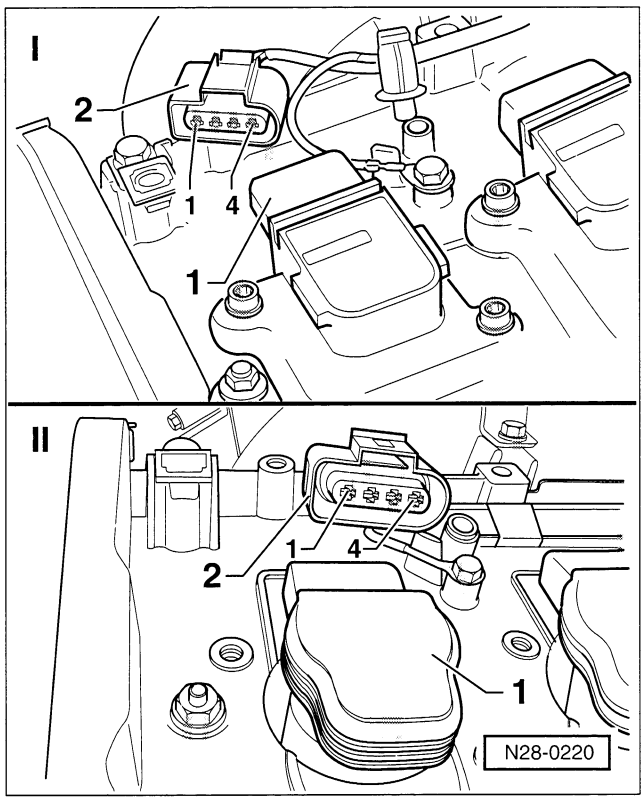
The tests that follow can be used to help isolate engine problems, to better understand a problem before starting expensive and extensive repairs, or to just periodically check engine condition.

Compression test

A compression test will tell a lot about the overall condition of the engine without the need for taking it apart. Testing is relatively simple and straightforward.

– Release locking pins for engine cover by turning 90°. Remove engine cover.

– Warm-up engine until it is a minimum of 30°C (86°F). Switch off ignition.



– Disconnect 4-pin harness connectors from all ignition coils. Remove all ignition coils.
  - For AWD engine, unbolt coils from head. (See **I** at left)
  - For AWW, AWP engines (see **II** at left), remove coils using special tool T10094.

– Use compressed air to clear area around spark plugs. Remove all spark plugs and lay aside in proper order.

– Remove fuse #32 for voltage supply to injectors.

– Fit compression tester into spark plug hole.

– Have a helper:
  - depress clutch pedal fully
  - put transmission in neutral or park
  - depress the accelerator pedal to floor
  - crank engine over with starter motor

NOTE —
Cranking engine with ignition system disabled and components disconnected will cause Diagnostic trouble codes (DTCs) to be stored in engine management system memory.

– Engine should be cranked a minimum of 4 to 5 revolutions.

– Record readings, release pressure in gauge and repeat procedure for each cylinder.

– Compare readings to specification.

Specification

- Compression pressures (1.8L engine)

new	10 to 14 bar (145 - 203 psi)
wear limit	7.0 bar (102 psi)
maximum difference between cylinders	3 bar (44 psi)

– When all cylinders have been checked, reinstall spark plugs and ignition coils, connect harness connectors for coils and install upper sound absorber panel.

Tightening torques

- Spark plug to cylinder head . . . . . 30 Nm (22 ft-lb)
- Ignition coil to cylinder head cover . . . 10 Nm (7 ft-lb)

Cylinder leakdown test

The most conclusive diagnosis of low compression symptoms requires a cylinder leak-down test. Using a special tester and a supply of compressed air, each cylinder is pressurized. The rate at which air leaks out of the cylinder, as well as the sound and location of escaping air can more accurately pinpoint the magnitude and source of leakage. Any engine compression diagnosis that will require major disassembly should first be confirmed by a cylinder leak-down test. Because this test requires special equipment and experience, it may be desirable to have it performed by a Volkswagen dealer or other qualified repair shop. Leakdown limit specifications are usually supplied by the equipment manufacturer.

CYLINDER HEAD SERVICE

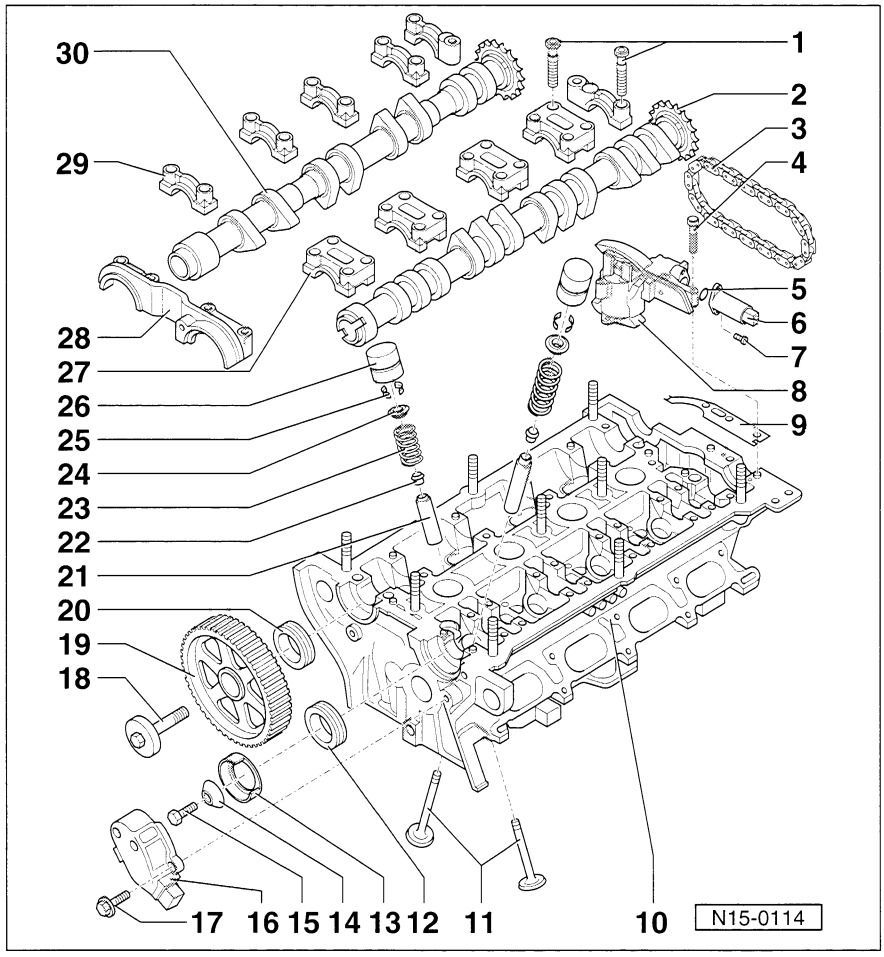
Many cylinder head repairs can be accomplished without removing the cylinder head from the engine. The cylinder head cover (valve cover) gasket, camshaft, camshaft oil seal, valve guide oil seals, valve springs, and camshaft followers are all accessible with cylinder head installed. This heading describes those repairs that can be done with cylinder head installed.

Exploded views of the internal and external cylinder head components are shown below.

NOTE —

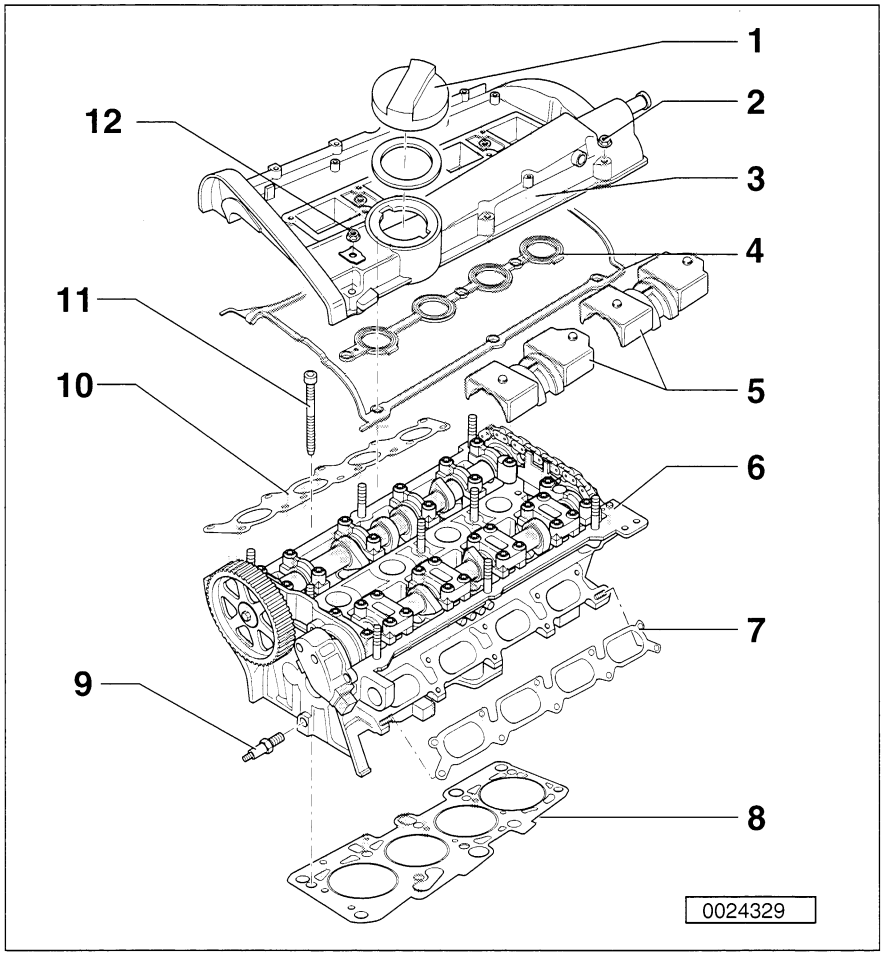
Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*

Internal cylinder head assembly



1. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
2. **Camshaft, intake**
   - With integral chain sprocket
   - Radial clearance (w/plastigage) wear limit: 0.1 mm (0.004 in.)
   - Run out: maximum 0.01 mm (0.0004 in.)
3. **Chain, camshaft drive**
   - Clean chain and sprocket and mark direction of rotation with ink or paint before removing
4. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
5. **O-ring (AWW/AWP only)**
   - Always replace
6. **Camshaft adjustment valve (N205) (AWW/AWP only)**
   - Resistance: 10-18Ω at room temp
7. **Screw (AWW/AWP only)**
   - Tighten to 3 Nm (27 in-lb)
8. **Camshaft adjuster (AWW/AWP only)**
   - AWD engine has chain tensioner
   - Compress with 3366 before removing
   - Apply sealant to outer edges before installing
9. **Gasket**
   - Rubber/metal seal
   - Always replace
10. **Cylinder head**
11. **Valves (5)**
    - Quantity: 2 exhaust, 3 intake
    - Sodium filled
    - Do not rework! Only lapping is permitted
12. **Oil seal**
13. **Shutter wheel**
    - For camshaft position sensor
    - Note installation position
14. **Washer**
    - Conical shape
15. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
16. **Camshaft position sensor (G40 or G163)**
17. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
18. **Camshaft sprocket bolt**
    - Tighten to 65 Nm (48 ft-lb)
    - Counterholder with 3036 to loosen and tighten
19. **Camshaft sprocket**
    - Installed position: small web faces outward and cylinder #1 TDC mark is visible
20. **Oil seal**
21. **Valve guide**
22. **Valve stem seal**
23. **Valve spring**
24. **Valve spring retainer**
25. **Valve keepers**
26. **Valve lifter, hydraulic**
    - Do not interchange
    - Equipped with hydraulic clearance compensation
    - Store with cam contact surface facing downwards
27. **Bearing cap, intake camshaft**
    - Note installation position and sequence
28. **Bearing cap, double**
    - Apply sealant to bearing cap/cylinder head mating surface before installing
    - Apply sealant AMV 174 004 01 to outer edges before installing
    - Ensure proper seating on dowel pins
29. **Bearing cap, exhaust camshaft**
    - Note installation position and sequence
30. **Camshaft, exhaust**
    - With integral chain sprocket
    - Radial clearance checked with plastigage wear limit: 0.1 mm (0.004 in.)
    - Run out: maximum 0.01 mm (0.0004 in.)

External cylinder head assembly



1. **Cap, oil filler**
   - Replace gasket if damaged
2. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
3. **Valve cover**
   - Also known as "cylinder head cover"
4. **Gasket, valve cover**
   - Set includes perimeter gasket and spark plug well seal
   - Replace if damaged
   - Apply sealant to corner areas at double bearing cap and chain tensioner of before installing
5. **Oil deflector**
   - Installed over intake camshaft
6. **Cylinder head**
   - Replace engine coolant if removing head
7. **Gasket, intake manifold**
   - Always replace
8. **Gasket, cylinder head**
   - Always replace
   - Metal construction
   - Installation position: part number must be readable from intake side
9. **Bolt, fitted**
   - Tighten to 27 Nm (20 ft-lbs)
   - Special fitted bolt for timing belt tensioner
   - Integral with tensioner on some engine versions
10. **Gasket, exhaust manifold**
    - Always replace
11. **Cylinder head bolt**
    - Always replace
    - Loosen and tighten in sequence only
12. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)

Cylinder head (valve) cover, removing and installing

– Remove upper sound absorber panel.

– Disconnect harness connectors from all ignition coils as shown earlier under **Compression test**.

– Remove all ignition coils.

– Remove ground wire terminal from cylinder head (valve) cover.

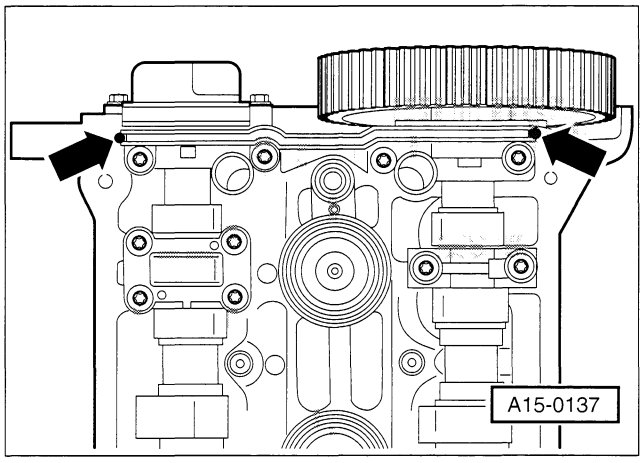
– Disconnect crankcase breather valve hoses from cylinder head cover.

– Remove nuts from cylinder head cover.

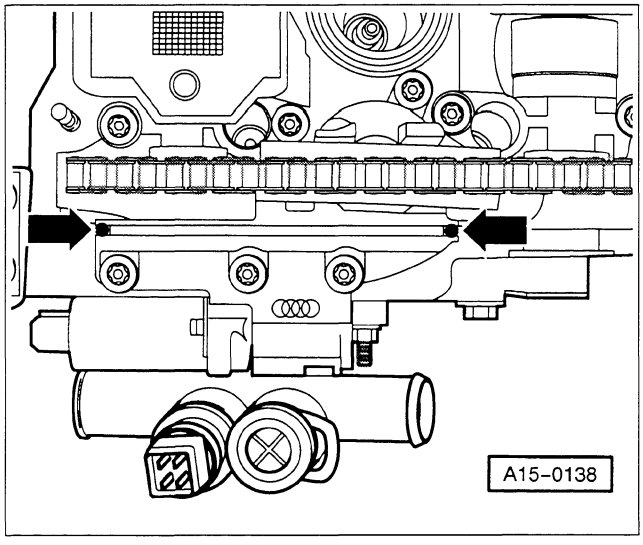
– Lift off cylinder head cover with outer gasket and spark plug well gasket.

Installation is reverse of removal noting the following additional points:

– Use new gaskets where appropriate.



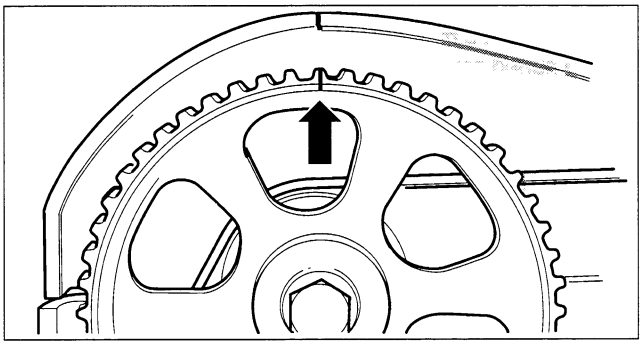
➢ Carefully apply a thin coat of sealant D 454 300 A2 to both edges of sealing surfaces between double bearing cap and cylinder head (**arrows**) using a small screwdriver or other suitable tool.



➢ Carefully apply a thin coat of sealant to both edges of sealing surfaces between camshaft adjuster and cylinder head (**arrows**) using a small screwdriver or other suitable tool.

Tightening torques

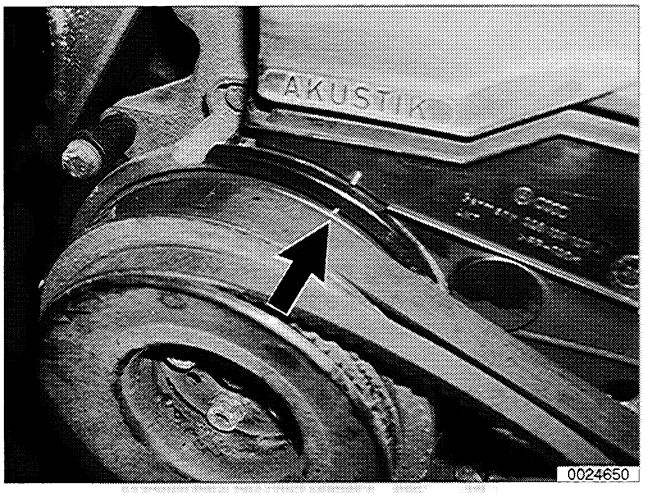
- Cylinder head cover to cylinder head 10 Nm (7 ft-lb)
- Ignition coil to cylinder head cover . . . 10 Nm (7 ft-lb)
- Ground wire to cylinder head cover . . 10 Nm (7 ft-lb)



Camshaft oil seal, exhaust cam, replacing

– Remove upper sound absorber panel and unclip and remove timing belt guard, upper section.

➢ Set engine to TDC (Top Dead Center) for cylinder #1 by turning crankshaft until timing mark (**arrow**) on camshaft sprocket aligns with mark on cylinder head (valve) cover.



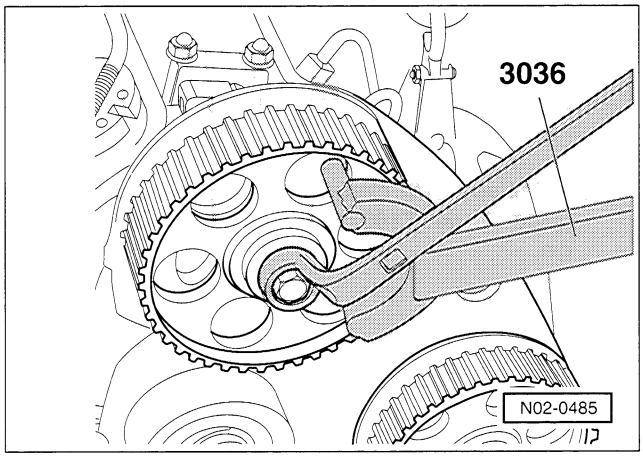
➢ Be sure that crankshaft timing marks (**arrow**) also align when setting engine to TDC.

– Remove cylinder head (valve) cover as given earlier.

– Release tensioning roller and slide timing belt off of camshaft sprocket.

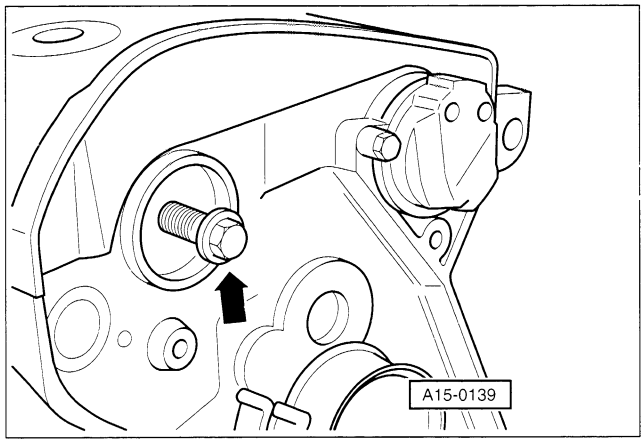
– Turn crankshaft back off TDC slightly.

NOTE —
Turning the crankshaft away from TDC slightly minimizes the chances of contact between pistons and valves upon re-assembly.



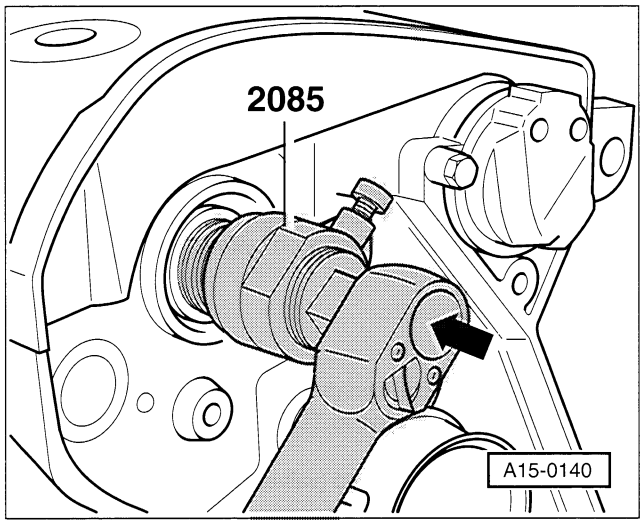
➢ Using a suitable spanner, remove camshaft sprocket bolt. (VW special tool **3036** shown to counter-hold sprocket).

– Remove camshaft drive sprocket and woodruff key.



➢ Thread camshaft sprocket bolt (**arrow**) back into camshaft by hand until it bottoms in camshaft.

NOTE —
Bolt is used to guide seal extractor tool.

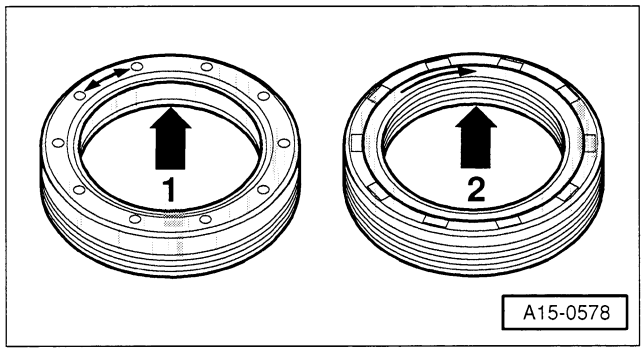


➢ Unscrew inner part of oil seal extractor **2085** two turns (approx. 3 mm) out of outer part and lock in position with knurled screw.

– Lubricate threaded head of oil seal extractor, place it in position and exerting firm pressure screw it into oil seal as far as possible

– Loosen knurled screw and turn inner part of extractor against camshaft until oil seal has been extracted.

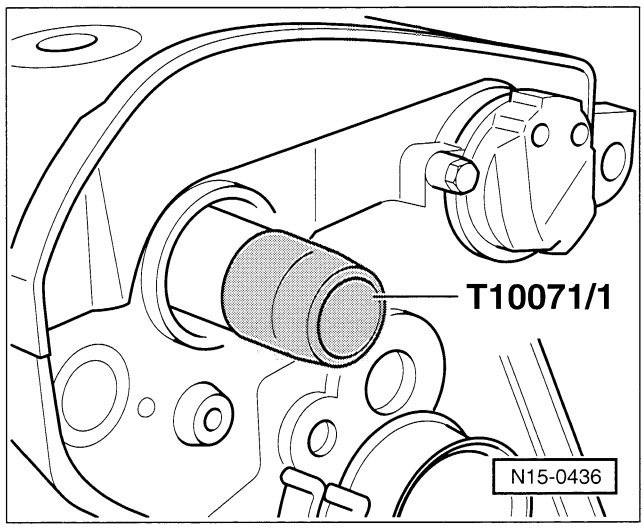
– Remove camshaft sprocket bolt.



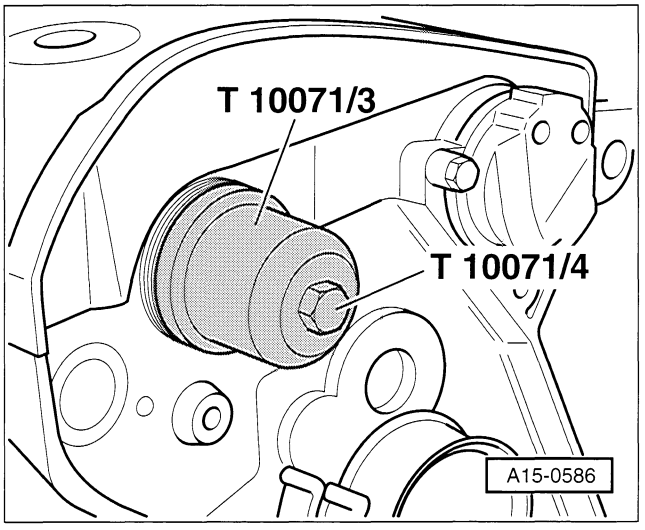
➢ Oil seal type identification
An oil seal constructed of PTFE (Teflon ®) was phased-in gradually during production of some engine types. PTFE oil seals replace the older spring-type seals, but spring-type seals should never be used in place of the PTFE type.

- PTFE (Teflon ®) seals (**right**) can be identified by the wider sealing lip (**arrow 2**). These seals are installed without lubricant of any kind on the seal.
- Spring-type seals (**left**) can be identified by the narrower sealing lip (**arrow 1**) and a tensioning spring behind the lip seal.

– Before installing new seal, clean oil from camshaft journal with clean cloth.



➢ Install seal with closed end facing out by sliding over guide sleeve (**T10071/1** shown) mounted on camshaft pin.



- Install the new oil seal by pressing seal into bottom of recess using seal installation tools (**T10071/3** and **T10071/4** shown)
- Install woodruff key and camshaft sprocket, hold sprocket with a spanner and torque bolt.

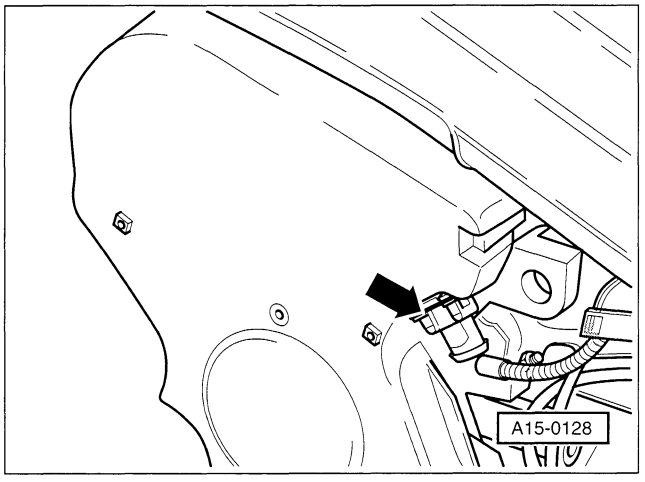
Tightening torque

- Camshaft sprocket to camshaft . . . . 65 Nm (48 ft-lb)

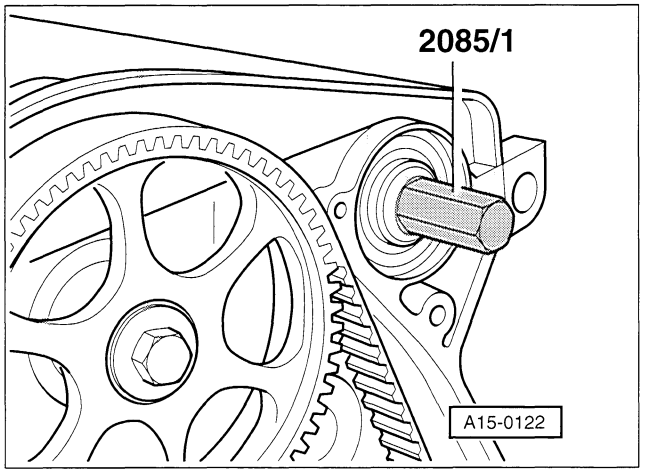
- Turn crankshaft back to TDC.
- Install timing belt and adjust tension, see **Timing Belt–Camshaft Drive**, given later.
- Install cylinder head (valve) cover, breather valve hoses and ignition coils.
- Install timing belt guard upper section, upper engine cover and any other removed components.
- Be sure to quality check your work, see **Quality Review** at end of this repair group.

Camshaft oil seal, intake cam, replacing

The camshaft position sensor is located behind the timing belt guard, upper section and is driven by the intake camshaft. A seal on the intake camshaft prevents oil leaks into the camshaft position sensor.



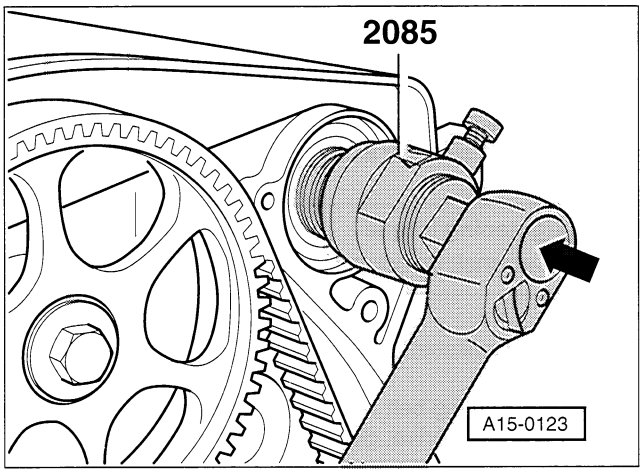
- Remove harness connector (**arrow**) from camshaft position sensor.
- Remove timing belt guard, upper section.
- Remove camshaft position sensor.
- Remove bolt, conical washer and shutter wheel from intake camshaft.



- Install guide tool (**2085/1** shown) into camshaft.

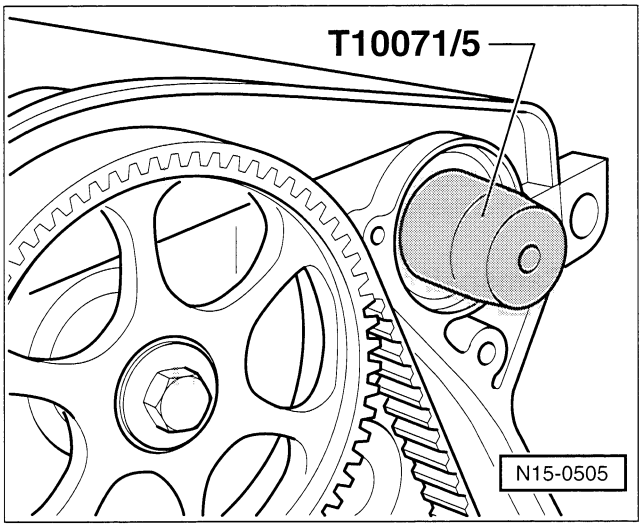
NOTE —

Guide tool is used to prevent damage to end of camshaft.



➢ Remove seal using a suitable seal extractor (**2085** shown).

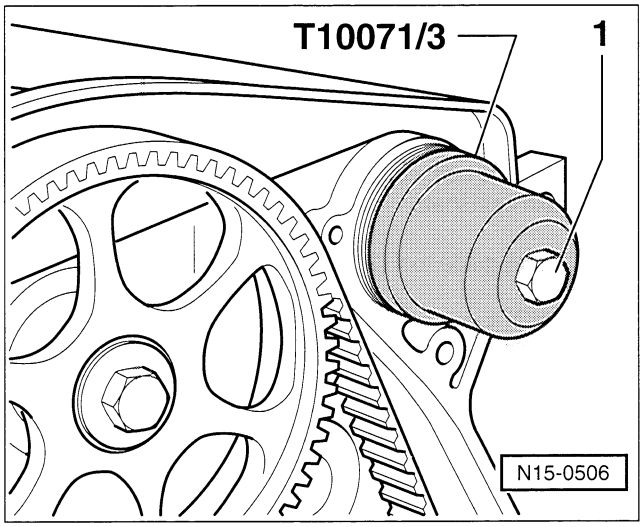
– Remove guide tool from camshaft.



➢ Install guide sleeve onto camshaft journal and slide seal over guide.

- Install with closed end facing out.
- For PTFE seal use **T10071/5** guide sleeve, as shown.
- For non-PTFE seal with annular spring, use **3241/2** guide sleeve. Lightly oil sealing lip.

– Before installing new seal, clean oil from camshaft journal with clean cloth.



➢ Install the new oil seal and press to bottom of recess using press sleeve.

- Install seal with closed end facing out.
- For PTFE seal use **T10071/3** press sleeve, as shown.
- For non-PTFE seal with annular spring, use **3241/1** press sleeve. Lightly oil sealing lip.

– Install shutter wheel, conical washer and bolt.

– Install camshaft position sensor.

Tightening torque

- Camshaft position sensor to cylinder head . . . . . 10 Nm (7 ft-lb)
- Shutter wheel to intake camshaft . . . 25 Nm (18 ft-lb)

– Install timing belt guard, upper section.

– Install harness connector for camshaft position sensor.

– Be sure to quality check your work, see **Quality Review** at the end of this repair group.

Camshafts, removing and installing

The intake and exhaust camshafts are removed and installed together with the drive chain and tensioner. This operation can be accomplished with the cylinder head installed. Removing the camshafts allows access to the hydraulic cam followers, the valve springs and the valve stem oil seals.

– Remove upper sound absorber panel and unclip and remove timing belt guard, upper section.

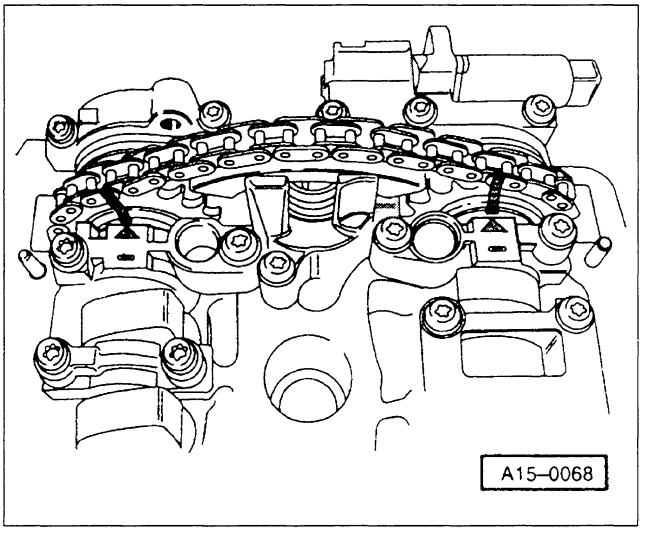
– Set engine to TDC for cylinder #1 by turning crankshaft until timing mark on camshaft sprocket aligns with mark on cylinder head (valve) cover as shown earlier.

– Remove cylinder head (valve) cover as given earlier.

– Release tensioning roller and slide timing belt off of camshaft sprocket.

– Turn crankshaft back off of TDC slightly.

NOTE —
Turning the crankshaft away from TDC slightly minimizes the chances of contact between pistons and valves upon re-assembly.



– Using a suitable spanner, remove the camshaft sprocket bolt as shown earlier.

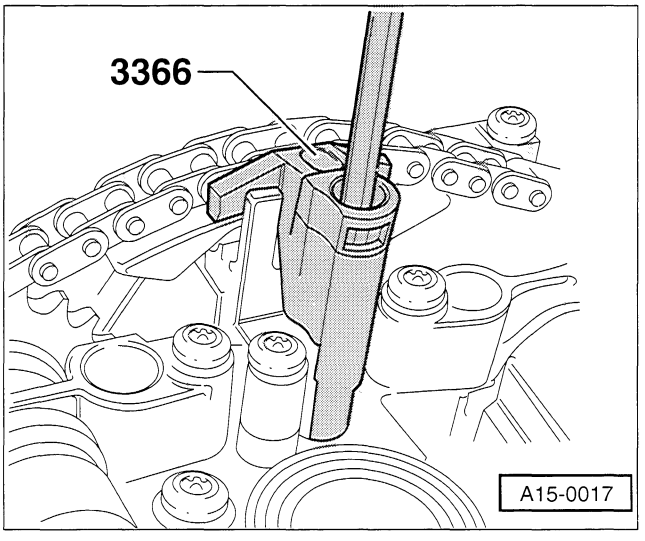
– Remove camshaft drive sprocket.

– Remove camshaft position sensor, conical washer and shutter wheel.

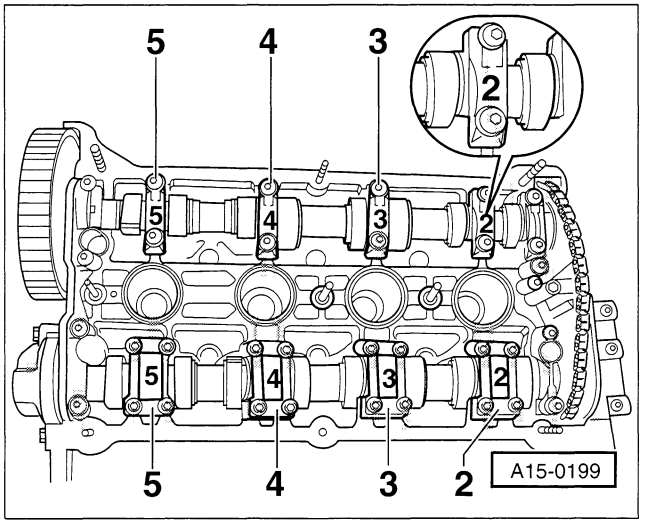
– Lift off plastic oil deflector to expose camshafts.

➤ Clean drive chain and camshaft sprocket in areas of arrows on bearing caps with a suitable degreaser. Mark installed position of drive chain and camshaft chain sprocket with a permanent marker pen in area of **arrows** on bearing caps.

NOTE —
- *Do not mark chain with a punch mark, notch or similar.*
- *The distance between both arrows or the permanent marker marks equals 16 rollers on the drive chain.*



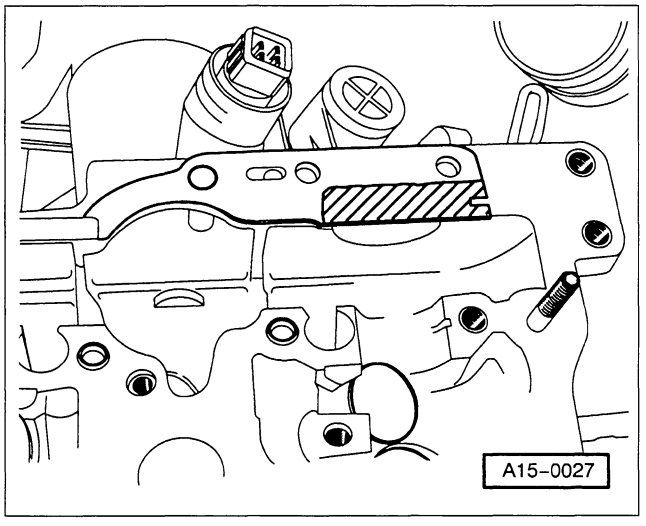
➤ Compress drive chain tensioner using special tool 3366, or equivalent. Tool shown pulls from bottom and top simulatneaously.



➤ Remove both camshafts together with the tensioner and the chain. Upper camshaft is exhaust and lower camshaft is intake in illustration at left. Use the following sequence for removal:

- Remove intake camshaft bearing caps **3** and **5**.
- Remove exhaust camshaft bearing caps **3** and **5**.
- Remove double bearing cap at sprocket end.
- Remove intake and exhaust camshaft bearing caps at chain sprocket end.
- Remove chain tensioner securing bolts.
- Remove intake camshaft bearing caps **2** and **4** alternately and evenly.
- Remove exhaust camshaft bearing caps **2** and **4** alternately and evenly.
- Remove drive chain tensioner.
- Remove drive chain tensioner compressor.

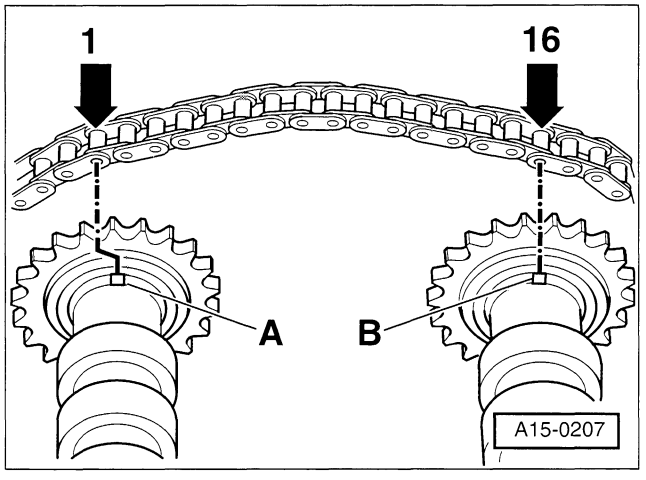
NOTE —
Mark each bearing cap before removing. Each cap is machined to each journal and must be reinstalled to that exact location to prevent damage.



– Lift out both camshafts with drive chain and tensioner and lay aside.

NOTE —
Once removed, the camshafts should be checked for wear and other visible damage as described later under **Cylinder Head Components**.

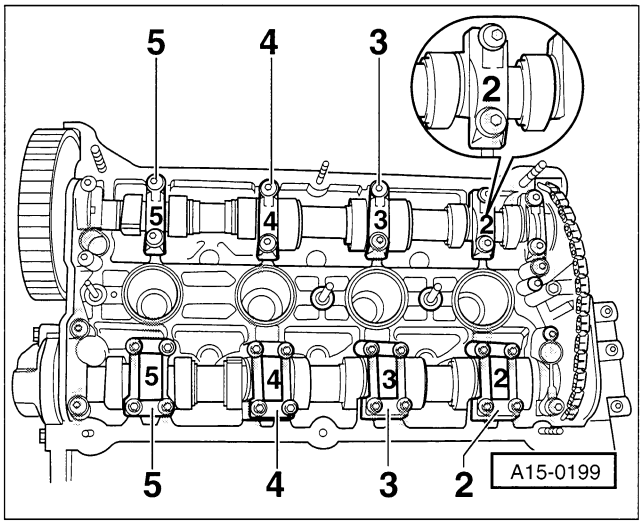
➤ Replace rubber/metal seal for chain tensioner and lightly coat with sealant in lined area shown at left.



➤ Install drive chain onto camshaft sprockets.

- Install drive chain with exactly 16 rollers between the notches (**A** and **B**) on the camshafts.
- Exhaust camshaft notch is slightly offset to the inside.
- Install compressor onto drive chain tensioner.
- Slide drive chain tensioner into drive chain between camshafts.
- Oil bearing surfaces of cylinder head and both camshafts.
- Install camshafts with drive chain tensioner into cylinder head. Lobes for cylinder number #1 of both camshafts and notches must point up.

NOTE —
When re-using an original drive chain, align marks made prior to removal. In all instances, however, there must be exactly 16 rollers between notches on camshafts.



– Install drive chain tensioner over dowel sleeves. Torque to specification.

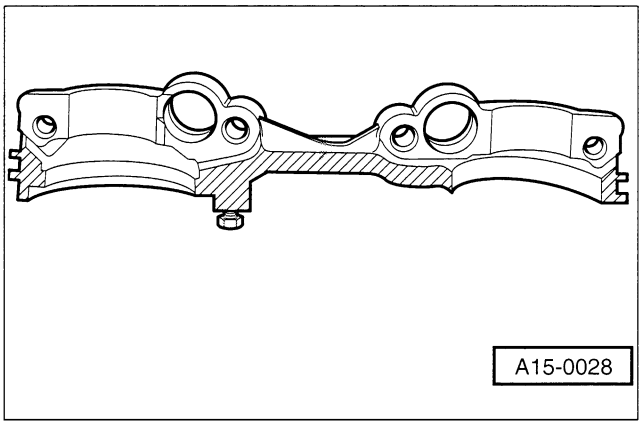
➢ Install bearing caps 2 and 4 for exhaust and intake camshafts over dowel sleeves. Tighten nuts alternately and evenly so that camshafts are drawn down fully and evenly into bearing saddles. Torque to specification.

Tightening torques

- Camshaft bearing cap to cylinder head . . . . . 10 Nm (7 ft-lb)
- Drive chain tensioner to cylinder head . . . . . 10 Nm (7 ft-lb)

CAUTION —

- *Be sure to install bearing caps correctly. The caps are bored off-center and only fit properly one way. Caps are matched to the cylinder head by the machining process and are not available separately. Broken caps will require the replacement of the cylinder head.*
- *When installed properly, cap markings can be read from intake side of cylinder head.*



– Install bearing caps over dowel sleeves at chain sprocket ends of both camshafts. Torque to specification.

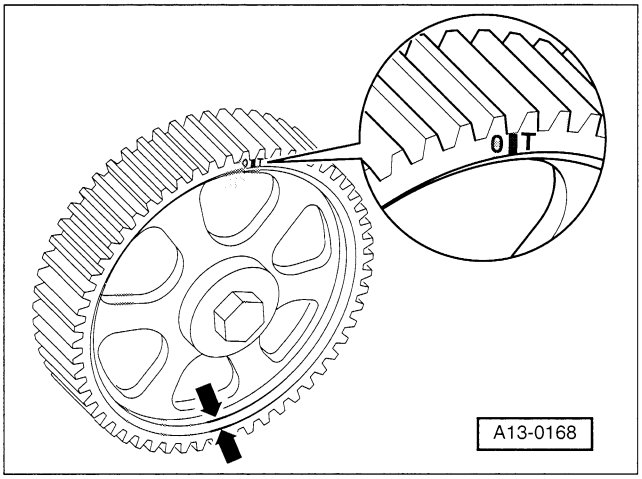
– Remove drive chain tensioner compressor.

➢ Lightly coat double bearing cap with sealant in lined area shown at left. Install over dowel sleeves. Torque to specification.

– Install remaining bearing caps. Torque to specification.

Tightening torque

- Camshaft bearing cap to cylinder head . . . . . 10 Nm (7 ft-lb)



– Observe installed position of camshaft drive sprocket.

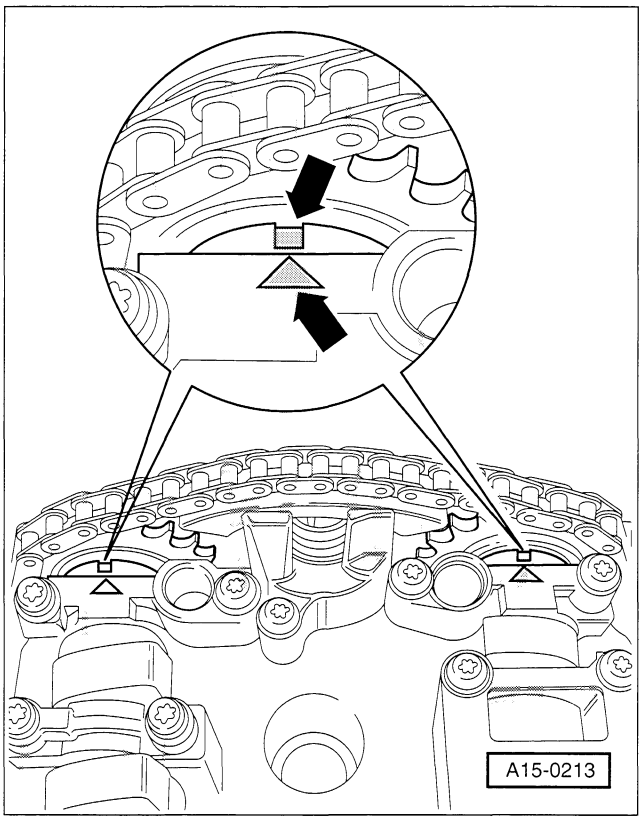
➢ Install camshaft drive sprocket with beveled edge (**arrows**) and cylinder #1 TDC markings facing outward. Use a suitable spanner wrench to tighten as shown earlier.

NOTE —

Ensure that camshaft lobes for cylinder #1 are still pointing up.

Tightening torque

- Camshaft sprocket to camshaft . . . . 65 Nm (48 ft-lb)



- Re-check position of camshafts. Position camshafts with drive sprocket so that arrows on bearing caps align with notches on camshafts. There must be exactly 16 chain rollers between notches.

- Install cylinder head (valve) cover.

- Install toothed camshaft drive belt and adjust tension, see **Timing Belt - Camshaft Drive** given later.

- Install timing belt guard, upper sound absorber panel and any other removed components.

> ***CAUTION —***
> *After installing the hydraulic cam followers, the engine should not be started for at least 30 minutes. Cam followers must be allowed to bleed down once they are installed. Failure to do so may cause the valves to strike the pistons resulting in serious damage.*

- Be sure to quality check your work, see **Quality Review** at the end of this repair group.

Hydraulic cam followers, checking

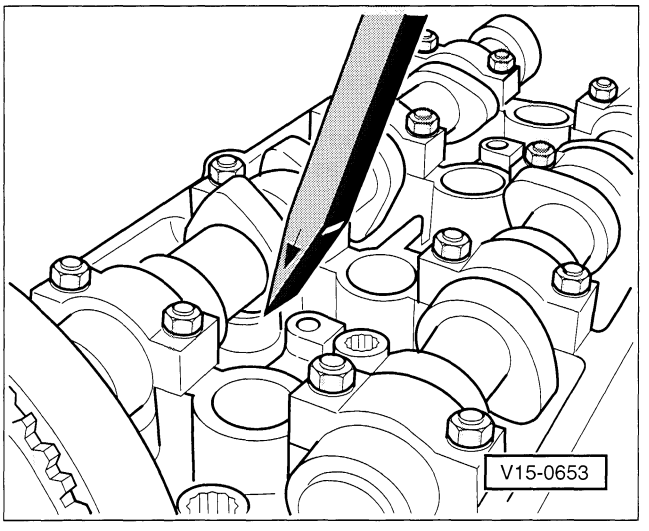
The 1.8 liter engine is equipped with hydraulic cam followers, also known as valve lifters. The cam followers are pumped up by engine oil pressure, expanding as necessary to fill the gap between the valve stem and the camshaft lobe. This occurs continuously and automatically to keep the valve in proper adjustment at all times.

Some valve noise at start-up and during the warm-up period is normal at times due to hydraulic cam followers that have bled down while the engine was not running. Before checking noisy cam followers, check that the engine oil is new and fresh, of the correct weight, and that the level is correct. Allow 2 minutes with a warm engine running at a fast idle for the lubrication system to properly pump up the cam followers.

Cam followers should only be checked when the engine is warm. Run the engine until the radiator fan has switched on at least one time. Increase the engine speed to 2,500 rpm and hold it there for approximately 2 minutes. If the hydraulic cam followers are still noisy, shut the engine off and proceed as follows while the engine is still warm.

- Remove cylinder head (valve) cover. See **Cylinder head (valve) cover, removing and installing**, given earlier.

- Turn engine by hand in the running direction until all camshaft lobes of cylinder #1 are pointing approximately up.



NOTE —
Hydraulic cam follower clearance can be checked on any cam follower (lifter) that is not being depressed by the camshaft lobe.

➤ Check clearance between cam follower and cam lobe on cylinder #1 using a plastic wedge as shown at left:

- Insert a 0.2 mm (0.008 in.) feeler gauge between the camshaft lobe and the follower. If clearance exceeds 0.2 mm (0.008 in.) replace the follower.
- If clearance is less, or if no clearance is present, lightly depress cam follower with a wooden or plastic wedge and insert a feeler gauge between camshaft lobe and the follower. If clearance exceeds 0.2 mm (0.008 in.), the lifter is faulty and should be replaced.

Specification

- Hydraulic cam follower maximum clearance (1.8L engine) . . . . . 0.2 mm (0.008 in.)

– Turn engine by hand and repeat procedure until all cam followers have been checked.

– Replace a faulty cam follower by removing camshaft as previously described and pulling follower from cylinder head. Faulty hydraulic cam followers can be replaced individually but only as a complete assembly.

CAUTION —
After installing new hydraulic cam followers, the engine should not be started for at least 30 minutes. New cam followers are usually at full extended height and must be allowed to bleed down to their proper height once installed. Failure to do so may cause the valves to strike the pistons resulting in serious damage.

NOTE —
Store removed hydraulic cam followers in order on a clean surface with the camshaft contact surface facing down to minimize bleed down. Cover with a clean lint-free shop cloth.

Valve stem oil seals, replacing

The sign of faulty valve stem seals is excessive oil consumption and oil smoke from the exhaust. This is usually most noticeable during periods of high manifold vacuum such as deceleration. If compression and leak-down testing confirm the integrity of the piston rings and the turbocharger shaft seals are good, but the engine consumes oil, it is possible that faulty valve stem seals are present. It should also be noted that worn valve stem seals could be due to worn valve guides and that the worn valve guides are the major cause of the oil consumption. See **Cylinder Head Components** for more information on checking valve guides.

Replacing the valve stem oil seals requires removal of the camshaft, cam followers, and the valve springs. This can be done with the cylinder head installed or removed. In either case, numerous Volkswagen special tools are required to compress the valve springs and remove and install the seals.

Working with the cylinder head installed:

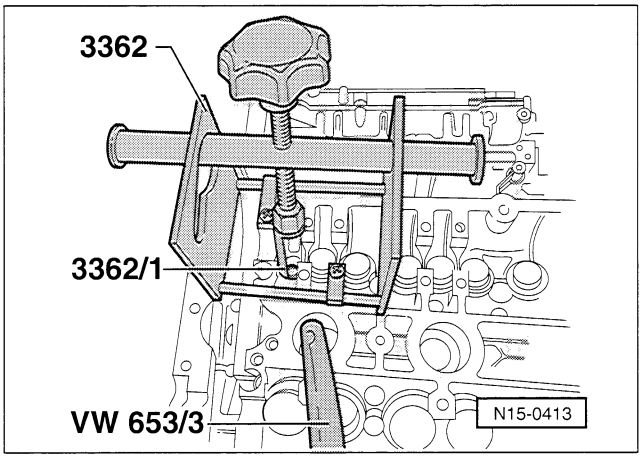
- Remove cylinder head (valve) cover, camshafts, and hydraulic cam followers as described earlier.
- Remove spark plugs.
- Set engine to bottom dead center (BDC) for cylinder #1 by turning crankshaft.
- Apply a continuous supply of compressed air with a minimum of 6 bar (87 psi) into the first spark plug hole with an adapter. This must be done to hold the valves in place while the springs are removed. Continue with **Working with cylinder head removed or installed:**.

> ***CAUTION —***
> *Compressed air supply must be able to maintain at least 6 bar (87 psi) during this repair. If air supply is interrupted while valve spring is removed, valve will fall into the cylinder and may require cylinder head removal to retrieve.*

Working with the cylinder head removed (only):

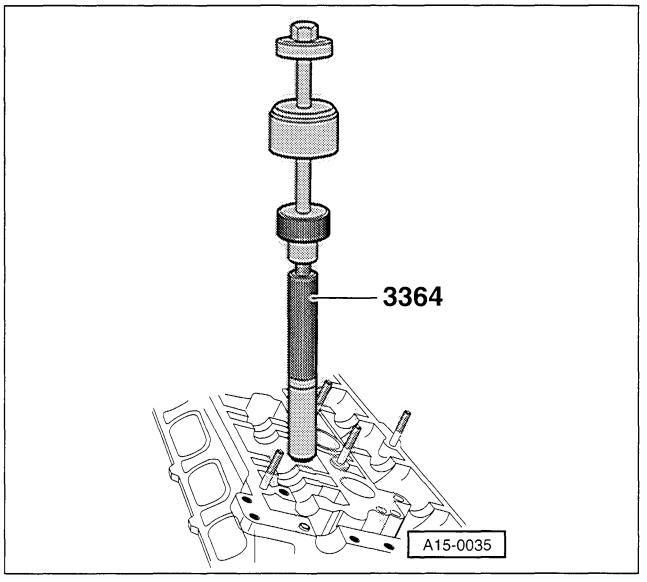
- Secure cylinder head to workbench. Use care to avoid damage to head gasket surfaces.
- Remove camshaft and hydraulic cam followers as described earlier. Continue below.

Working with cylinder head removed or installed:

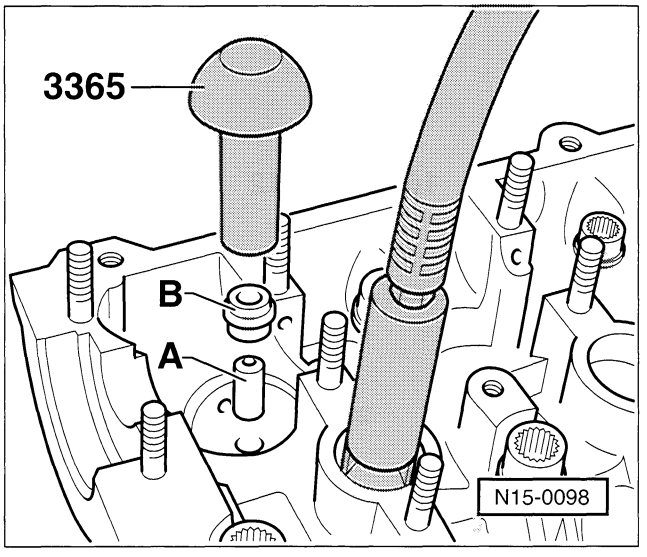


- Install appropriate valve spring compressor tools. Compress spring for the first cylinder and remove spring retainer, both keepers, and valve spring. If spring will not compress, lightly tap tool to release stuck keepers. Use a small magnet to retrieve keepers.

> ***NOTE —***
> *Volkswagen valve spring compressor tool 3362 has different positions for compressing the various valves:*
> - *Outer intake valve - lower position*
> - *Center intake valve - upper position*
> - *Exhaust valve - lower position*



➤ Remove valve stem seals with special slide hammer tool (VW special tool 3364 shown).



– Begin installation of new seal by temporarily fitting a protective plastic fitting sleeve over the valve stem. This sleeve is usually included with new seal set and will prevent damage to the seal due to the sharp edges of the keeper grooves. Lubricate new seal with clean engine oil and position it in installation tool.

➤ Push the installation tool (**3365**) with valve stem seal (**B**) down over valve stem until seal is fully seated on guide. Remove tool and protective fitting sleeve (**A**).

– Reinstall valve spring, retainer and keepers.

– Repeat for the each valve on the cylinder.

– When all valve seals have been replaced on the first cylinder, transfer compressed air adapter (if working with cylinder head installed) to next cylinder and repeat process until all valve seals have been replaced.

– Remaining installation is reverse of removal.

CAUTION —
To prevent cylinder head or camshaft damage, be sure to follow the camshaft installation procedure exactly when tightening the camshaft bearing caps. See **Camshaft, removing and installing**.

Tightening torque

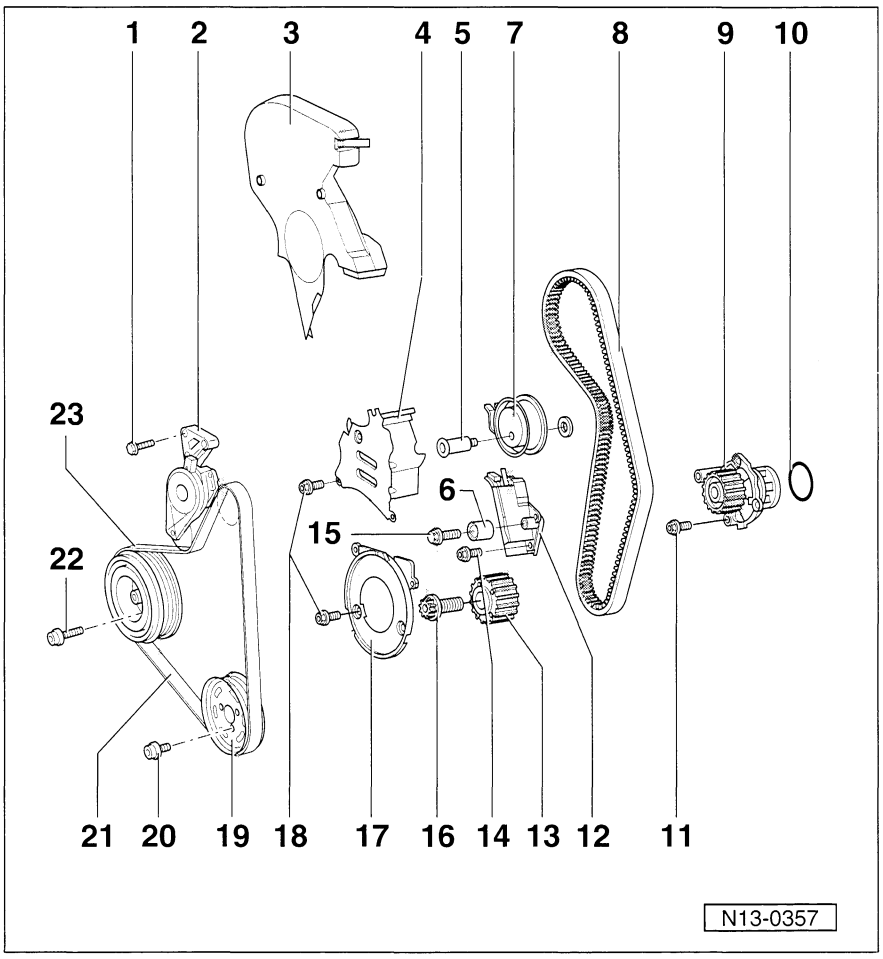
- Spark plug to cylinder head . . . . . 30 Nm (22 ft-lb)

– Be sure to quality check your work, see **Quality Review** at end of this repair group.

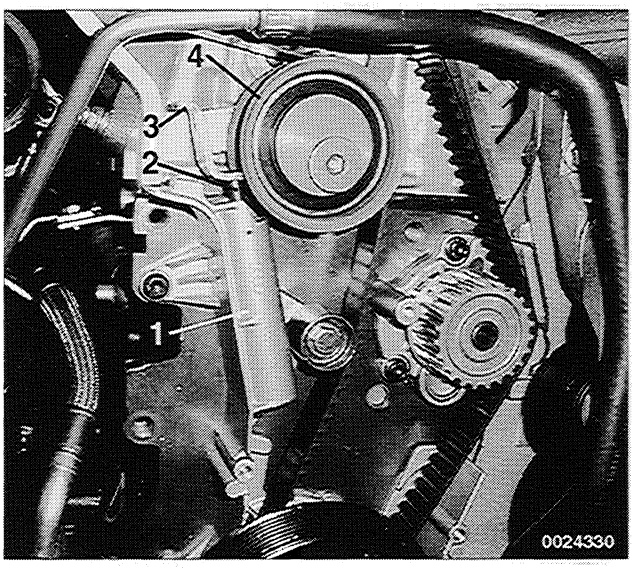
TIMING BELT - CAMSHAFT DRIVE

The timing belt, also known as the toothed belt or camshaft drive belt, and its related parts are shown at right. The belt and tensioner should be inspected and replaced at regular intervals, see **0 Maintenance**. The belt width can also be measured to help determine wear, see **0 Maintenance**. Belt replacement will prevent damage to the engine due to belt stretch or breakage.

Drive belts, assembly



1. **Bolt**
   - Tighten to 25 Nm (18 ft-lb)
2. **Tensioner, ribbed V-belt**
   - Loosen ribbed belt by turning with open-end wrench
3. **Timing belt guard, upper section**
4. **Timing belt guard, center section**
5. **Bolt, fitted**
   - Tighten to 27 Nm (20 ft-lbs)
   - Special fitted bolt for timing belt tensioner
   - Integral with tensioner on some engine versions
6. **Idler roller**
7. **Tension roller, timing belt**
8. **Timing belt**
   - Mark engine direction of rotation before removing
   - Check for wear
   - Do not kink
9. **Coolant pump**
10. **O-ring**
    - Always replace
11. **Bolt**
    - Tighten to 15 Nm (11 ft-lb)
12. **Tensioning damper**
    - See **Timing belt tensioner assembly** on following page
13. **Timing belt drive sprocket (crankshaft)**
14. **Bolt**
    - Tighten to 15 Nm (11 ft-lb)
15. **Bolt**
    - Tighten to 20 Nm (15 ft-lb)
16. **Bolt**
    - Tighten to 90 Nm (66 ft-lb) + ¼ turn (90°)
    - Always replace
    - Threads and shoulder must be free of grease
    - Counterhold with 3415 as required
17. **Timing belt guard, lower section**
18. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
    - Install with locking fluid D 000 600 A2
19. **Pulley**
    - For power steering pump
20. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
21. **Ribbed belt**
    - Mark direction of rotation before removing
22. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
23. **Belt pulley/vibration damper**
    - Can only be installed in one position, holes are offset
    - Note position when installing timing belt



Timing belt tensioner, assembly

Components of timing belt tensioner.

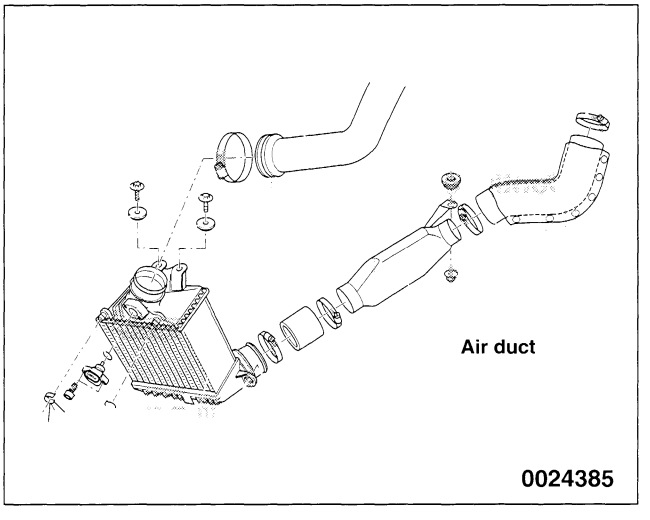
- Tension damper (**1**)
- Tension damper piston (**2**)
- Tension damper arm (**3**)
- Tension roller (**4**)

Timing belt for camshaft drive, removing

– Remove the upper sound absorber panel.

– Remove the lower sound absorber panel (belly pan).

– Remove passenger side headlight, see **94 Lights, Accessories–Exterior**.

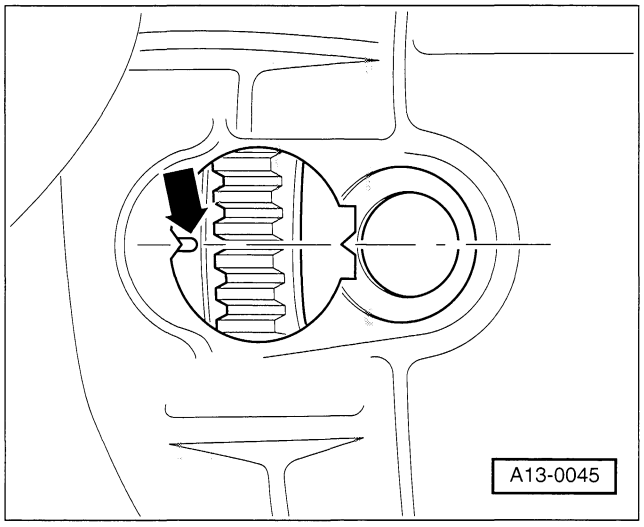


Remove air duct between intercooler and turbocharger.

– Remove the ribbed belt and tensioner, see **0 Maintenance**.

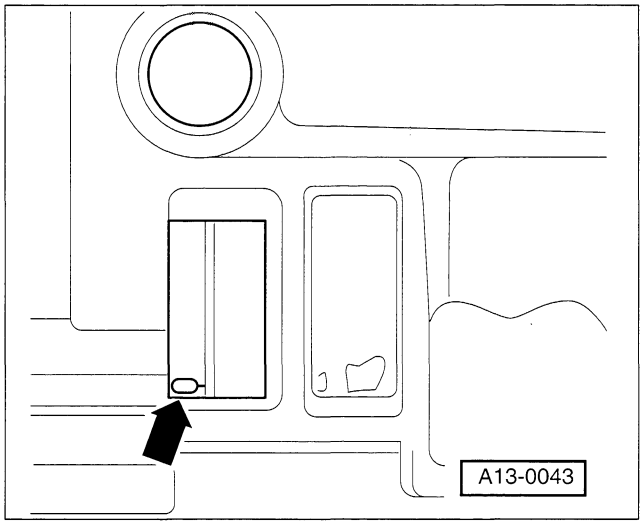


Set engine to TDC for cylinder #1 by turning crankshaft until timing marks line up on belt pulley (**arrow**) and timing belt guard.



Manual transmission vehicles

Confirm that engine is set to TDC for cylinder #1 by checking that timing mark on flywheel (**arrow**) lines up with notch at inspection hole on manual transmission.

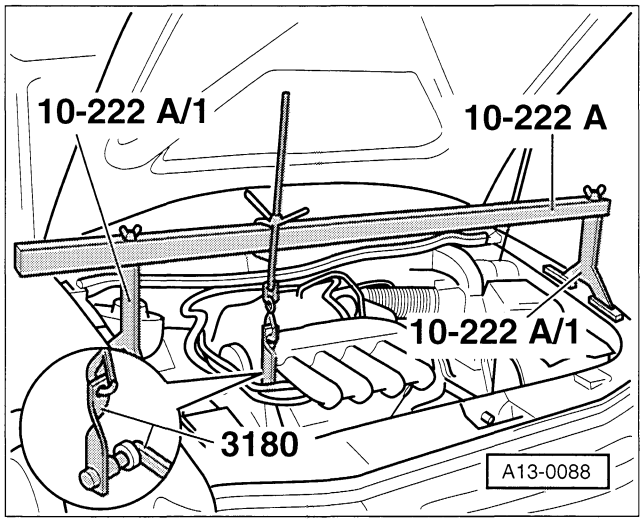


Automatic transmission vehicles

Confirm that engine is set to TDC for cylinder #1 by checking that timing mark on torque converter (**arrow**) lines up with edge of inspection hole on automatic transmission.

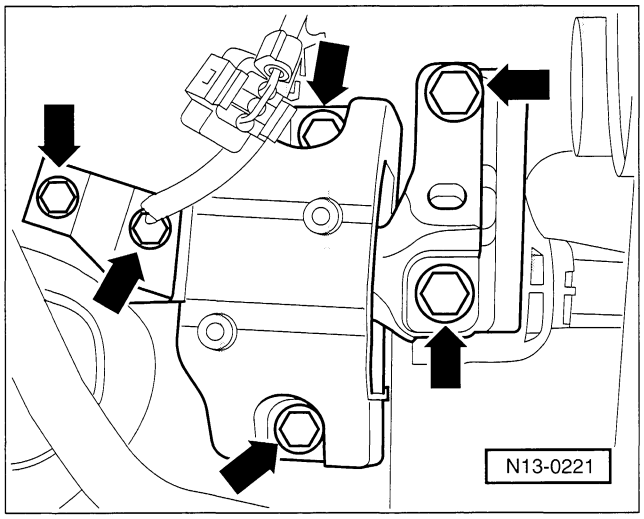
Continued for all vehicles

- Remove coolant expansion tank without disconnecting hoses and move to the side.
- Remove power steering reservoir without disconnecting hoses and move to the side.
- Label and remove vacuum hoses from evaporative emission solenoid and throttle control module.
- Remove timing belt guard, upper section.



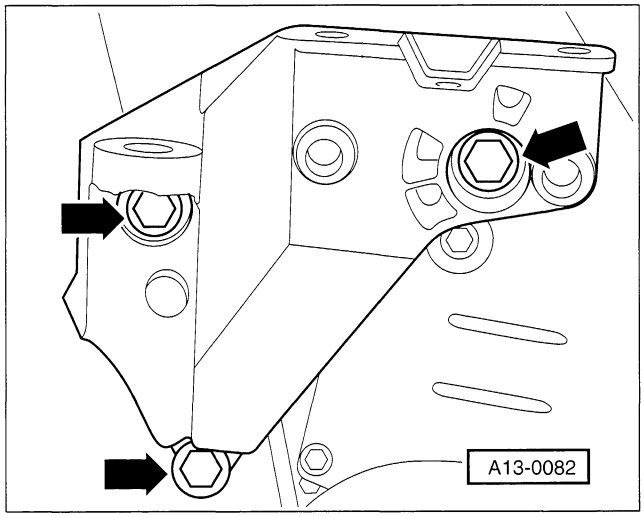
Support engine with a suitable fixture that is designed to support the weight of the engine and transmission without damaging the body.

- Lift the supporting device slightly, so that the weight of the engine and transmission is on the supporting device.

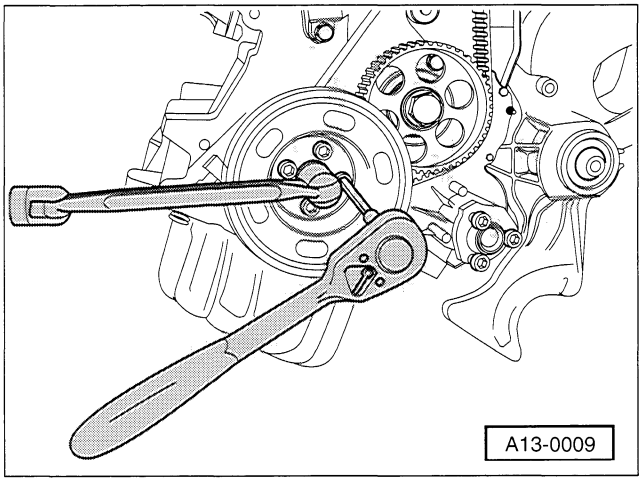


➢ Remove right side engine mount bolts (**arrows**) and mount from body and bracket on engine.

NOTE —
When loosening the right side engine mount, raise the engine slightly with the support device.



➢ Remove right side engine mount bracket from engine block. There will not be sufficient room to withdraw the bolts, so the bracket and the bolts (**arrows**) are all removed at the same time.

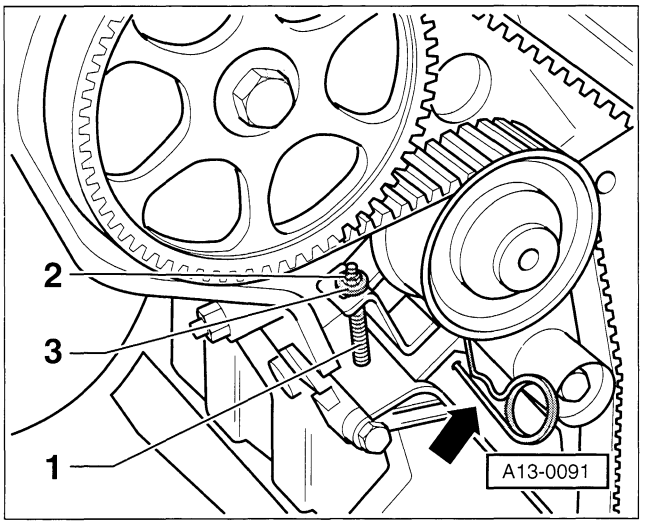


➢ Counter-hold the large center bolt of the crankshaft V-belt pulley/vibration damper while removing the four pulley mounting bolts. Remove the V-belt pulley from the crankshaft timing belt sprocket.

NOTE —
Early version of crankshaft V-belt pulley and engine block shown at left.

– Remove the timing belt guard, center and lower sections. See **Drive belts, assembly** given earlier.

– Mark running direction of timing belt.



➤ Release tension on timing belt and remove belt.

- Screw a 5x55 mm threaded stud or tool **T10092** (**1**) into timing belt tensioning damper housing and install a nut (**2**) and washer (**3**) to the other end
- Line up the hole in the tensioning damper housing with the hole in the pressure piston by turning the pressure piston. Use a suitable tool to turn the pressure piston before tightening the nut on the threaded stud
- Tighten nut (**2**) on threaded stud until the hole in the pressure piston aligns with the hole in the tension damper housing
- Secure pressure piston in position with a pin or tool **T40011** (**arrow**) inserted through hole in tensioning damper housing

– Remove timing belt.

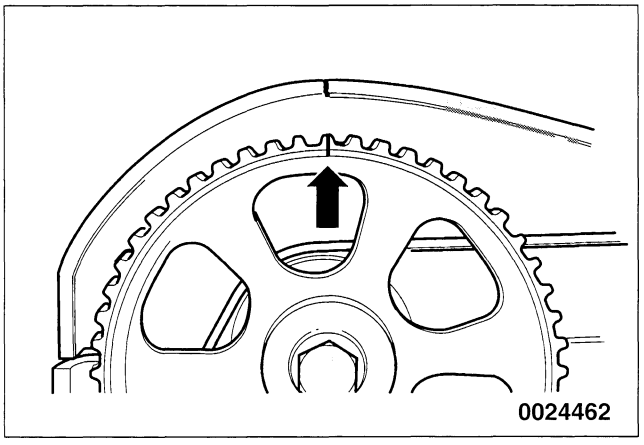
– Turn crankshaft back off of TDC slightly.

CAUTION —
Due to engine design, care must be used when turning the camshaft with the timing belt removed. If valves are allowed to open with the piston at TDC, serious internal damage will result.

Timing belt for camshaft drive, installing

CAUTION —
Belt tension must not be adjusted on a hot engine. Allow to cool sufficiently before proceeding. Engine temperature must be no hotter than warm to the touch.

– Ensure that crankshaft is NOT at TDC.



➤ Align mark on camshaft sprocket with mark on upper rear timing belt guard. This brings the camshaft to TDC for cylinder number #1.

– Install timing belt onto the crankshaft (not camshaft) drive sprocket only.

NOTE —
If re-using an old belt, be sure to note running direction marks placed on it before removal.

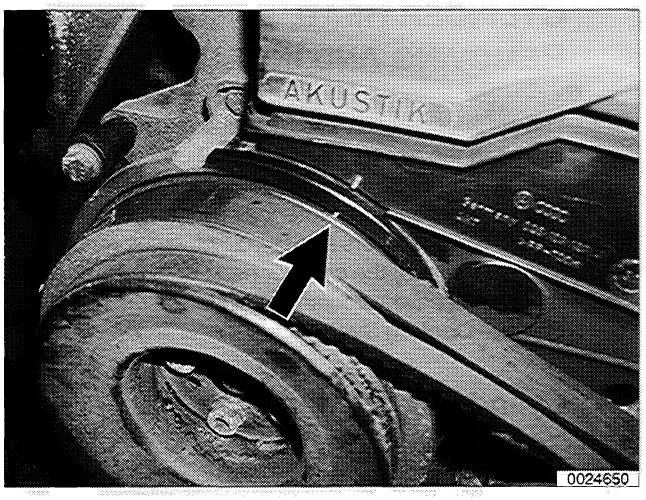
– Install bolts into right side engine mount bracket and install on cylinder block.

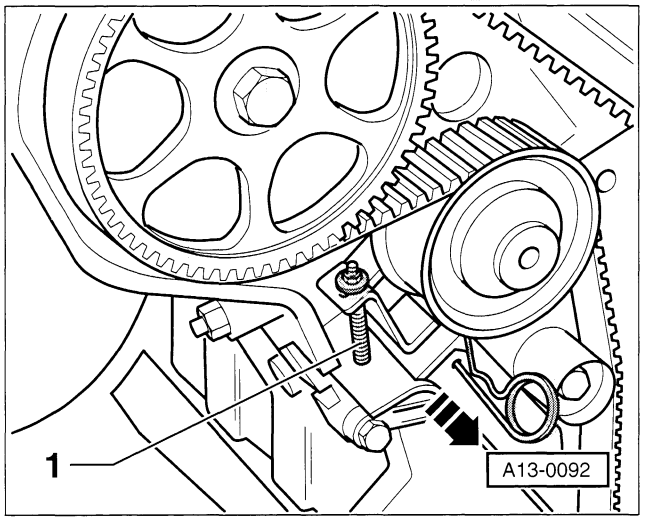
Tightening torques

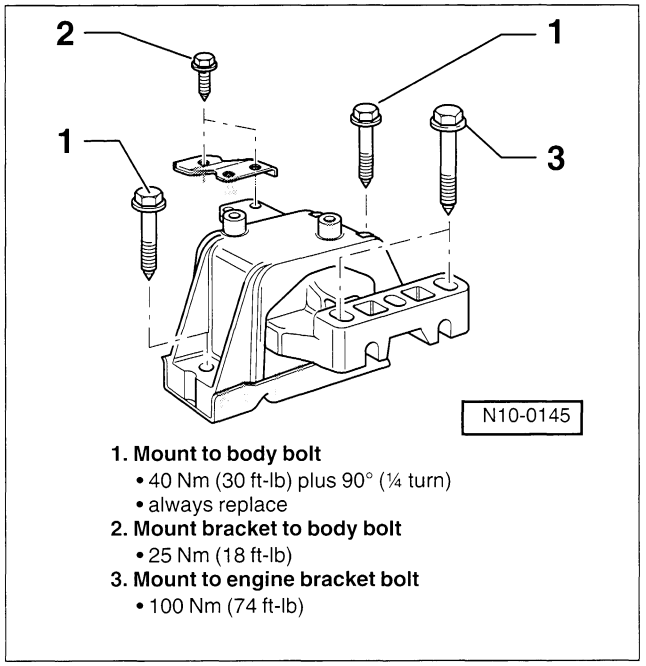
- Right side engine mount bracket to cylinder block (M10) . . . . . 45 Nm (33 ft-lb)

– Install timing belt guard, lower section.

– Install crankshaft V-belt pulley/vibration damper to timing belt crankshaft drive sprocket.







1. **Mount to body bolt**
   - 40 Nm (30 ft-lb) plus 90° (¼ turn)
   - always replace
2. **Mount bracket to body bolt**
   - 25 Nm (18 ft-lb)
3. **Mount to engine bracket bolt**
   - 100 Nm (74 ft-lb)

Tightening torques

- Vibration dampener/belt pulley to timing belt drive sprocket (M8) . . . . . 25 Nm (18 ft-lb)

➢ Set crankshaft to TDC for cylinder #1 by turning crankshaft belt pulley/vibration dampener until timing marks line up on belt pulley (**arrow**) and timing belt guard.

– Ensure that camshaft is still at TDC for cylinder number 1.

– Install the timing belt onto the tensioner, coolant pump and camshaft drive sprockets and check for correct placement of belt on all sprockets.

➢ Apply tension to timing belt.

- Remove securing pin or tool **T40011** (**arrow**) from tensioning damper housing
- Loosen nut on threaded stud or tool **T10092** (**1**) and allow belt tension to tighten
- Remove threaded stud, nut and washer from tensioning damper housing

– Ensure that camshaft and crankshaft marks are still at TDC for cylinder number 1

– Turn engine two full turns in the running direction and confirm that camshaft and crankshaft reference marks still align with the respective points

NOTE —
Some movement of the sprockets and their marks is to be expected as belt tension is adjusted. Keep in mind that the smallest possible increment of adjustment is one whole tooth of the belt or sprocket.

– Install timing belt guards, center and upper sections.

– Install right side engine mount bracket and tighten bolts to 45 Nm (33 ft-lb).

➢ Install right side engine mount using new stretch bolts.

– Remove engine support fixture.

– Install ribbed belt and tensioner. Tighten tensioner to mounting bracket (M8 bolts) to 25 Nm (18 ft-lb).

– Install connecting pipe between intercooler and bottom right side of body longmember.

– Install lower sound absorber panels (belly pan) and upper sound absorber panel.

– Install any remaining parts and quality check your work, see **Quality Review** at end of this repair group.

CYLINDER HEAD, REMOVING AND INSTALLING

The cylinder head can be removed and installed with the engine in the vehicle. See **Internal** and **External Cylinder Assembly** given earlier for removal of cylinder head related components. Note that cylinder head bolts are stretch type fasteners and should never be reused. In addition, whenever the cylinder head or cylinder head gasket is replaced, the coolant must also be replaced, see **19 Engine–Cooling System**.

Cylinder head, removing

> ***WARNING —***
> *Do not start work on a hot engine. Allow to cool sufficiently before proceeding. Engine temperature must be no hotter than warm to the touch. Cylinder head warpage can result due to uneven cooling rates.*

NOTE —

- *Disconnecting the battery cables will erase fault codes and basic settings in the engine management and automatic transmission control unit memories. Some driveability problems may be noticeable until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. See* **24 Fuel Injection – Motronic (1.8L engine)** *for additional information. In most instances proper diagnosis will require the use of a scan tool such as the Volkswagen supplied VAG 1551 or 1552. Use and operation of this tool is outside the scope of this repair manual.*
- *Cylinder head will be removed with the exhaust manifold and the intake manifold still attached.*

– With ignition switched off, disconnect the battery negative terminal from the battery.

NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.

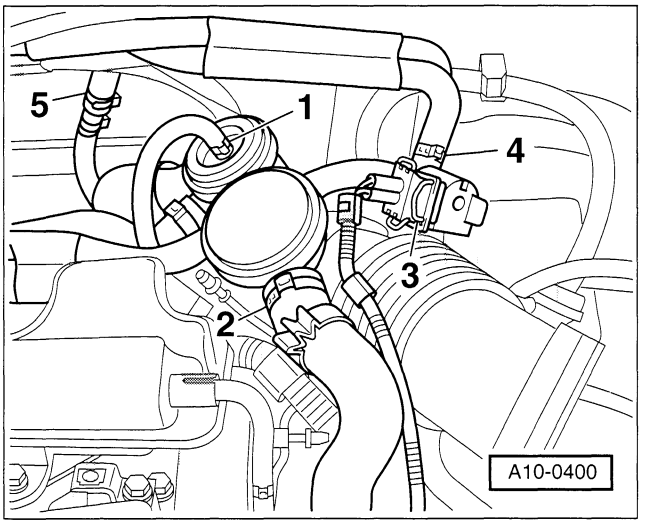
– Remove upper sound absorber panel.

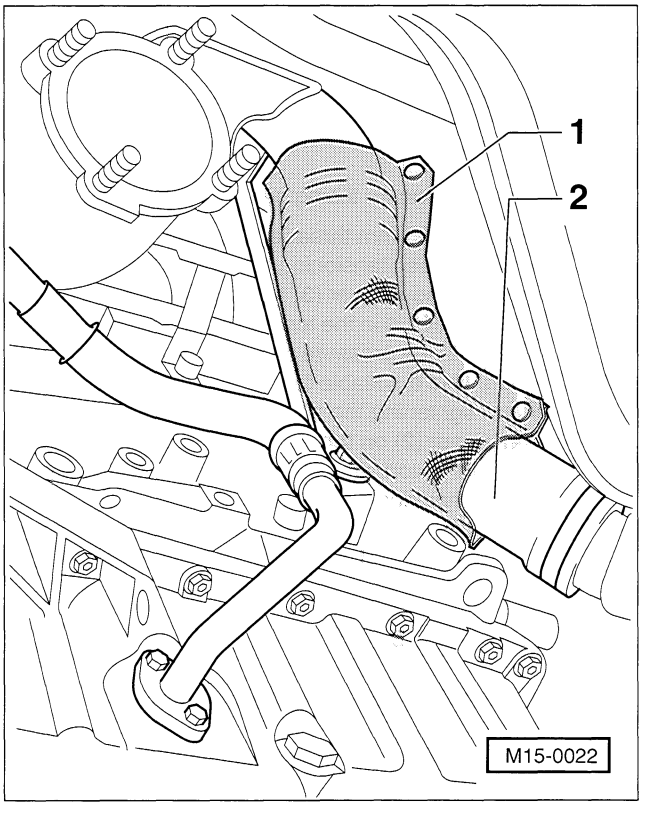
– Remove the lower sound absorber panels (belly pan).

– Drain engine coolant, see **19 Engine–Cooling System**.

– Label and disconnect fuel supply and fuel return lines.

> ***WARNING —***
> *Fuel will be expelled when disconnecting fuel hoses. Wrap a cloth around the fuel line fittings before disconnecting them. Do not smoke or work near heaters or other fire hazards. Have a fire extinguisher handy.*





– Label and disconnect vacuum connections at cylinder head.

– Seal off disconnected fuel and vacuum lines to prevent contamination.

– Unbolt coolant connection flange from end of cylinder head and carefully move aside. The coolant hoses stay connected.

– Disconnect ignition coil harness connectors and ground wires.

– Disconnect all other electrical connectors and hoses as necessary and move aside.

➤ Remove intake air hose from connecting pipe to turbocharger inlet. Connections shown at left:

- Air recirculation valve vacuum hose (**1**)
- Crankcase ventilation valve (PCV valve) (**2**)
- Wastegate solenoid harness connector (**3**)
- Wastegate solenoid pressure inlet (**4**)
- Wastegate solenoid valve to turbocharger at bulkhead (**5**).

– Disconnect hose connecting evaporative emissions canister and turbocharger at bulkhead.

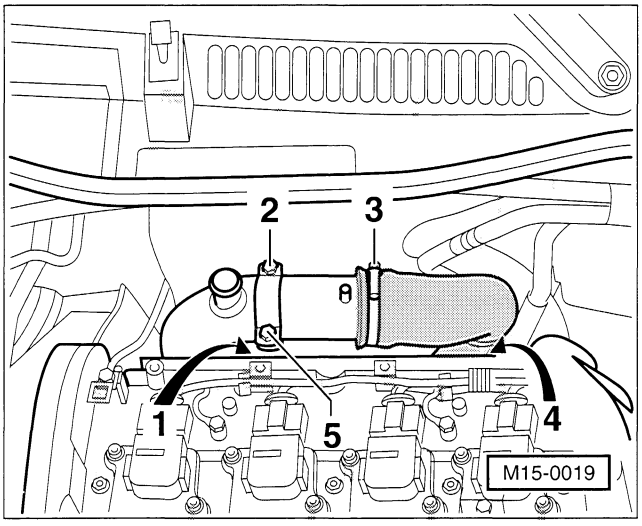
– Remove retaining clip at turbocharger inlet and remove connecting pipe.

➤ Observe position of heat insulation (**1**) on lower turbocharger outlet pipe and remove. Remove lower outlet pipe (**2**).

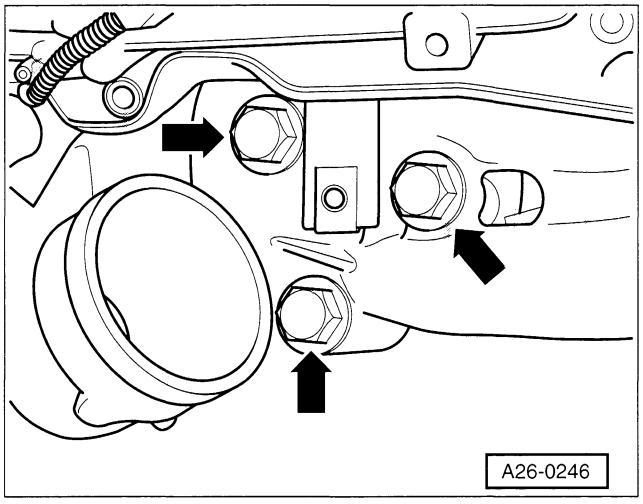
– Loosen securing bolts for turbocharger outlet pipe retaining bracket.

– Observe position of heat insulation on upper turbocharger outlet pipe and remove.

– Loosen upper turbocharger outlet pipe clamp.



➢ Remove two securing bolts (**1** and **4**) for rear cylinder head heat shield and loosen retaining bracket securing bolts (**2** and **5**). Remove upper turbocharger outlet pipe (**3**), and rear cylinder head heat shield.



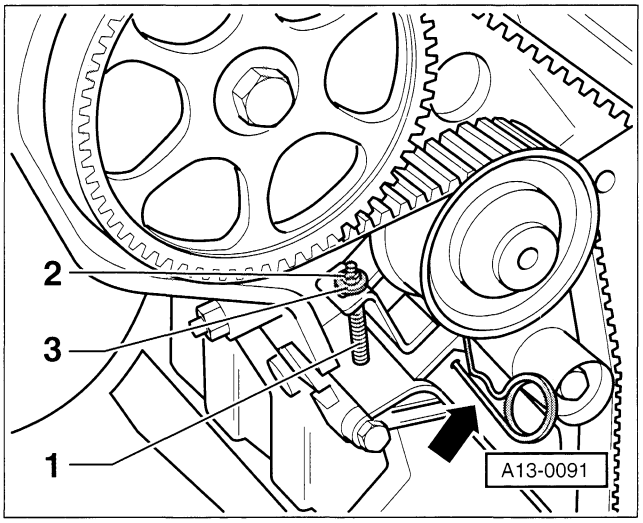
➢ Remove turbocharger to exhaust manifold securing bolts (**arrows**). Turbocharger remains with vehicle when cylinder head is removed.

– Remove the ribbed V-belt and tensioner.

– Remove timing belt guard, upper section.

– Set engine to TDC for cylinder #1 by turning crankshaft until timing mark on camshaft sprocket aligns with mark on cylinder head (valve) cover as shown earlier.

– Mark running direction of timing belt.



➢ Release tension on timing belt and remove belt.

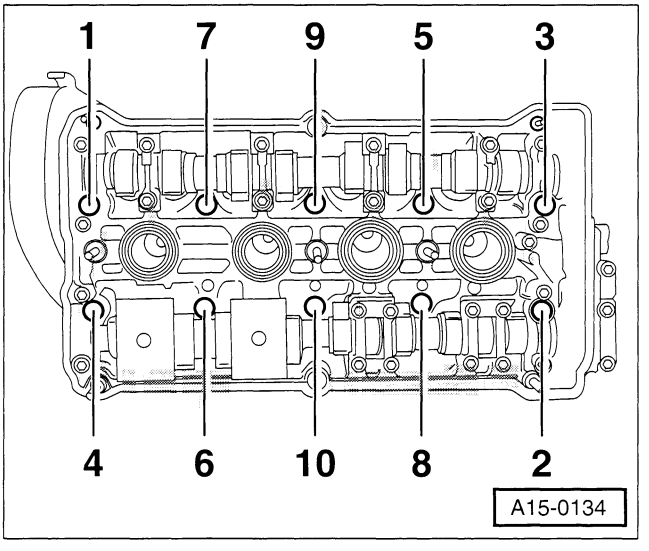
- Screw a 5x55 mm threaded stud or tool **T10092** (**1**) into timing belt tensioning damper housing and install a nut (**2**) and washer (**3**) to the other end
- Line up the hole in the tensioning damper housing with the hole in the pressure piston by turning the pressure piston. Use a suitable tool to turn the pressure piston before tightening the nut on the threaded stud
- Tighten nut (**2**) on threaded stud until the hole in the pressure piston aligns with the hole in the tension damper housing
- Secure pressure piston in position with a pin or tool **T40011** (**arrow**) inserted through hole in tensioning damper housing

– Remove timing belt.

– Turn crankshaft back off of TDC slightly.

– Loosen nut on threaded stud and remove threaded stud, nut and washer from tensioning damper housing.

– Remove cylinder head (valve) cover as given earlier.



CAUTION —
Due to engine design, care must be used when turning the camshaft with the timing belt removed. If valves are allowed to open with the piston at TDC, serious internal damage will result.

➤ Loosen the socket head bolts slightly in sequence shown at left. Loosen all bolts slightly the first time around, repeat the order, finish loosening and then remove. Do not re-use head bolts.

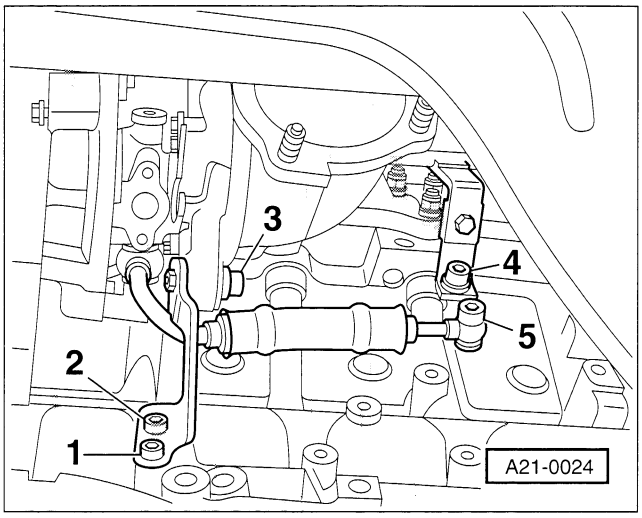
– Carefully lift off cylinder head and place in a clean area. If the head is stuck, use a soft-faced mallet or pry gently with a wooden stick.

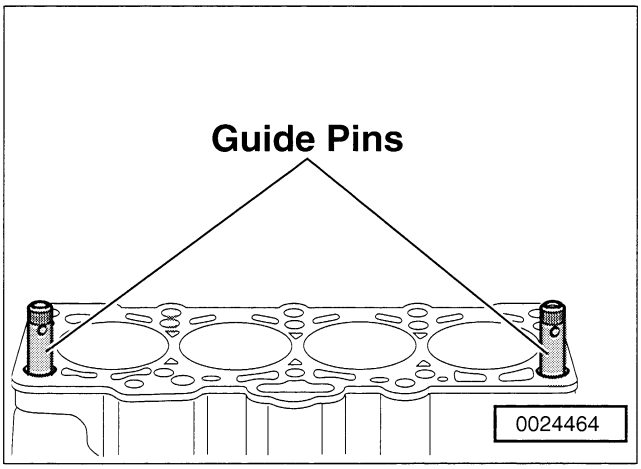
CAUTION —
Some of the valves will be open. Use extra care when removing and handling to avoid damage. Place the cylinder head on the bench or table so that the weight of the cylinder head will not rest on the valves.

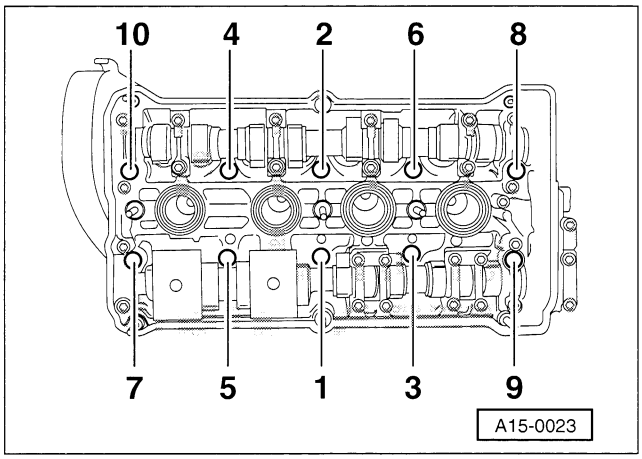
Cylinder head, installing

Before proceeding with the installation of the cylinder head, whether an original or a new unit, observe the following important points:

- Check the cylinder head and block for distortion and warpage, see **Cylinder Head Components**, given later in this section.
- Carefully clean the cylinder block and cylinder head sealing surfaces being sure to avoid scratching them during the cleaning process. Do not use metal scrapers or wire brushes.
- When using abrasive paper do not use any grades coarser than 100 grit (such as 80 grit). Lower numbers are coarser.
- If cylinder head will not be reinstalled immediately, take precautions to prevent rust from forming on the cylinder block walls and gasket sealing surfaces.
- When cleaning the old gasket material off of the cylinder block, take precautions to keep the old gasket material and the abrasive particles and dirt out of the cooling and oiling system passages. Place a clean shop cloth over the cylinders to prevent contamination from getting between the cylinder wall and the piston.
- Do not take the new cylinder head gasket out of the packaging until ready to use. Handle the new gasket with extreme care as any damage will lead to leaks.
- There MUST NOT BE any oil or coolant in the head bolt holes in the cylinder block. Any fluids in the holes creates the danger of hydrolock while torquing which could lead to structural damage of the cylinder block. Use thread chasers to remove foreign material as required. Be sure that all 10 bolt holes are clean and dry.







Cylinder head, installing (continued)

- When all traces of the old gasket material have been removed from the cylinder block and head, carefully remove all traces of metal particles, abrasives and lint. All gasket sealing surfaces and bolt holes must be clean and dry to ensure a proper seal.
- Always use new cylinder head bolts and a new gasket.
- Do not use gasket sealer on cylinder head gasket.
- If installing a Volkswagen supplied replacement cylinder head, be sure to inspect for and remove any plastic packaging materials used to protect the head and open valves.

– Position the crankshaft so that pistons are NOT at TDC.

➤ Loosen turbocharger securing bracket bolts (**1** and **2**) slightly to facilitate cylinder head installation. Remaining bolts (**3**, **4** & **5**) do not need to be loosened.

➤ Install guide pins (VW special tool 3450) into two head bolt holes of cylinder block. Pins allow for proper alignment of the head on block, preventing slippage and damage to head gasket. Old head bolts with the hex head cut off can also be used as alignment pins.

– Install new cylinder head gasket onto block with numbers and letters facing up. Be sure that no wiring or vacuum hoses are caught between cylinder head and block.

– Carefully install cylinder head onto block over alignment pins and screw in 8 new head bolts. Tighten bolts hand-tight only. New head bolts may require different hex head socket tool than old ones (12 pt. vs. 6 pt.).

– Remove alignment pins from the bolt holes with the tool and install remaining 2 new head bolts. Tighten these bolts hand-tight.

➤ Tighten 10 cylinder head bolts in three stages following the tightening order at left.

Tightening torque

- Cylinder head to cylinder block, 1.8L engine (stretch bolts – always replace)
  stage I . . . . . 40 Nm (30 ft-lb)
  stage II . . . . . additional ¼ turn (90°)
  stage III . . . . . additional ¼ turn (90°

– Install new gasket and bolts between turbocharger and exhaust manifold.

– Lubricate camshafts and followers and install cylinder head (valve) cover.

– Install timing belt, adjust tension and belt timing.

– Install timing belt guard, upper section.

– Install ribbed V-belt tensioner and V-belt.

- Install rear cylinder head heat shield and upper turbocharger outlet pipe and heat shield.
- Install lower turbocharger outlet pipe and heat shield.
- Install turbocharger inlet connecting pipe.
- Install hose connecting evaporative emissions canister and turbocharger at bulkhead.
- Install intake air hose from connecting pipe to turbocharger.
- Reconnect all disconnected electrical components and connections, including ignition coils.
- Reconnect all coolant flanges and lines.
- Reconnect all vacuum hoses connections.
- Reconnect fuel supply and return lines.
- Refill cooling system with fresh coolant in the appropriate ratio. See **19 Engine–Cooling System.**

> ***CAUTION —***
> *• Use only Volkswagen original coolant when filling the cooling system. Use of any other coolant may be harmful to the cooling system. Do not use coolant containing phosphates.*
>
> *• Do not use tap water in cooling system. Use distilled water only to mix anti-freeze.*

- Install lower sound absorber panels (belly pan) and upper sound absorber panel.
- Reconnect the battery only after all parts/electrical connections have been reinstalled and reconnected.
- Be sure to quality check your work, see **Quality Review** at end of this repair group.

Tightening torques

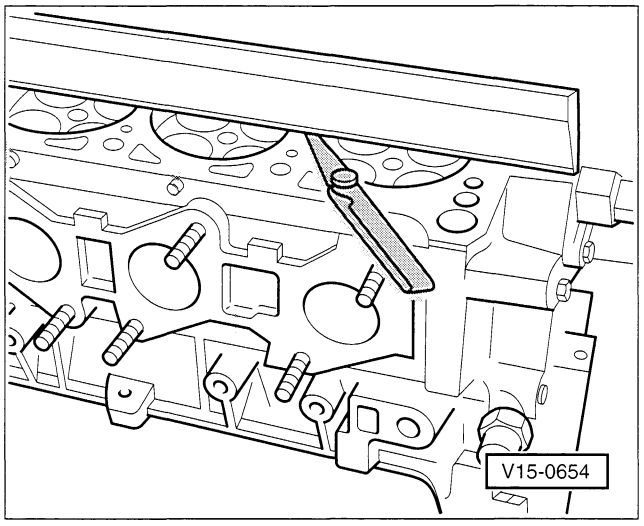
- Cylinder head cover to cylinder head . 10 Nm (7 ft-lb)
- Ignition coil to cylinder head cover . . . 10 Nm (7 ft-lb)
- Ground wire to cylinder head cover . . 10 Nm (7 ft-lb)
- Heat shield to cylinder head . . . . . 20 Nm (15 ft-lb)
- Ribbed V-belt tensioner to bracket . . 25 Nm (18 ft-lb)
- Turbocharger to exhaust manifold (special nuts - always replace) . . . . . 30 Nm (22 ft-lb)
- Coolant outlet flange to head . . . . . 10 Nm (7 ft-lb)
- Secondary air pump bracket to cylinder block . . . . . 25 Nm (18 ft-lb)
- Secondary air pump to support bracket nut . . . . . 10 Nm (7 ft-lb)
- Securing bolt for turbocharger connecting pipes . . . . . 10 Nm (7 ft-lb)

CYLINDER HEAD COMPONENTS

This section provides the specifications and special information necessary to repair the cylinder head that has been removed from the Volkswagen 1.8L engine. Special service tools and machine shop services are required for most cylinder head repair.

NOTE —
The information given under this heading assumes that the cylinder head is removed. For cylinder head removal procedures, see **Cylinder head, removing** *given earlier.*

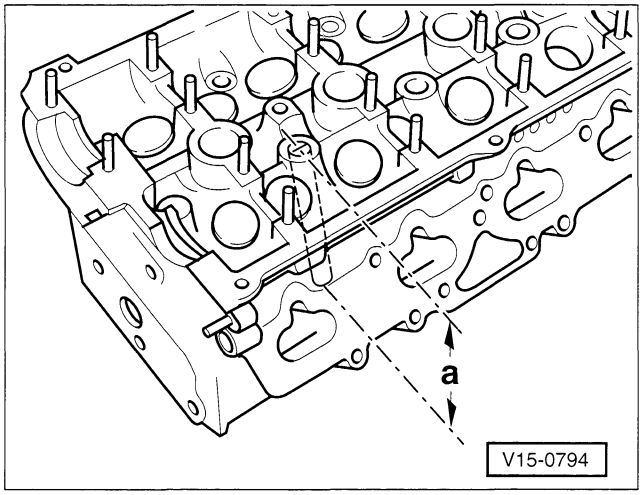
Cylinder head and camshaft



Check the cylinder head for warpage and distortion with an accurate straight edge and a feeler gauge.

Specification

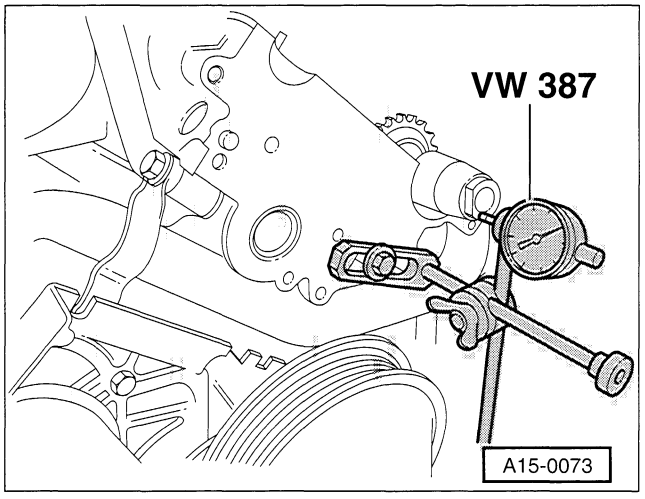
- Maximum cylinder head distortion/warpage . . . . . 0.1 mm (0.004 in.)



The cylinder head can be resurfaced as long as the distance (**a**) from the cylinder head (valve) cover seating surface to the head gasket surface is never less than specified. Measure this distance through a cylinder head bolt hole. Machining too much material off of the cylinder head surface will change the compression ratio and will affect engine emissions.

Specification

- Minimum cylinder dimension (valve cover gasket surface to the head gasket surface) . . . . . 139.2 mm (5.48 in.)



The in and out movement of the camshaft is known as axial play and is measured with the cam followers and drive chain removed and only the first and last bearing caps installed.

A dial gauge (VW 387 shown) is set up on the sprocket end of the camshaft and the camshaft axial clearance is checked by moving the camshaft as far as it can go in each direction.

NOTE —
Check camshaft axial clearance with lifters and camshaft timing chain removed and number 2 and 4 bearing caps installed.

Specification

- Camshaft axial clearance, maximum . . . . . 0.20 mm (0.008 in.)

Valves

Valves should not be re-worked on a machine. Only lapping by hand with valve compound is permitted. Valve dimensions are listed in **Table a**.

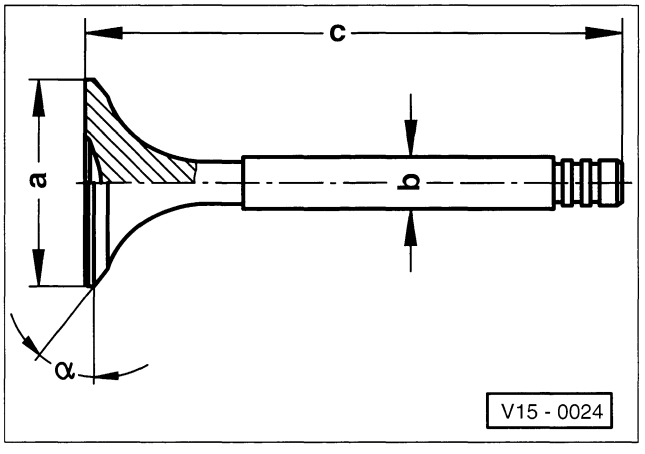
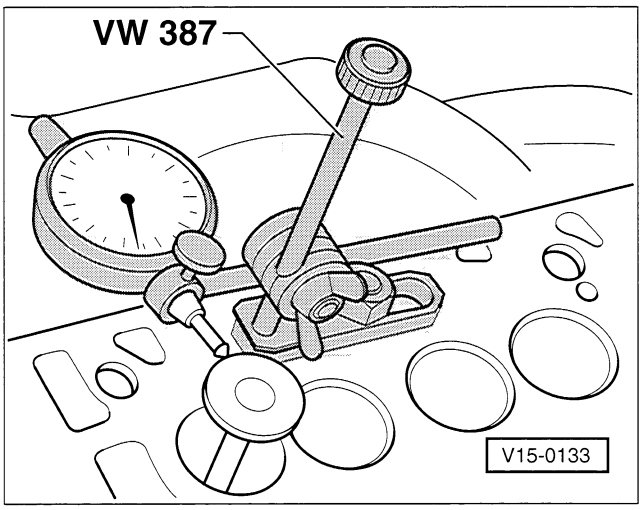
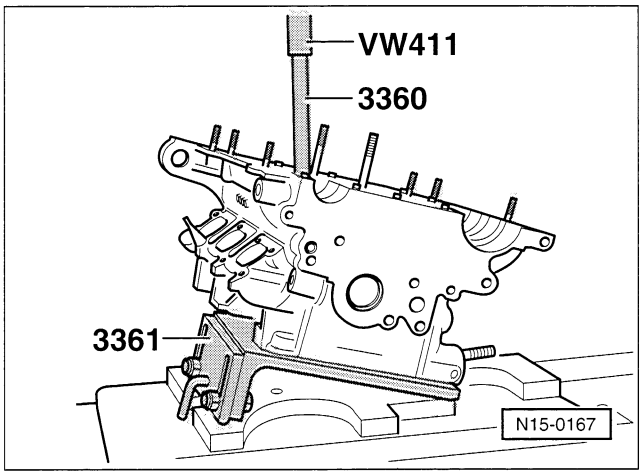


Table a. Valve Dimensions

Engine: 1.8L turbo	
Valve head diameter (**a**) intake exhaust	 26.9 mm (1.059 in.) 29.9 mm (1.177 in.)
Valve stem diameter (**b**) intake exhaust	 5.963 mm (0.235 in.) 5.943 mm (0.234 in.)
Valve length (**c**) intake exhaust	 104.84 to 105.34 mm (4.128 to 4.147 in.) 103.64 to 104.14 mm (4.080 to 4.100 in.)
Valve face angle (α) intake exhaust	 45° 45°

NOTE —
Care must be taken when disposing of old sodium filled valves. They must be cut through in the center of the stem with a hacksaw. When doing this they must be perfectly dry. The valves prepared in this way can then be thrown into a bucket of water a maximum of ten at a time. When doing this step back quickly because a sudden chemical reaction causes the sodium filling to burn. After this treatment, the valves can be put in with the normal scrap.





Valve guides

NOTE —

- *Special tools and a press are required to replace the valve guides.*
- *Replacement valve guides for the 1.8L engines are no longer available through the Volkswagen/Audi parts system. In cases where the wear limits are exceeded, Volkswagen recommends cylinder head replacement. Valve guide replacement information is presented for reference purposes.*

Check valve guide wear with a new valve. Always use an intake valve in an intake guide and an exhaust valve in an exhaust guide. Insert valve until stem end is flush with end of guide. Rock valve back and forth (**arrow**) to check total travel.

Inspect the valve seats to ensure that the cylinder head can be reconditioned before installing new valve guides. Press out worn original valve guides with Volkswagen special driver tool 3360 from camshaft side of head. Replacement valve guides have a shoulder on the camshaft side to limit the installed depth and must be pressed out from the combustion chamber side.

When installing new valve guides, lubricate with clean engine oil and press in from the camshaft side down to the shoulder. The cylinder head should be cold for this operation. Once the shoulder of the valve guide contacts the cylinder head, do not allow the pressure on the guide to exceed 2000 psi (1 ton) otherwise the cylinder head or the guide will be damaged. When the guide has been replaced, ream it to the proper size and continue with the reworking of the valve seats.

- Exhaust valve angle: 20°
- Outer intake valve angle: 21.5°
- Center intake valve angle: 15°

Specification

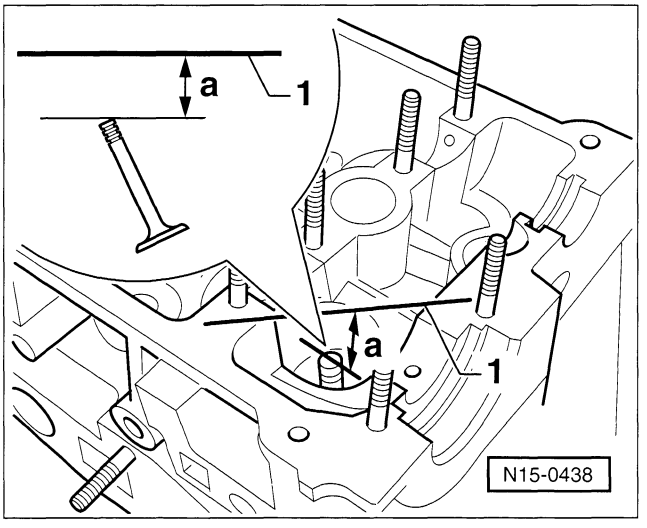
- Valve guide (wear limits-maximum play)
  with new valve
  intake valve guide . . . . . 0.8 mm (0.031 in.)
  exhaust valve guide . . . . . 0.8 mm (0.031 in.)

NOTE —

Due to the close tolerances found in the valve guides, it is recommended that Volkswagen special tool 3360 be used for removal and installation and special tool 3363 be used to ream the valve guide to size.

Valve seats

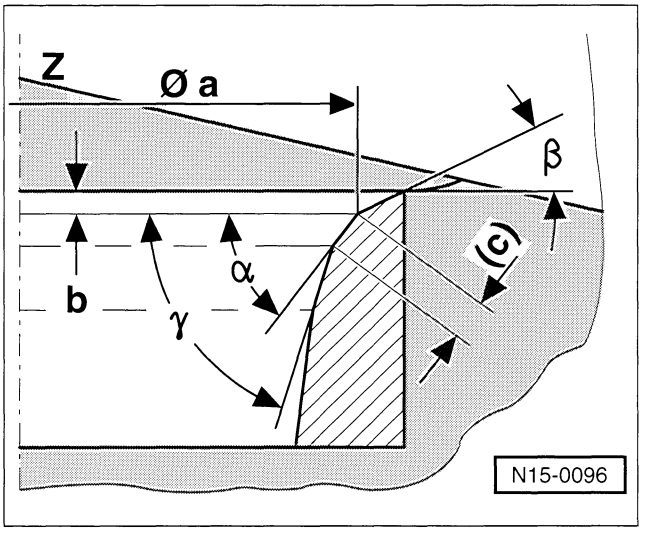
When resurfacing valve seats, there is a limit to the amount of material that can be removed to bring the seat back into specification. If too much material is removed, the final assembly will leave too little space for the hydraulic cam follower to function properly. The maximum refacing dimension, that is, the maximum amount of material that can be removed from the valve seat, is calculated as described below.



➤ Measure distance (**a**) between top of valve stem and gasket surface (**1**) of cylinder head and subtract the minimum dimension, as given in **Table b**. The difference is the maximum amount of material that can be removed from the valve seat.

Table b. Minimum Dimensions for Calculating Valve Seat Refacing Dimensions

Engine	Intake	Exhaust
1.8L turbo	Outer 34.0 mm (1.339 in.) Center 33.7 mm (1.327 in.)	34.4 mm (1.354in.)



➤ Valve seat dimensions for reworking valves are given in **Table c** and correspond to valve dimensions at left.

NOTE —
Use care when reworking the exhaust valve seats to avoid changing the shape of the port. This can upset the flow characteristics of the valve.

Table c. Valve Seat Dimensions

Engine: 1.8L	Intake	Exhaust
Seat diameter (**a**)	26.2 mm (1.031 in.)	29.0 mm (1.142 in.)
Maximum refacing dimension (**b**)	Calculated, see above	Calculated, see above
Seat width (**c**)	1.5-1.8 mm (0.059-0.071 in.)	approx. 1.8 mm (0.071 in.)
Valve seat angle (α)	45°	45°
Correction angle, upper (β)	30°	30°
Correction angle, lower (γ)	60°	60°

NOTE —
Z shows cylinder head surface reference.

QUALITY REVIEW

When you have finished working under the hood and around other areas of the vehicle it is advisable to take a moment to quality check or review your work. This helps to ensure that the operation or repair has been completed properly with all affected systems functioning within normal parameters. This may include the following:

- Make sure that the radiator fan cycles properly and that the coolant level and concentration are correct.
- Ensure that all cable ties and hose clamps that were removed as part of the repair are replaced.
- Check and adjust all other applicable fluid levels.
- Make sure that there are no fluid leaks.
- Make sure that there are no air, vacuum or exhaust leaks.
- Make sure that all components involved in the repair are positioned correctly and function properly.
- Male sure all tools, shop cloths, fender covers, and protective tape are removed.
- Clean grease from painted surfaces and steering wheel.
- Unlock the anti-theft radio and reset the clock.

In addition to the above noted points, the ECM and TCM may need to be checked using the Volkswagen supplied VAG 1551 or 1552 scan tool as mentioned at the start of this repair.

15b Cylinder Head and Valvetrain (1.9L Engine)

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GENERAL

This section covers most cylinder head and valvetrain service and repair work for the 4-cylinder, 2 valve per cylinder, 1.9 liter diesel engine. For information on short block engine rebuilding and internal engine specifications, see **13a Crankshaft/Cylinder Block (4-cylinder)**.

Most of the operations described in this repair group require special equipment and experience. If you lack the skills, tools, or a suitable workplace for servicing or repairing the cylinder head, we suggest that you leave these repairs to an authorized Volkswagen dealer or other qualified shop.

Engine Codes

- ALH . . . . . 1.9L 4-cylinder turbo diesel

DIAGNOSTIC TESTING

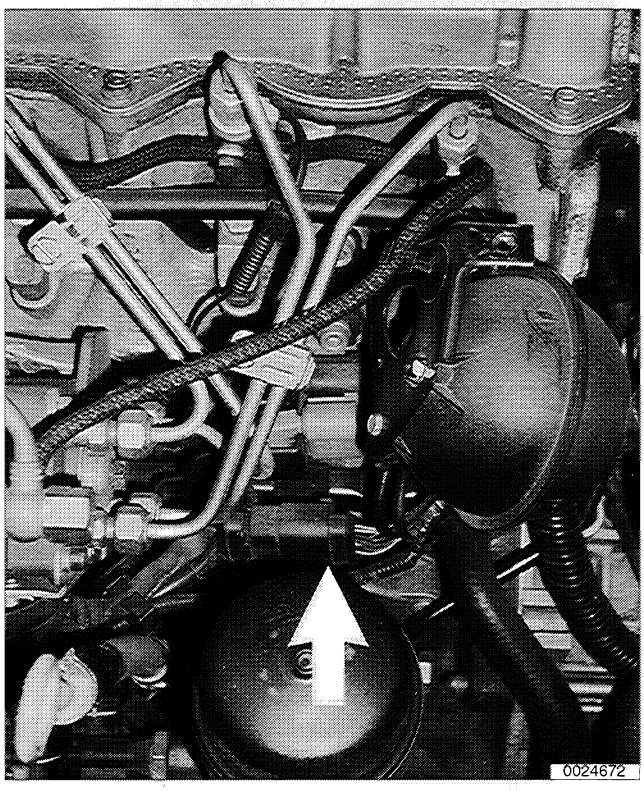
The tests that follow can be used to help isolate engine problems, to better understand a problem before starting expensive and extensive repairs, or to just periodically check engine condition.

Compression Test

A compression test will tell a lot about the overall condition of the engine without the need for taking it apart. Testing is relatively simple and straightforward.

– Remove two plastic caps and retaining nuts on upper sound absorber panel. Loosen rear retaining nut slightly. Remove dipstick, lift cover up slightly and pull forward.

– Warm-up engine until it is a minimum of 30°C (86°F).



– Disconnect harness connector (**arrow**) for fuel cut-off valve from diesel injection pump.

– Disconnect bus connector from each glow plug by gently pulling up on it. Lay complete bus connector aside.

– Use compressed air to clear area around glow plugs.

– Using a 10 mm deep socket and swivel or Volkswagen special tool 3220, remove all glow plugs and lay aside in proper order.

– Install compression tester adaptor VAG 1381/12 into glow plug hole and connect compression tester.

– Have a helper:

- depress clutch pedal fully
- put transmission in neutral or park
- crank engine over with starter motor

NOTE —

Cranking engine over with diesel injection system components disconnected may Diagnostic Trouble Codes (DTCs) to be stored in engine management system memory.

– Engine should be cranked a minimum of 4 to 5 revolutions.

– Record readings, release pressure in gauge and repeat procedure for each cylinder.

– Compare readings to specification.

Specification

- Compression pressures (1.9L diesel engine)

new	25 to 31 bar (363 - 450 psi)
wear limit	19 bar (276 psi)
maximum difference between cylinders	5 bar (73 psi)

– When all cylinders have been checked, reinstall glow plugs and bus connector, connect harness connector for quantity adjuster and fuel cut-off valve. Install upper engine cover.

Tightening torque

• Glow plug to cylinder head. . . . . 15 Nm (11 ft-lb)

Cylinder leakdown test

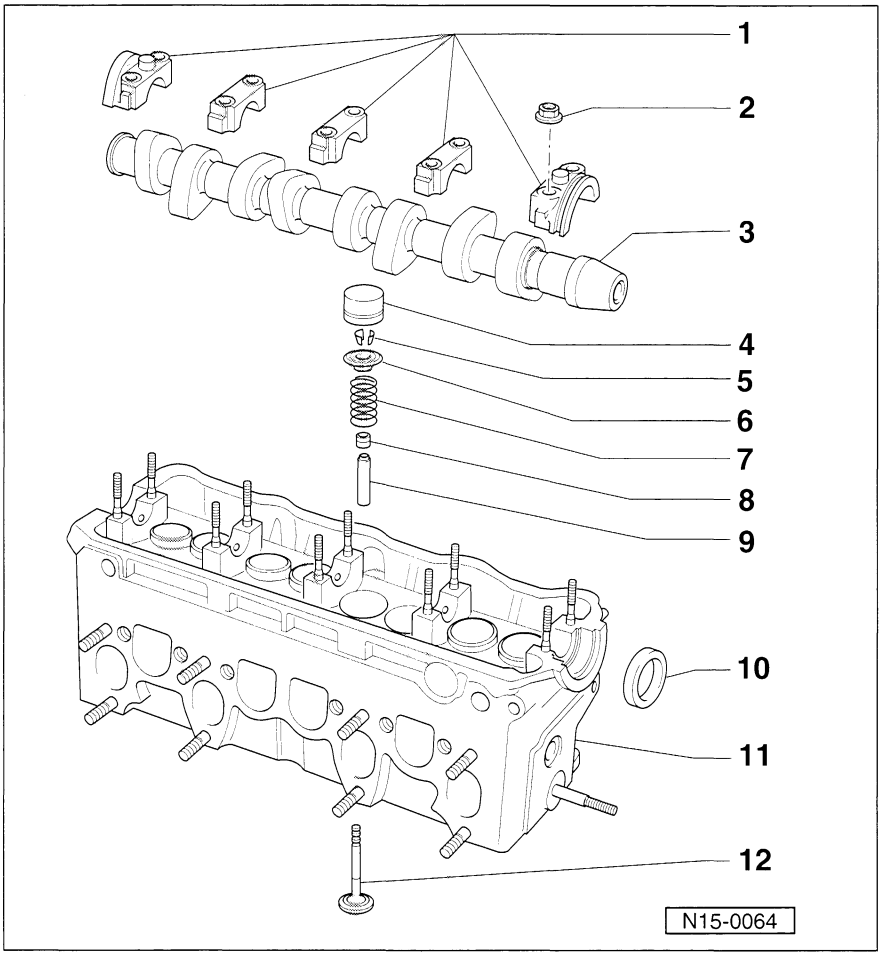
The most conclusive diagnosis of low compression symptoms requires a cylinder leak-down test. Using a special tester and a supply of compressed air, each cylinder is pressurized. The rate at which air leaks out of cylinder, as well as the sound and location of escaping air can more accurately pinpoint the magnitude and source of leakage. Any engine compression diagnosis that will require major disassembly should first be confirmed by a cylinder leak-down test. Because this test requires special equipment and experience, it may be desirable to have it performed by a Volkswagen dealer or other qualified repair shop. Leakdown limit specifications are usually supplied by the equipment manufacturer.

CYLINDER HEAD SERVICE

Many cylinder head repairs can be accomplished without removing cylinder head from engine. The cylinder head cover (valve cover) gasket, camshaft, camshaft oil seal, valve guide oil seals, valve springs, and camshaft followers are all accessible with cylinder head installed. This heading describes those repairs that can be done with cylinder head installed.

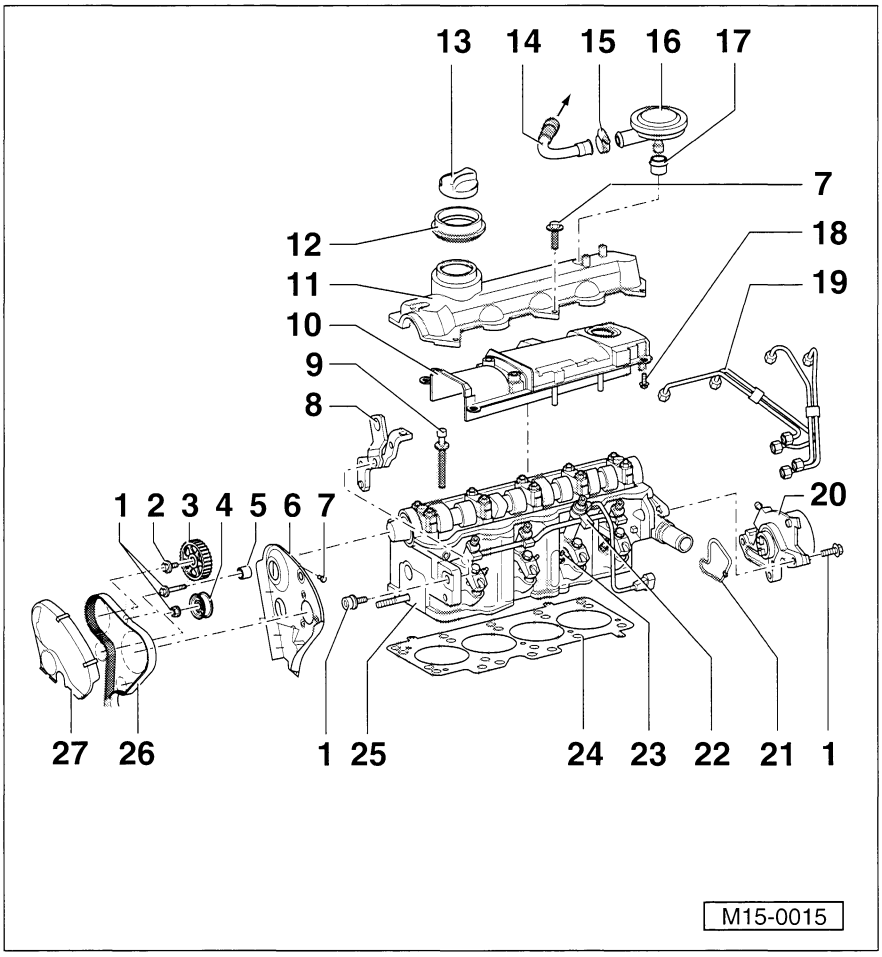
The following two pages contain assembly views of internal and external cylinder head components.

Internal cylinder head assembly



1. **Bearing cap**
   - Coat bearing cap #1 lightly with sealant AMV 174 004 01
   - Bearing cap #1 is near belt end and oil seal (item **10**)
   - Note installation position
2. **Nut**
   - Tighten to 20 Nm (15 ft-lb)
3. **Camshaft**
   - Checking radial clearance with plastigage
     wear limit: 0.11 mm (.0043 in.)
   - Run-out: max. 0.01 mm (.0004 in.)
4. **Valve lifter, hydraulic**
   - Do not interchange
   - Store with cam contact surface facing downwards
   - Equipped with hydraulic clearance compensation
   - Before installing, check camshaft axial clearance, see **Cylinder Head Components** maximum clearance: 0.20 mm (0.008 in.)
   - Oil contact surfaces
5. **Keepers**
6. **Valve spring retainer**
7. **Valve spring**
8. **Valve stem seal**
9. **Valve guide**
10. **Oil seal**
    - To remove and install, remove bearing cap
11. **Cylinder head**
12. **Valves**
    - Do not rework! Only lapping is permitted

External cylinder head assembly



1. **Nut/Bolt**
   - Tighten to 20 Nm (15 ft-lb)
2. **Bolt**
   - Tighten to 45 Nm (33 ft-lb)
   - To loosen and tighten use counter-holding tool 3036
3. **Camshaft sprocket**
   - Loosen from camshaft with 2-arm puller T40001
4. **Tensioning roller**
   - Semi-automatic
   - For timing belt
5. **Idler roller**
6. **Timing belt guard, rear**
7. **Nut**
   - Tighten to 10 Nm (7 ft-lb)
8. **Lifting eye**
9. **Cylinder head bolt**
   - Always replace
   - Note sequence when loosening and tightening, see **Cylinder head, removing & installing**
10. **Oil deflector**
    - Installed over camshaft
11. **Valve cover**
    - Also known as cylinder head cover
    - Valve cover gasket is integral with the cover itself. If gasket is damaged or leaking, replace the entire cover
12. **Seal**
    - Between valve cover and upper engine sound absorber
    - Replace if damaged
13. **Cap**
    - Replace seal if damaged
14. **Breather pipe/hose**
15. **Retaining clip**
16. **Crankcase ventilation valve**
    - For positive crankcase ventilation and regulation
17. **Seal**
    - Replace if damaged
18. **Bolt**
    - Tighten to 5 Nm (44 in-lb)
19. **Fuel injector lines**
    - Tighten to 25 Nm (18 ft-lb)
    - Remove using 3035 offset tubing wrench
    - Always remove fuel line cluster as an assembly
    - Do not bend, kink or alter shape
20. **Vacuum pump**
    - For brake booster
21. **Seal**
    - Replace if damaged
22. **Fuel injector**
    - Removing and installing, see **23a Fuel Injection–Diesel (1.9L Engine)**
23. **Glow plug**
    - Tighten to 15 Nm (11 ft-lb)
    - Checking, see **28 Ignition System–Diesel (1.9L Engine)**
24. **Cylinder head gasket**
    - Always replace
    - Always measure piston projection before securing new parts.
    - 3 different thicknesses. Thickness determines compression height, see **13a Crankshaft/Cylinder Block (4-cylinder)**
    - Replace engine coolant if removing head
25. **Cylinder head**
    - Replace engine coolant if removing head
26. **Timing belt**
    - Mark direction of engine rotation before removing
    - Check for wear
    - Do not kink
27. **Timing belt guard, upper section**

Cylinder head (valve) cover, removing and installing

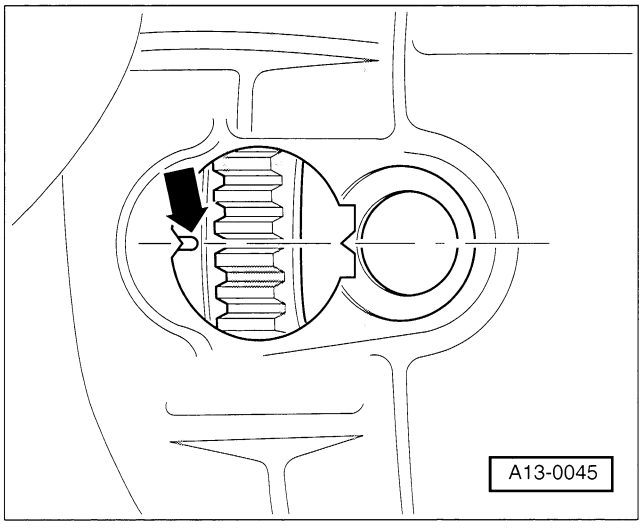
NOTE —
The valve cover gasket is vulcanized into the rigid aluminum cover and is not available as a separate part.

- Remove upper engine cover.
- Remove connecting pipe between intercooler and intake hose.
- Disconnect breather hose from breather valve.
- Remove 4 cylinder head cover securing bolts from rear and 3 from the front.
- Lift off cover with attached oil separator and gasket.
- Installation is reverse of removal.

Tightening torque
- Cylinder head cover to cylinder head . . . . . 10 Nm (7 ft-lb)

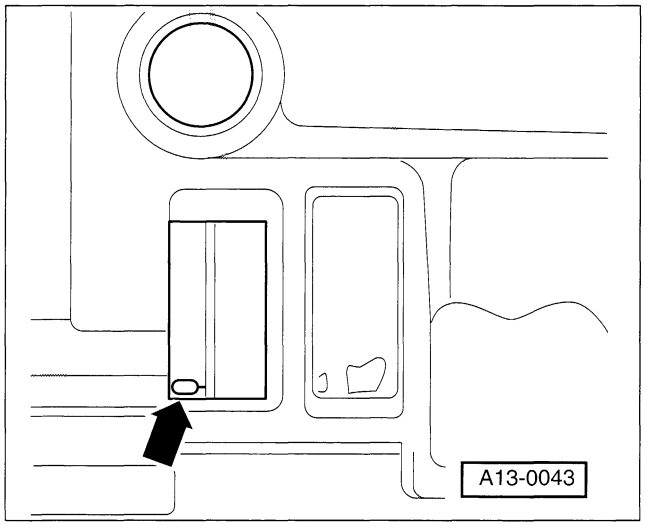
Camshaft oil seal, replacing

- Remove upper engine cover.
- Remove connecting pipe between intercooler and intake hose.
- Remove upper timing belt guard.
- Remove cylinder head (valve) cover.
- Remove brake booster vacuum pump from end of cylinder head.
- Set engine to TDC for cylinder 1 by turning crankshaft until the timing mark on flywheel or torque converter aligns with mark on transmission case.



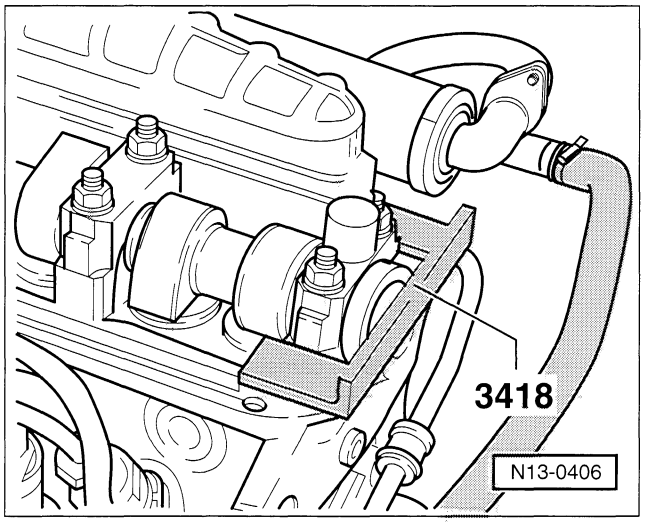
Manual transmission vehicles

Confirm that engine is set to TDC for cylinder #1 by checking that timing mark on flywheel (**arrow**) lines up with notch at inspection hole on manual transmission.



Automatic transmission vehicles

➢ Confirm that engine is set to TDC for cylinder #1 by checking that timing mark on torque converter (**arrow**) lines up with edge of inspection hole on automatic transmission.

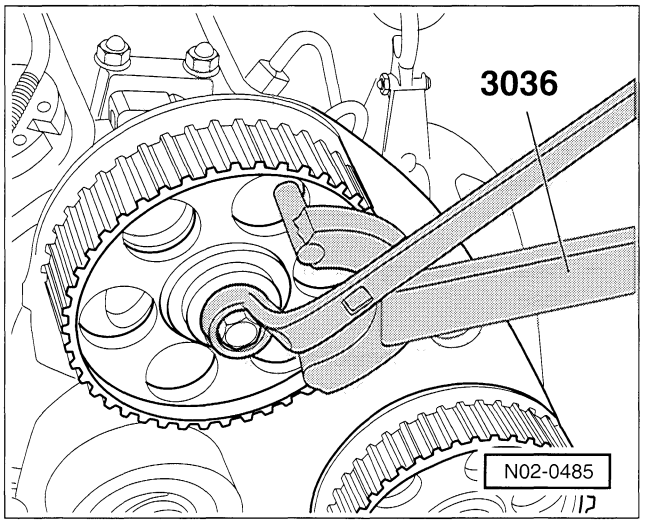


Continued for all vehicles

➢ Lock camshaft at TDC with setting bar (VW special tool 3418 shown). Setting bar is installed at flywheel/driveplate end of engine.

NOTE —
Setting bar will only fit onto camshaft properly if camshaft is at TDC. Camshaft and crankshaft should both be at TDC.

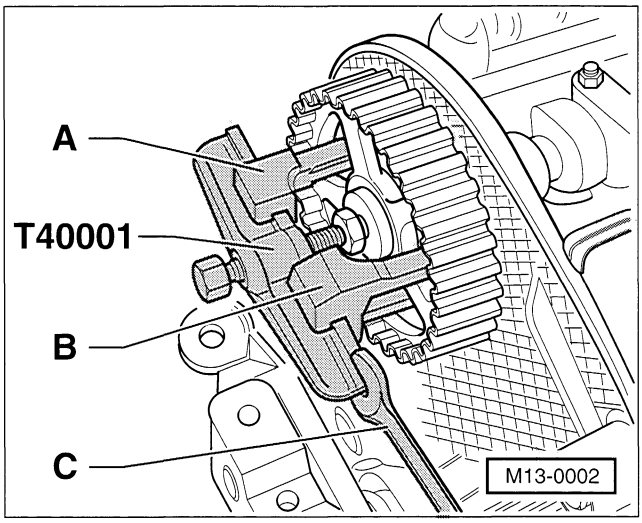
– Release tensioning roller and slip timing belt off camshaft sprocket.



➢ Loosen camshaft sprocket mounting bolt about 1 turn while counter-holding camshaft sprocket. VW special tool 3036 shown to counter-hold sprocket bolt.

CAUTION —
Do not use 3418 setting bar by itself to lock camshaft when loosening camshaft sprocket bolt. Hold camshaft sprocket using 3036 holding tool or equivalent. Possible damage to camshaft could result if only setting bar is used to lock camshaft.

NOTE —
The camshaft end is tapered. Loosening the sprocket will allow the camshaft sprocket to rotate independently of the camshaft. There may be a keyway cut into end of camshaft. However, there is no matching keyway cut into the sprocket nor is there a Woodruff key.



➤ Release camshaft sprocket from camshaft with two-arm puller (VW special tool #T40001 shown).

- Center arms (**A** and **B**) in camshaft sprocket and counter-hold puller using open-end wrench (**C**).

NOTE —

Tapping camshaft sprocket lightly with a soft mallet may help release sprocket from tapered end of camshaft.

– Remove camshaft sprocket mounting bolt and sprocket.

– Loosen and remove camshaft bearing cap #1.

NOTE —

Bearing cap #1 is closest to the belt end of camshaft.

– Slide seal through rear timing belt guard and off end of camshaft.

– Install new seal noting following points:

- Lubricate new seal with clean engine oil.
- Install with closed end facing out.
- Use a suitable installation tool.
- Press seal into bottom of recess.

– Install bearing cap #1.

Tightening torque

- Camshaft bearing cap to cylinder head . . . . . 20 Nm (15 ft-lb)
- Camshaft sprocket to camshaft . . . . 45 Nm (33 ft-lb)

– Install camshaft drive belt sprocket.

– Install timing belt and adjust tension, see **Timing Belt–Camshaft Drive**, given later.

– Install brake booster vacuum pump, cylinder head (valve) cover, and upper timing belt guard.

Tightening torque

- Vacuum pump to cylinder head . . . . 20 Nm (15 ft-lb)
- Valve cover to cylinder head . . . . . 10 Nm (7 ft-lb)

– Install connecting pipe between intercooler and intake hose.

– Check that all components are installed, properly secured, and install upper engine cover.

– Be sure to quality check your work, see **Quality Review** at end of this repair group.

Camshaft, removing and installing

The camshaft can be removed and installed with cylinder head installed. Removing the camshaft allows access to hydraulic cam followers, valve springs and valve stem oil seals.

- Remove upper sound absorber panel.
- Remove connecting pipe between intercooler and intake hose.
- Remove upper timing belt guard.
- Remove cylinder head (valve) cover.
- Remove brake booster vacuum pump from end of cylinder head.
- Turn crankshaft to top dead center (TDC) for cylinder 1 by aligning marks on flywheel/torque converter as shown earlier.
- Lock camshaft with setting bar as shown earlier.
- Release tensioning roller and slide timing belt off camshaft sprocket.
- Slightly turn crankshaft counterclockwise of engine rotation.
- Loosen camshaft sprocket mounting bolt about 1 turn. Release camshaft sprocket from camshaft with two-arm puller as shown earlier.
- Remove camshaft sprocket mounting bolt and sprocket.

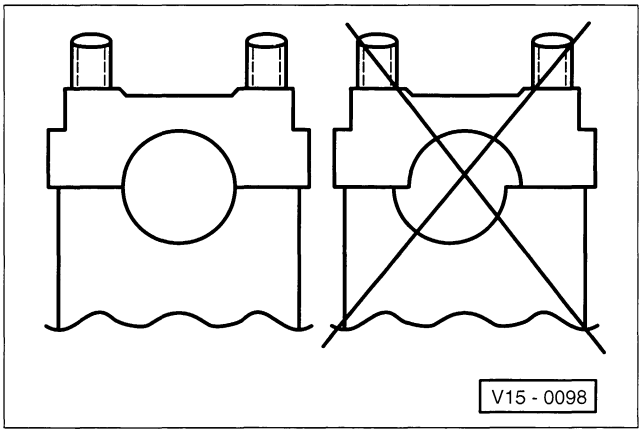
NOTE —
Mark each bearing cap before removing. Each cap is machined to each journal and must be reinstalled to that exact location to prevent damage.

- Loosen and remove bearing caps from positions 5, 1 and 3 in that order.

NOTE —
Position 1 is closest to belt end of camshaft.

- Loosen nuts on bearing cap 2 slightly and then loosen nuts on bearing cap 4 slightly. Loosen nuts alternately and evenly a little at a time on each of two bearing caps. Remove nuts (and washers, if equipped), and remove bearing caps.
- Lift out camshaft and lay aside.

NOTE —
Once removed, camshaft should be checked for wear and other visible damage as described later under **Cylinder Head Components**.



– Oil bearing surfaces of cylinder head and camshaft and install camshaft into cylinder head with lobes for cylinder number 1 pointing up.

➢ Install bearing caps 2 and 4. Install nuts (and washers, if equipped) and tighten nuts alternately and evenly so that camshaft is drawn down fully and evenly into bearing saddles. Torque to specification.

Tightening torque

- Camshaft bearing cap to cylinder head . . . . . 20 Nm (15 ft-lb)

CAUTION —

Be sure to install bearing caps correctly. The caps are bored off-center and only fit properly one way. Caps are matched to cylinder head by the machining process and are not available separately. Broken caps will require replacement of cylinder head.

– Install all remaining bearing caps and torque to specification.

– Install camshaft drive belt sprocket.

NOTE —

Ensure that camshaft lobes for cylinder #1 are still pointing up.

Tightening torque

- Camshaft sprocket to camshaft . . . . 45 Nm (33 ft-lb)

– Install timing belt and adjust tension, see **Timing Belt–Camshaft Drive** given later.

– Install brake booster vacuum pump, cylinder head (valve) cover, and upper timing belt guard.

Tightening torque

- Vacuum pump to cylinder head . . . . 20 Nm (15 ft-lb)
- Valve cover to cylinder head . . . . . 10 Nm (7 ft-lb)

– Install connecting pipe between intercooler and intake hose.

– Install upper engine cover.

– Be sure to quality check your work, see **Quality Review** at end of this repair group.

Hydraulic cam followers, checking

The 1.9 liter diesel engine is equipped with hydraulic cam followers which are also known as lifters.The cam followers are pumped up by engine oil pressure, expanding as necessary to fill the gap between valve stem and camshaft lobe. This occurs continuously and automatically to keep valve in proper adjustment at all times.

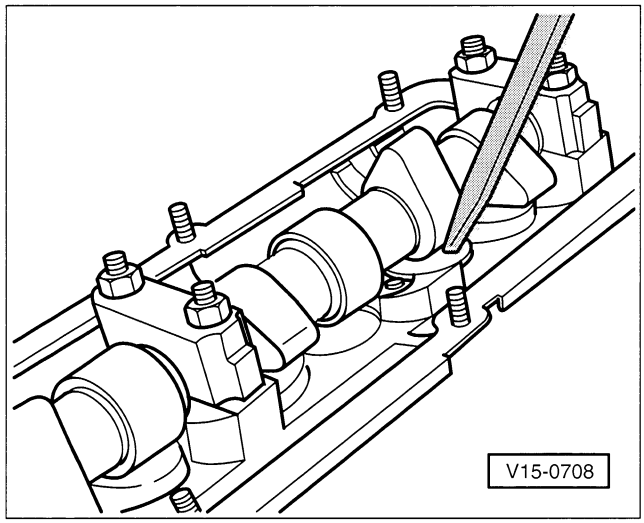
Some valve noise at start-up and during warm-up period is normal at times due to hydraulic cam followers that have bled down while engine was not running. Before checking noisy cam followers, check that engine oil is new and fresh, of correct weight, and that level is correct. Allow 2 minutes with a warm engine running at a fast idle for lubrication system to properly pump up cam followers.

Cam followers should only be checked when engine is fully up to operating temperature. Run engine until radiator fan has switched on at least one time. Increase engine speed to 2,500 rpm and hold it there for approximately 2 minutes. If hydraulic cam followers are still noisy, shut engine off and proceed as follows while engine is still warm.

– Remove cylinder head (valve) cover. See **Cylinder head (valve) cover, removing and installing**, given earlier.

– Turn engine by hand until both camshaft lobes of cylinder #1 are pointing approximately up.

NOTE —
Hydraulic cam follower clearance can be checked on any cam follower (lifter) that is not being depressed by camshaft lobe.



➤ Check clearance between cam follower and cam lobe on cylinder #1 by lightly depressing cam follower with a wooden or plastic wedge and inserting a feeler gauge into gap. If clearance exceeds specified limit, the lifter is faulty and should be replaced.

Specification

- Hydraulic cam follower maximum clearance (1.9L diesel engine) . . . . . 0.2 mm (0.008 in.)

– Turn engine by hand and repeat procedure until all cam followers have been checked.

– Replace a faulty cam follower by removing camshaft as previously described and pulling follower from cylinder head. Faulty hydraulic cam followers can be replaced individually but only as a complete assembly.

> ***CAUTION —***
> *After installing new cam followers, the engine should not be started for at least 30 minutes. New cam followers are usually at full extended height and must be allowed to bleed down to their proper height once installed. Failure to do so may cause valves to strike pistons resulting in serious damage.*

NOTE —
Store removed hydraulic cam followers in order on a clean surface with camshaft contact surface facing down to minimize bleed down. Cover with a clean lint-free shop cloth.

Valve stem oil seals, replacing

The sign of faulty valve stem seals is excessive oil consumption and oil smoke from exhaust. This is usually most noticeable during periods of high manifold vacuum such as deceleration. If compression and leak-down testing confirm integrity of piston rings, but the engine consumes oil, it is likely that faulty valve stem seals are present. It should also be noted that worn valve stem seals could be due to worn valve guides and that worn valve guides are the major cause of oil consumption. See **Cylinder Head Components** for more information on checking valve guides.

Replacing valve stem oil seals requires removal of camshaft, cam followers, and valve springs. This can be done with cylinder head installed or removed. In either case, several Volkswagen special tools are required to compress valve springs and remove and install seals.

Working with cylinder head installed:

– Remove cylinder head cover, camshaft, and hydraulic cam followers as described earlier.

– Turn crankshaft so that cylinder #1 is at TDC. Continue under **Working with cylinder head removed or installed**.

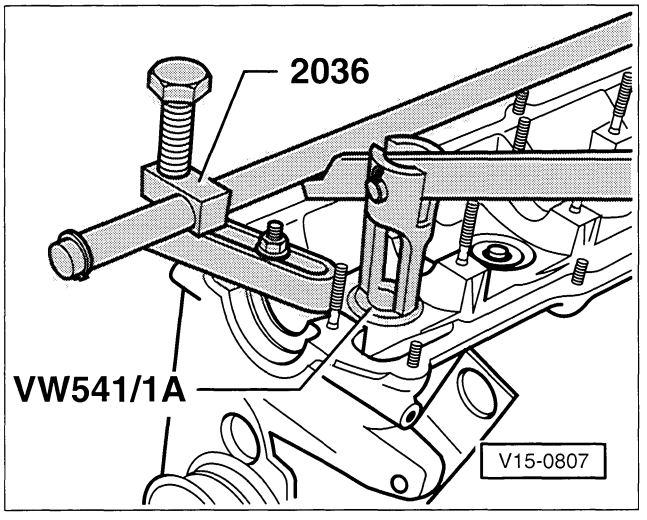
NOTE —
Compressed air is not used as on other engines. When the spring is removed, the valve is properly supported by piston crown at TDC.

Working with cylinder head removed:

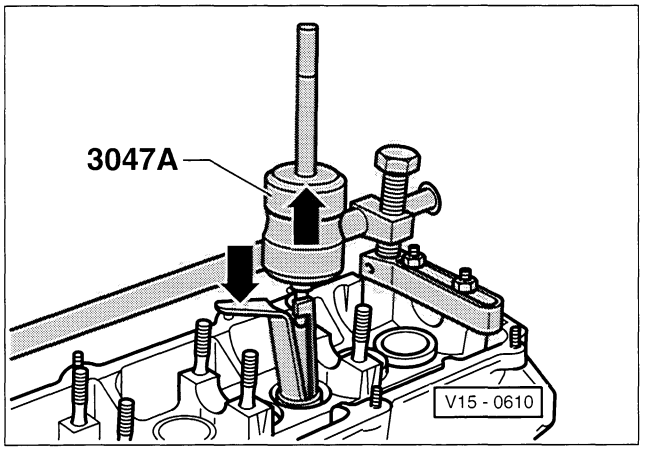
– Secure cylinder head to workbench. Use care to avoid damage to head gasket surfaces.

– Remove camshaft and hydraulic cam followers as described earlier. Continue below.

Working with cylinder head removed or installed:

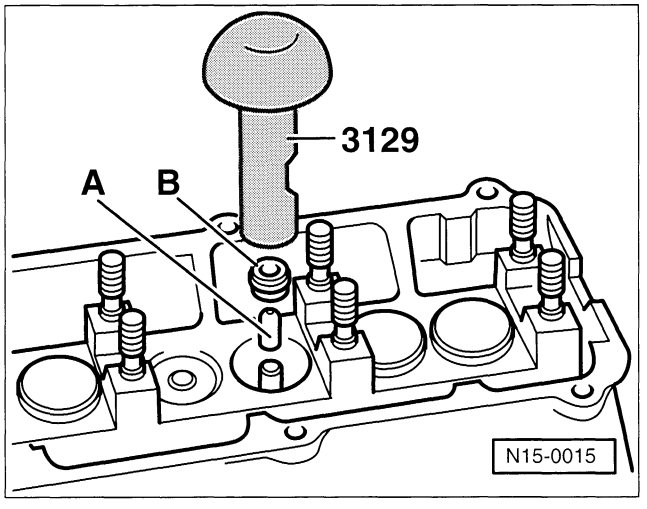


➢ Install appropriate valve spring compressor tools. Compress spring for first cylinder and remove spring retainer, both keepers, and valve spring. If spring will not compress, lightly tap tool to release stuck keepers. Use a small magnet to retrieve keepers.



➢ Remove valve stem seals with special slide hammer tool (VW 3047A shown).

- Valve stem seal removal tool shown in position to remove valve stem seal. Push down on tool (**left arrow**) while sliding hammer up (**right arrow**).



➢ Begin installation of new seal by temporarily fitting a protective plastic fitting sleeve over valve stem. This sleeve is usually included with new seal set and will prevent damage to seal due to sharp edges of keeper grooves. Lubricate new seal with clean engine oil and fit it to installation tool.

- Plastic fitting sleeve (**A**), shown with valve stem seal (**B**) and plastic installation tool 3129 available from Volkswagen or other aftermarket parts specialists.

– Push tool (with seal) down over valve stem until seal is fully seated on guide. Remove tool and protective fitting sleeve.

– Reinstall valve spring, retainer and keepers.

– Repeat for second valve on the cylinder.

– When both valve seals have been replaced on first cylinder, turn crankshaft to TDC for next cylinder (if working with cylinder head installed) and repeat process until all valve seals have been replaced.

– Remaining installation is reverse of removal.

> ***CAUTION —***
> *To prevent cylinder head or camshaft damage, be sure to follow camshaft installation procedure when tightening camshaft bearing caps. See* **Camshaft, removing and installing**.

Tightening torque

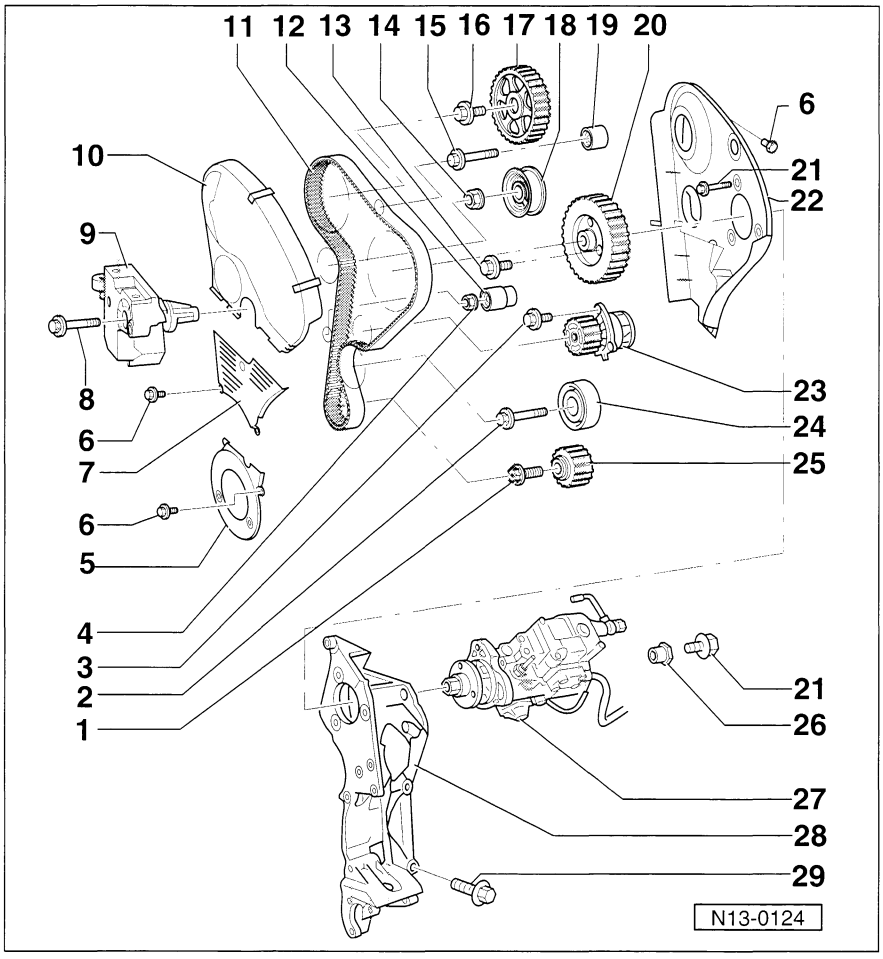
- Glow plug to cylinder head . . . . . 15 Nm (11 ft-lb)

– Be sure to quality check your work, see **Quality Review** at end of this repair group.

TIMING BELT - CAMSHAFT DRIVE

The timing belt, also known as the toothed belt or camshaft drive belt, and its related parts are shown below. Required maintenance involves inspection at the specified intervals. The belt and tensioner are to be replaced at different intervals, depending on model year and whether vehicle has a manual or automatic transmission. See **0 Maintenance** for the appropriate inspection and/or replacement intervals listed in the maintenance schedules. Belt and tensioner replacement will help prevent damage to engine due to belt stretch and long term effects of heat.

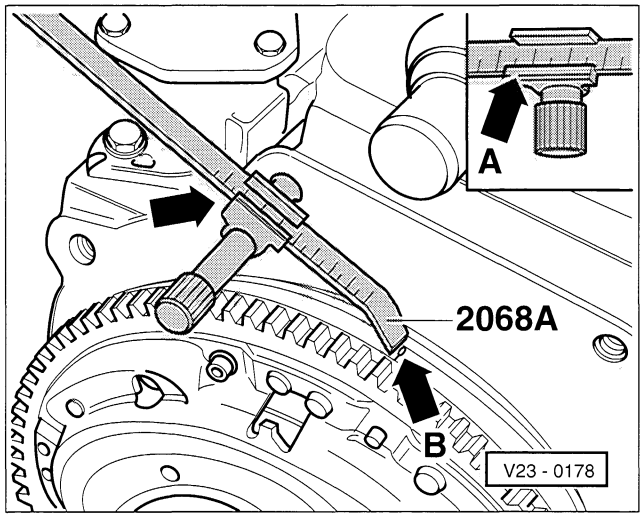
Drive belts, assembly



1. **Bolt**
   - Always replace
   - Tighten to 120 Nm (88 ft-lb) + ¼ turn (90°)
   - To loosen and tighten, counter-hold with 3415
   - Threads and shoulder must be free of oil and grease
   - Additional quarter turn can be obtained in two $^{1}/_{8}$ turn (45°) stages
2. **Bolt**
   - Always replace
   - Tighten to 40 Nm (30 ft-lb) + ¼ turn (90°)
3. **Bolt**
   - Tighten to 15 Nm (11 ft-lb)
4. **Nut**
   - Tighten to 22 Nm (16 ft-lb)
5. **Timing belt guard, lower section**
6. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
7. **Timing belt guard, middle section**
8. **Bolt**
   - Tighten to 45 Nm (33 ft-lb)
9. **Right engine mount**
10. **Timing belt guard, upper section**
11. **Timing belt**
    - Mark engine direction of rotation before removing
    - Check for wear
    - Do not kink
12. **Idler pulley**
13. **Bolt**
    - Always replace
    - Tighten to 20 Nm (15 ft-lb) + ¼ turn (90°)
14. **Nut**
    - Tighten to 20 Nm (15 ft-lb)
15. **Bolt**
    - Tighten to 20 Nm (15 ft-lb)
16. **Bolt**
    - Tighten to 45 Nm (33 ft-lb)
    - To loosen and tighten bolt, counter-hold using 3036
17. **Camshaft sprocket**
    - Release from camshaft using two-arm puller
18. **Tensioning roller**
    - Semi-automatic timing belt tensioning roller
19. **Idler pulley**
20. **Injection pump sprocket**
    - Two piece construction
21. **Bolt**
    - Tighten to 30 Nm (22 ft-lb)
22. **Timing belt guard, rear**
23. **Coolant pump**
    - Check impeller for ease of movement
24. **Idler pulley**
    - Remove before removing coolant pump
25. **Crankshaft timing belt drive sprocket**
26. **Bushing, threaded**
27. **Diesel injection pump**
28. **Assembly bracket**
    - Mounting for diesel injection pump, generator, power steering pump, and air conditioner compressor
29. **Bolt**
    - Tighten to 45 Nm (33 ft-lb)

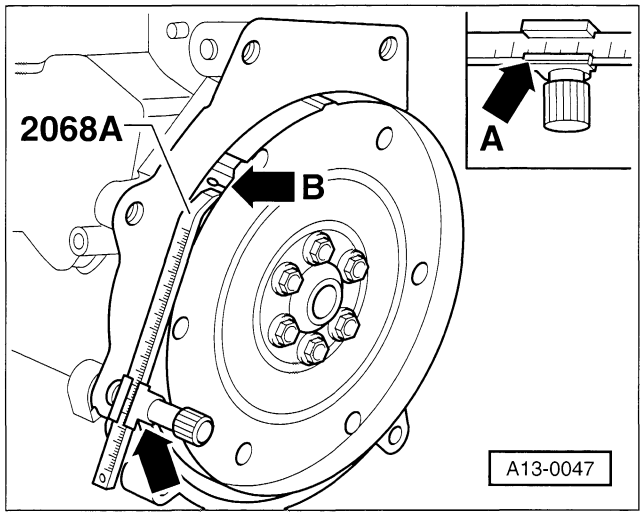
Timing belt for camshaft drive, removing

- Remove upper engine cover.
- Remove lower sound absorber panel (belly pan).
- Remove ribbed V-belt and tensioner, see **0 Maintenance**.
- Remove brake booster vacuum pump from end of cylinder head.
- Remove upper timing belt guard.
- Remove cylinder head (valve) cover.
- Remove connecting pipe between intercooler and intake hose, see **21 Turbocharger and Intercooler**.
- Turn crankshaft to top dead center (TDC) for cylinder #1 by aligning marks on flywheel or torque converter and transmission housing as shown earlier, see **Camshaft oil seal, replacing**. If engine and transmission are separated use alternate procedures described below.



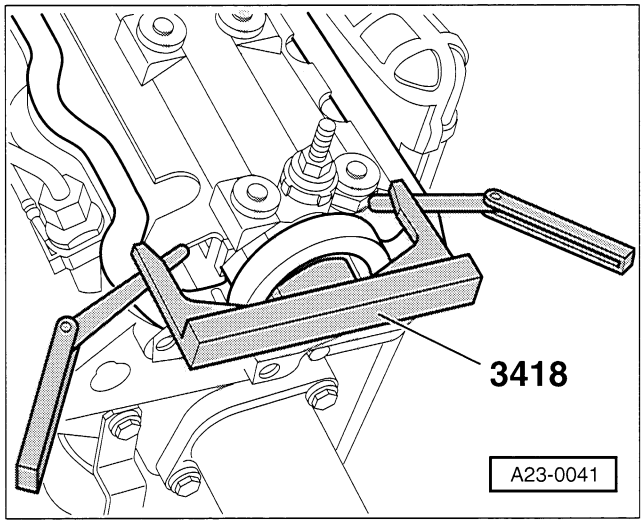
Set TDC for manual transmission vehicles with engine removed.

- Install Volkswagen special tool 2068A as shown. Set adjustment to 96 mm (**arrow A**, inset) and align with TDC mark on flywheel (**arrow B**).



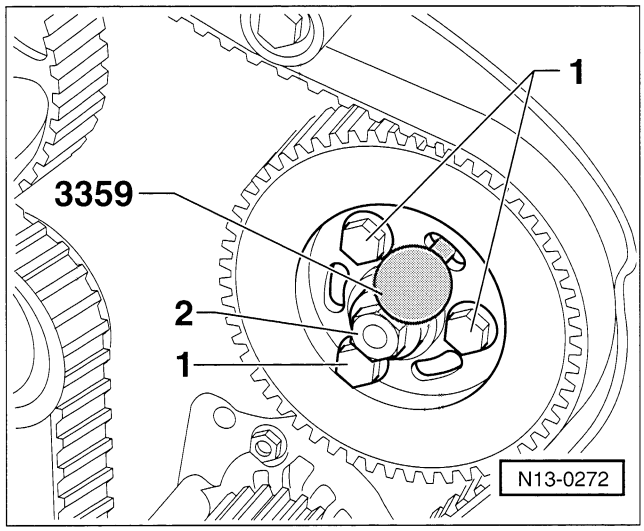
Set TDC for automatic transmission vehicles with engine removed.

- Install Volkswagen special tool 2068A as shown. Set adjustment to 30 mm (**arrow A**) and align with TDC mark on driveplate (**arrow B**).



- Lock camshaft with setting bar and shim between gasket surface and both sides of Volkswagen special tool 3418 with equal thickness of feeler gauges. This will insure that camshaft is at actual TDC. Setting bar is installed at flywheel/driveplate end of engine.

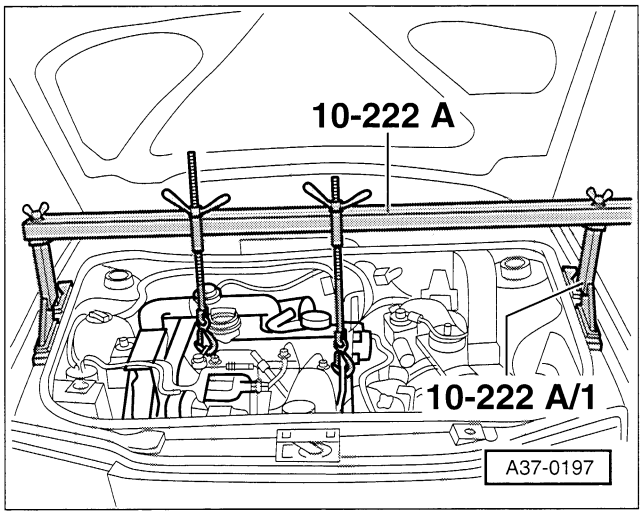
NOTE —
Setting bar will only fit onto camshaft properly if camshaft is at TDC. Camshaft and crankshaft should both be at TDC.



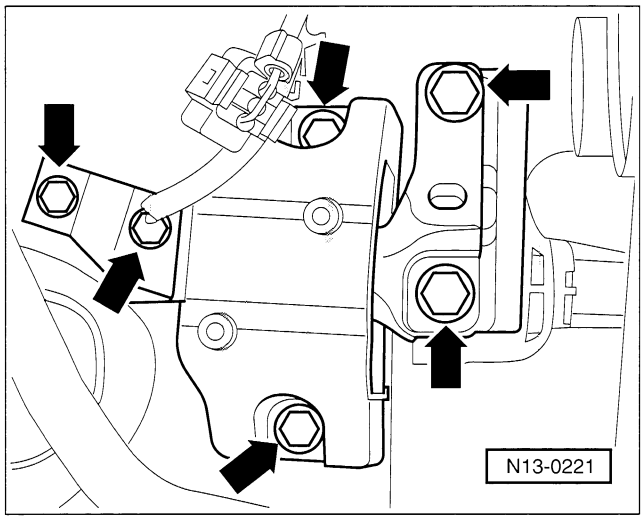
- Lock injection pump sprocket with an appropriate locking tool (**3359** shown). Loosen injection pump sprocket mounting bolts (**1**). Do not loosen hub bolt (**2**).

CAUTION —
Do not loosen or remove hub from Diesel injection pump. The hub is pressed onto tapered end of camshaft and NOT keyed to pump drive shaft! If removed, it will no longer be correctly indexed to pump. Correct indexing requires special equipment and training available only at specialized Bosch service centers and is beyond the scope of this manual.

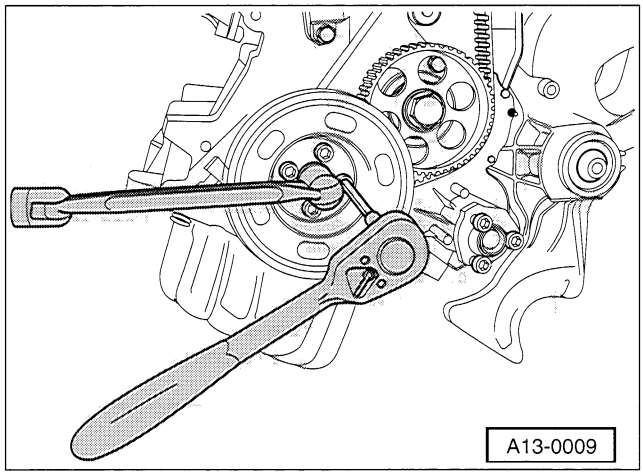
- Loosen tensioner for timing belt.



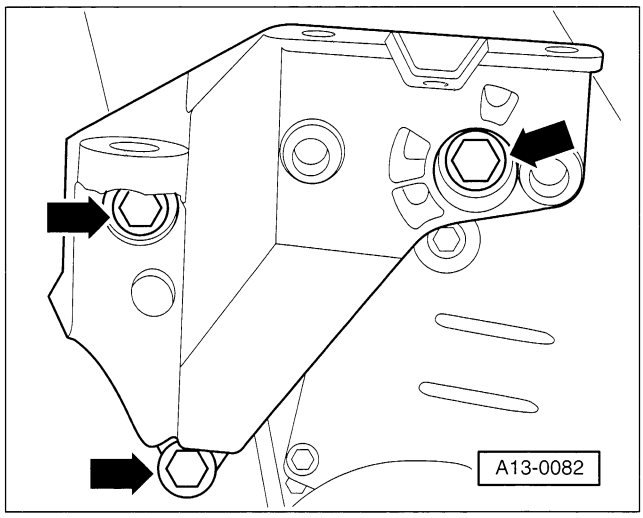
- Support engine with a suitable fixture that is designed to support weight of engine and transmission without damaging body.
- Lift supporting device slightly, so that weight of engine and transmission is on supporting device.
- Remove coolant expansion tank (coolant hoses remain attached).
- Remove power steering fluid reservoir (hoses remain attached).
- Remove vibration dampener/belt pulley from crankshaft.
- Remove center and lower timing belt guards.



➢ Remove the bolts (**arrows**) securing the right side engine mount and remove the mount.



➢ Remove crankshaft pulley/vibration dampener.



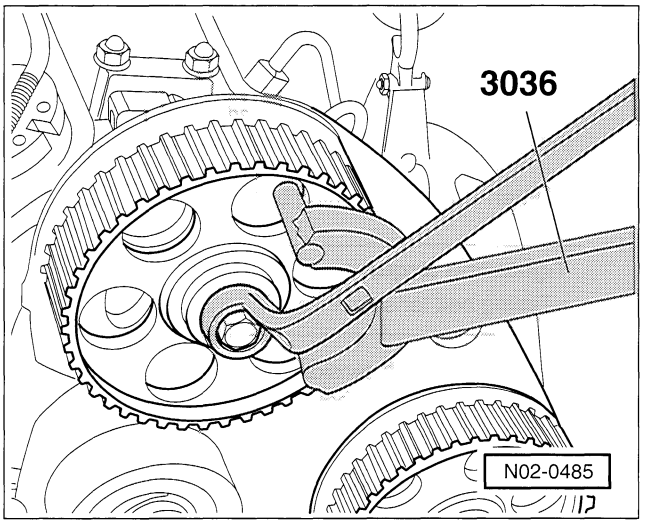
➢ Remove engine mount bracket bolts (**arrows**).

NOTE —
To remove forward bolt for engine mount bracket, raise engine slightly using support fixture.

– Mark running direction of timing belt.

– Release belt tensioner and remove timing belt.

Timing belt for camshaft drive, installing



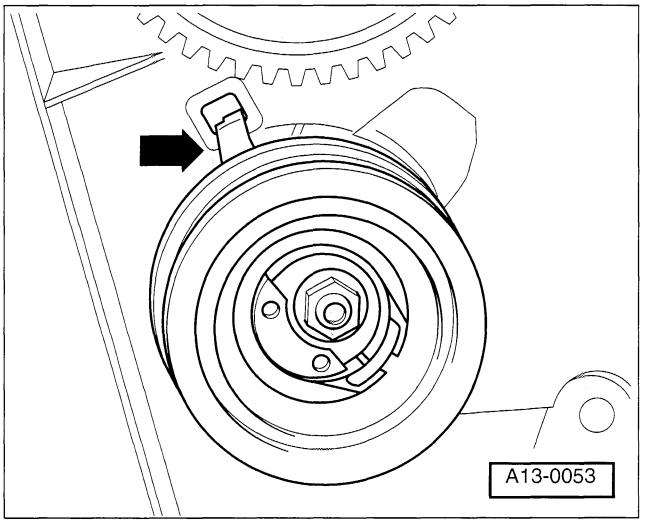
– Ensure that engine is at Top Dead Center (TDC) for cylinder #1 by aligning the mark on flywheel/driveplate with mark on transmission as shown previously.

NOTE —
If engine and transmission are separated, use alternate procedure to set TDC using special tools as shown earlier.

➤ If not previously removed, loosen camshaft sprocket mounting bolt about ½ turn. Hold camshaft sprocket using counter-holding tool (**3036** shown).

NOTE —
Do not use setting bar 3418 to lock camshaft sprocket. Camshaft damage will usually result. Counterhold with 3036 as shown.

– If not previously removed, remove camshaft sprocket as described earlier with two-arm puller.

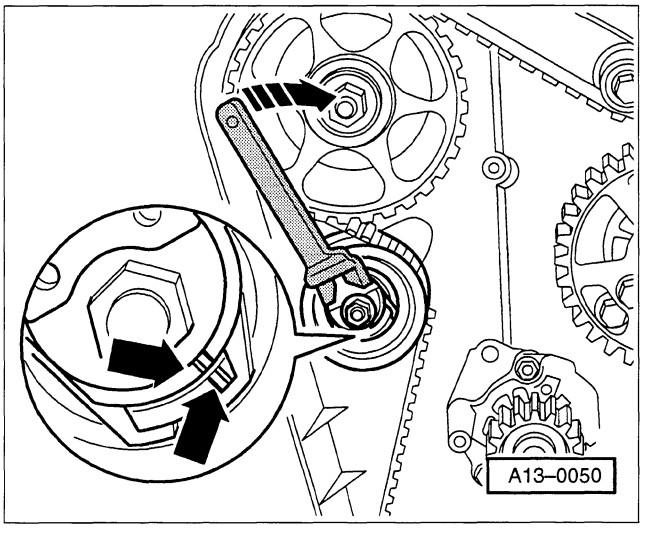


– Install new mounting bolts into diesel injection pump sprocket, but do not torque at this time.

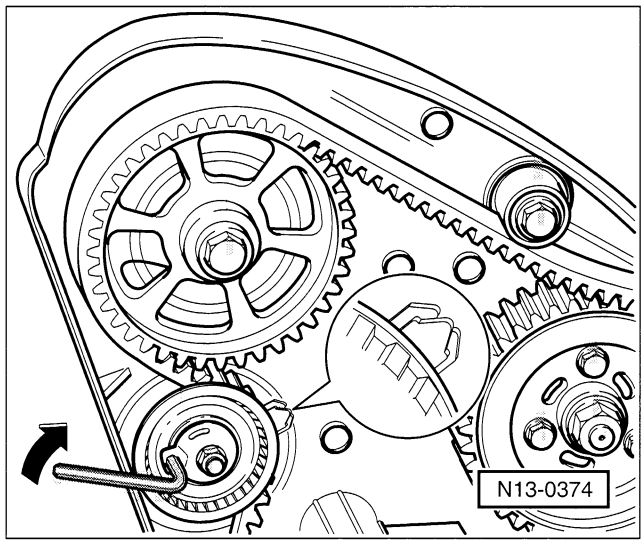
– Install timing belt (noting directional mark if re-using old belt) on crankshaft timing belt sprocket, idler wheels, injection pump sprocket and coolant pump.

– When belt is properly positioned, slip camshaft sprocket into timing belt and slide onto camshaft. Install securing bolt only enough to hold sprocket in place.

➤ Ensure that tab on rear of tensioning roller is positioned into oil galley hole (**arrow**).



➤ For manual transmission vehicles, tension timing belt using a two-pin spanner such as T10020 in holes in eccentric center section. Belt is tensioned properly when notch and raised mark are aligned (inset **arrows**).



For automatic transmission vehicles, tension timing belt using an Allen wrench in eccentric center section. Belt is tensioned properly when Allen wrench is moved in direction shown (**arrow**) and notch and raised mark are aligned (**inset**).

NOTE —
If adjusting cam is turned too far and correct tension is exceeded, tension must be fully released, then readjusted.

– Tighten lock nut on timing belt tensioner.

Tightening torque
- Timing belt tensioner (M8) . . . . . 20 Nm (15 ft-lb)

– Check timing belt tensioner by pushing belt with thumb pressure. Tensioner should spring back to original position.

– Ensure that crankshaft is still at TDC. Remove setting bar and feeler gauges.

– Tighten camshaft sprocket mounting bolt using 3036 to counterhold.

Tightening torque
- Camshaft sprocket to camshaft . . . . . 45 Nm (33 ft-lb)

– Tighten new injection pump sprocket mounting bolts to initial torque (stage I) only and remove locking pin.

NOTE —
The injection pump sprocket mounting bolts should only be used one time, since by design they have a reduced shank and are stretch bolts.

– Turn crankshaft two rotations in the running direction and recheck timing belt tension.

– Dynamically check diesel injection pump timing, see **23 Fuel Injection–Diesel (1.9L engine)**. If engine is removed, diesel pump injection timing must be checked and adjusted after engine has been installed.

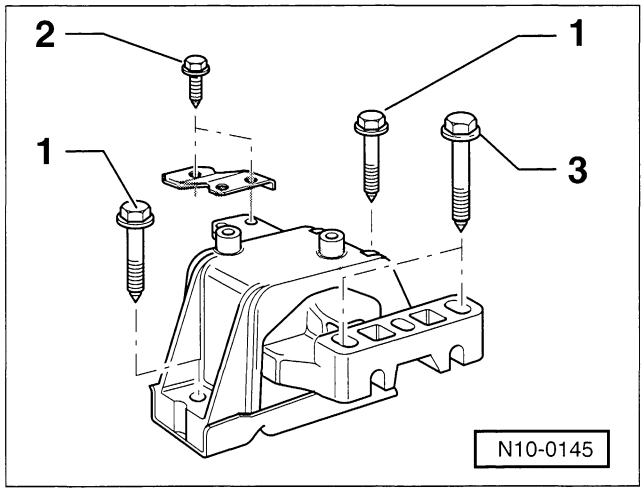
– Return engine to TDC for cylinder #1. Install locking pin tool 3359 and tighten injection pump sprocket mounting bolts to final torque (stage II).

Tightening torque
- Injection pump sprocket - always replace
  stage I . . . . . 20 Nm (15 ft-lb)
  stage II . . . . . additional ¼ turn (90°)

– Install center and lower timing belt guards.

– Install vibration dampener/ribbed belt pulley on crankshaft.

Tightening torque
- Vibration dampener/ribbed belt pulley to timing belt drive sprocket (M8) . . . . . 25 Nm (18 ft-lb)



– Insert bolts into right side engine mount bracket and attach bracket to block.

Tightening torque

- Right side engine mount bracket to cylinder block (M10) . . . . . 45 Nm (33 ft-lb)

Install right side engine mount with new stretch bolts.

1. **Mount to body bolt**
   - 40 Nm (30 ft-lb) plus 90° (¼ turn)
   - always replace
2. **Mount bracket to body bolt**
   - 25 Nm (18 ft-lb)
3. **Mount to engine bracket bolt**
   - 60 Nm (44 ft-lb) plus 90° (¼ turn)
   - always replace

– Remove engine support device.

– Install coolant expansion tank and power steering reservoir.

Tightening torque

- Coolant expansion tank to body . . . . . 10 Nm (7 ft-lb)
- Power steering reservoir to bracket . . 10 Nm (7 ft-lb)

– Install brake booster vacuum pump and cylinder head (valve) cover.

Tightening torque

- Vacuum pump to cylinder head . . . . 20 Nm (15 ft-lb)
- Valve cover to cylinder head . . . . . 10 Nm (7 ft-lb)

– Install ribbed V-belt and tensioner.

Tightening torque

- Ribbed V-belt tensioner (M8) . . . . . 25 Nm (18 ft-lb)

– Install connecting pipe between intercooler and turbocharger and between intercooler and intake hose.

– Install upper timing belt guard.

– Start engine and re-check diesel injection pump timing, see **23 Fuel Injection–Diesel (1.9L Engine)**.

– Install lower sound absorber panel (belly pan).

– Install upper engine cover.

– Be sure to quality check your work, see **Quality Review** at end of this repair group.

CYLINDER HEAD, REMOVING AND INSTALLING

The cylinder head can be removed and installed with engine in vehicle. Cylinder head assembly views given earlier show a view of the ALH cylinder head and related components. Note that cylinder head bolts are stretch type fasteners and should never be reused. In addition, whenever the cylinder head or cylinder head gasket is replaced, the coolant must also be replaced, see **19 Engine–Cooling System**.

Cylinder head, removing

The cylinder head can be removed with exhaust manifold, turbo-charger and intake manifold still attached. The plenum close-out panel at the base of the windshield will be removed to allow easier access to cylinder head and provide space needed for an engine support.

> ***WARNING —***
> *Do not start work on a hot engine. Allow to cool sufficiently before proceeding. Engine temperature must be no hotter than warm to the touch. Cylinder head warpage can result due to uneven cooling rates.*

NOTE —
Disconnecting battery cables will erase fault codes and basic settings in engine management and automatic transmission control unit memories. Some driveability problems may be noticeable until system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. See **23a Fuel Injection – Diesel (ALH)** *for additional information. In some instances proper diagnosis will require use of a scan tool such as Volkswagen supplied VAG 1551 or 1552. Use and operation of this tool is outside the scope of this repair manual.*

– With ignition switched off, disconnect battery negative terminal from battery.

NOTE —
Be sure to have anti-theft radio code on hand before disconnecting battery.

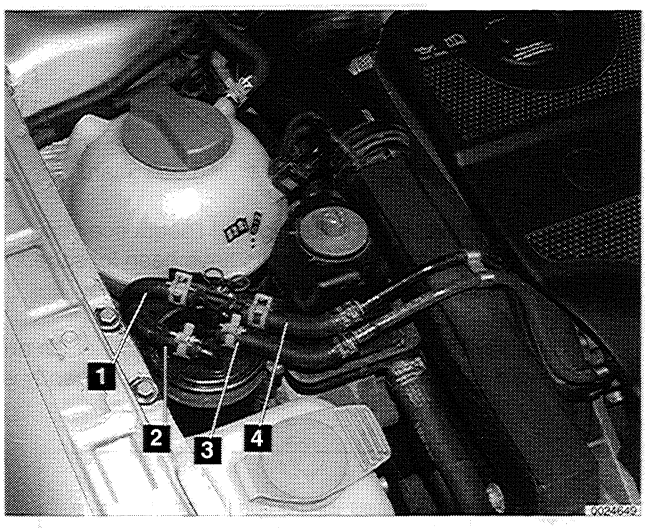
– Position crankshaft so that pistons are NOT at TDC.

– Remove upper engine cover.

– Remove air cleaner assembly and connecting pipe.

– Remove connecting pipe and hose between intercooler and intake manifold/EGR solenoid.

– Remove connecting pipe and hoses between turbocharger and intercooler.



– Remove lower sound absorber panel (belly pan).

– Drain engine coolant, see **19 Engine–Cooling System**.

➢ Disconnect and label fuel supply and return lines at fuel filter.

- 1 - Fuel return to tank
- 2 - Fuel supply from tank
- 3 - Fuel supply to engine
- 4 - Fuel return from engine

> ***WARNING —***
> *Fuel will be expelled when disconnecting fuel hoses. Wrap a cloth around fuel line fittings before disconnecting them. Do not smoke or work near heaters or other fire hazards. Have a fire extinguisher handy.*

– Seal off disconnected fuel and vacuum lines to prevent contamination.

– Remove fuel filter and bracket.

– Unbolt front exhaust pipe from turbo-charger, see **26 Exhaust System and Emission Controls**.

– Remove ribbed V-belt and tensioner.

– Remove both wiper arms and plenum close-out panel at base of windshield, see **92 Wipers and Washers**.

– Remove coolant flange from end of cylinder head and disconnect coolant hoses from EGR cooler.

– Disconnect breather and vacuum hoses from cylinder head.

– Disconnect all electrical connectors from cylinder head including glow plug bus connector.

– Remove upper timing belt guard.

– Remove cylinder head (valve) cover.

– Remove brake booster vacuum pump.

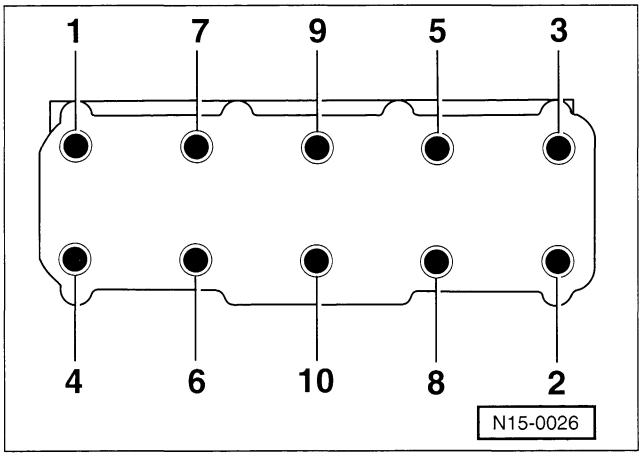
– Disconnect oil return line at turbo-charger, see **21 Turbocharger and Intercooler**.

– Disconnect turbo-charger oil supply line and support bracket.

– Remove metal fuel injector lines.

- Remove all four lines together as a set.
- Use an offset flare nut wrench such as Volkswagen special tool 3035 to loosen fittings of injector lines.
- Take care not to bend lines or change the shape.

– Remove small injector fuel return hoses.



– Position engine to TDC for cylinder #1 and install setting bar as shown earlier.

– Loosen camshaft sprocket as shown earlier and slip timing belt off of camshaft sprocket.

– Remove timing belt tensioning roller and camshaft sprocket as shown earlier.

– Remove upper bolt from rear timing belt guard.

➢ Loosen socket head bolts slightly in sequence shown but do not remove until all 10 bolts have been loosened. Do not re-use head bolts.

– Carefully lift off cylinder head and place in a clean area. If head is stuck, use a soft-faced mallet or pry gently with a wooden stick.

> ***CAUTION —***
> *Some of the valves will be open. Use extra care when removing and handling to avoid damage. Place cylinder head on bench or table so that weight of cylinder head will not rest on valves.*

Cylinder head, installing

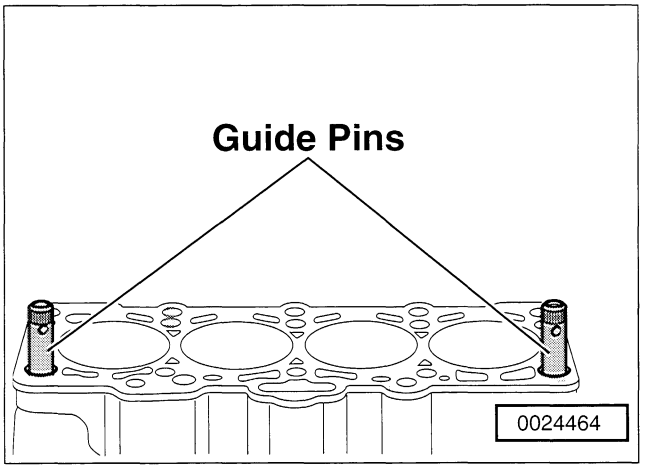
Before proceeding with installation of the cylinder head, whether an original or a new unit, observe following important points:

- Check cylinder head and block for distortion and warpage, see **Cylinder Head Components**, given later in this section.
- Carefully clean cylinder block and cylinder head sealing surfaces being sure to avoid scratching them during cleaning process. Do not use metal scrapers or wire brushes.
- When using abrasive paper do not use any grades coarser than 100 grit (such as 80 grit). Lower numbers are coarser.
- If cylinder head will not be reinstalled immediately, take precautions to prevent rust from forming on cylinder block walls and gasket sealing surfaces.
- When cleaning old gasket material off of cylinder block, take precautions to keep old gasket material and the used abrasive particles and dirt out of cooling and oiling system passages. Place a clean shop cloth over cylinders to prevent contamination from getting between cylinder wall and piston.
- Do not take new cylinder head gasket out of packaging until ready to use. Handle new gasket with extreme care as any damage will lead to leaks.
- There MUST NOT BE any oil or coolant in head bolt holes in cylinder block. Any fluids in holes creates danger of hydrolock while torquing which could lead to structural damage of cylinder block. Use thread chasers to remove foreign material as required. Be sure that all 10 bolt holes are clean and dry.

Cylinder head, installing (continued)

- When all traces of old gasket material have been removed from cylinder block and head, carefully remove all traces of metal particles, abrasives and lint. All gasket sealing surfaces and bolt holes must be clean and dry to ensure a proper seal.
- Always use a new cylinder head gasket and new head bolts.
- Do not use any gasket sealer on new cylinder head gasket.
- If installing a Volkswagen supplied replacement cylinder head, be sure to inspect for and remove any plastic packaging materials used to protect head and the open valves.

– Position crankshaft to TDC for cylinder #1 and then turn backwards until all pistons are equally spaced below TDC.



➢ Install guide pins (VW special tool 3450) into two head bolt holes of cylinder block. Pins allow for proper alignment of the head on block, preventing slippage and damage to head gasket. Old head bolts with the socket head cut off can also be used as alignment pins.

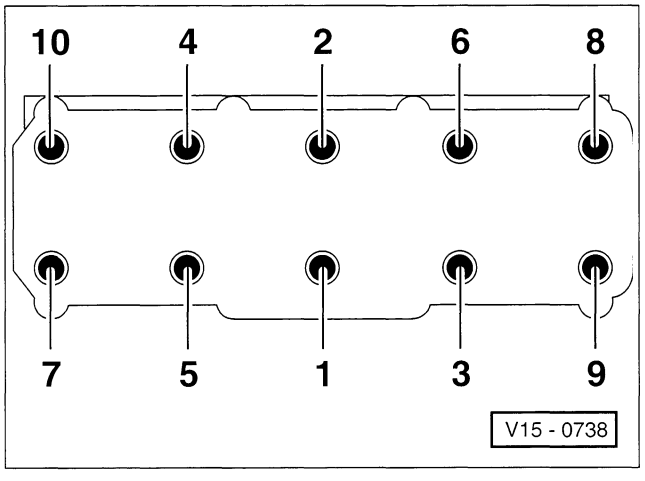
– Install new cylinder head gasket onto block with numbers and letters facing up. Be sure that none of the wiring or any vacuum hoses are caught between cylinder head and block.

NOTE —
Be sure that cylinder head gasket is the same thickness as the original, or, that the correct thickness gasket is being installed on the basis of actual measurements. See ***Crankshaft/Cylinder Block, 4-cylinder 13a, Piston Projection at TDC (diesel engines).***

– Carefully install cylinder head onto block over alignment pins and screw in 8 new head bolts. Tighten bolts hand-tight only.

NOTE —
New head bolts may require different hex head socket tool than old ones (12 pt. vs. 6 pt.).

– Remove alignment pins from bolt holes with tool and install remaining 2 new head bolts. Tighten these bolts hand-tight.



➢ Tighten 10 cylinder head bolts in three stages following tightening order shown at left.

Tightening torque

- Cylinder head to cylinder block, engine code ALH (stretch bolt - always replace)
  - stage I . . . . . 40 Nm (30 ft-lb)
  - stage II . . . . . 60 Nm (44 ft-lb)
  - stage III . . . . . additional ¼ turn (90°)
  - stage IV . . . . . additional ¼ turn (90°)

– Ensure that setting bar remains in place on end of camshaft as shown earlier.

- Attach available support hook from engine support fixture tool to lifting eye on cylinder head. Slightly lift this support hook to relieve tension on other support hook and remove it along with adapter.
- Install upper bolt for rear timing belt guard where it is attached to cylinder head.
- Position crankshaft at TDC for cylinder #1 by carefully turning in normal running direction.
- Install timing belt, sprocket and tensioner, see **Timing belt for camshaft drive, installing**, given earlier.
- Install brake booster vacuum pump.
- Install cylinder head (valve) cover.
- Install bolts into right side engine support bracket and attach bracket to block.
- Install engine mount with new stretch bolts, see **10 Engine–Removing and Installing**.
- Relieve tension on engine support bracket hook and remove fixture.
- Install metal fuel injector lines and small fuel return hoses.
- Connect turbo-charger oil lines.
- Attach front exhaust pipe to turbo-charger with new nuts.
- Install lower sound absorber panel (belly pan).
- Install upper timing belt guard.
- Install ribbed V-belt and tensioner.
- Install plenum close-out panel and wiper arms.
- Install coolant flange and hoses to cylinder head.
- Install coolant reservoir and refill cooling system with fresh coolant of appropriate ratio. See **19 Engine–Cooling System**.

> ***CAUTION —***
> - *Use only Volkswagen original anti-freeze when filling cooling system. Use of any other anti-freeze may be harmful to cooling system. Do not use an anti-freeze containing phosphates.*
> - *Do not use tap water in cooling system. Use distilled water only to mix anti-freeze.*

- Install fuel filter, bracket and fuel hoses.
- Install breather and vacuum hoses.

- Install all electrical connectors including glow plug bus.
- Install connecting pipes between intercooler, turbocharger and intake manifold.
- Install air cleaner assembly and connecting pipe.
- Install upper sound absorber panel.
- Reconnect battery only after all parts have been reinstalled and reconnected.
- Start engine and re-check diesel injection pump timing, see **23 Fuel Injection–Diesel (1.9L engine)**.
- Be sure to quality check your work, see **Quality Review** at end of this repair group.

Tightening torques

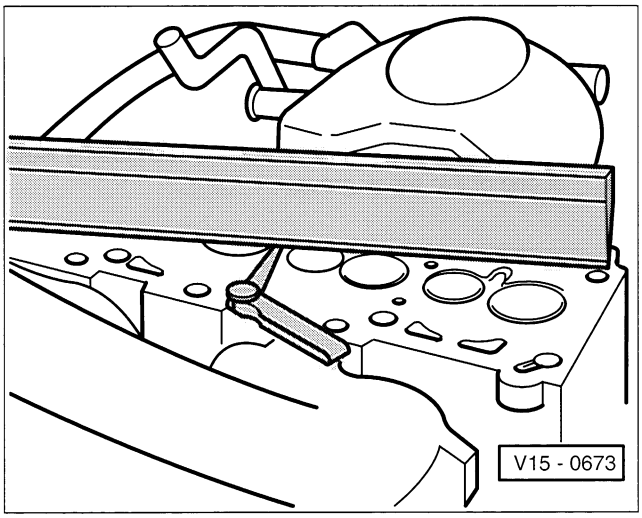
- Cylinder head cover to cylinder head (M6) . . . . . 10 Nm (89 in-lb)
- Cylinder head to cylinder block, engine code ALH (stretch bolt - always replace)
  - stage I . . . . . 40 Nm (30 ft-lb)
  - stage II . . . . . 60 Nm (44 ft-lb)
  - stage III . . . . . additional ¼ turn (90°)
  - stage IV . . . . . additional ¼ turn (90°)
- Front exhaust pipe to exhaust manifold (special nuts - always replace)(M8) . 25 Nm (18 ft-lb)
- Coolant outlet flange to cylinder head (M6) . . . . . 10 Nm (7 ft-lb)
- Rear timing belt guard to cylinder head (M6) . . . . . 10 Nm (7 ft-lb)
- Ribbed belt tensioner to bracket (M8) 25 Nm (18 ft-lb)
- Timing belt tensioner (M8) . . . . . 20 Nm (15 ft-lb)
- Fuel injector line flare nut . . . . . 25 Nm (18 ft-lb)
- Vacuum pump to cylinder head . . . . 20 Nm (15 ft-lb)
- Camshaft sprocket to camshaft . . . . 45 Nm (33 ft-lb)
- Right side engine mount bracket to cylinder block (M10) . . . . . 45 Nm (33 ft-lb)

CYLINDER HEAD COMPONENTS

This section provides specifications and special information necessary to repair the cylinder head that has been removed from the Volkswagen ALH 1.9L diesel engine. Special service tools and machine shop services are required for most cylinder head repair.

NOTE —

- *The information given under this heading assumes that cylinder head is removed. For cylinder head removal procedures, see* **Cylinder head, removing** *given earlier.*

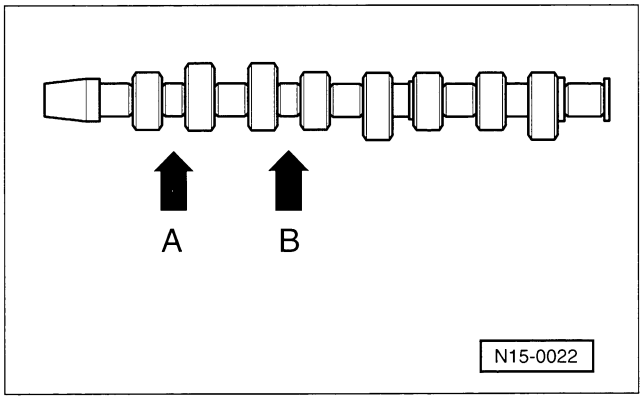


Cylinder Head and Camshaft

Check cylinder head for warpage and distortion with an accurate straight edge and a feeler gauge. Resurfacing of cylinder head is specifically not recommended by Volkswagen. Excessively warped or distorted cylinder heads must be replaced.

Specification

- Maximum cylinder head distortion/warpage . . . . . 0.1 mm (0.004 in.)

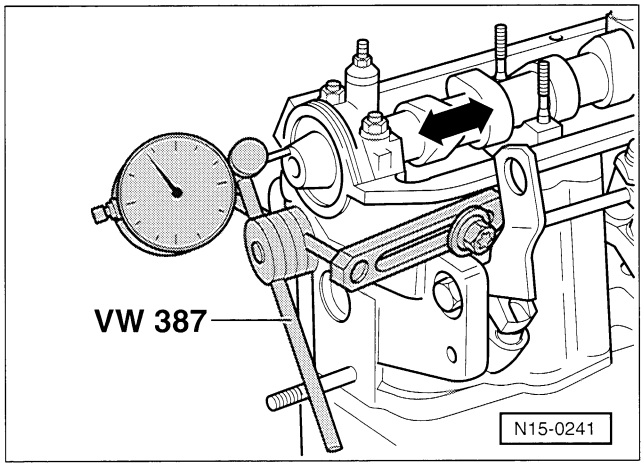


The camshaft for AHL 1.9L diesel engines is easily identified by markings cast into it during manufacture.

- **Arrow A** identifier is -38K-
- **Arrow B** identifier is -DE-

Specification

- Valve timing at 1 mm valve lift, engine code ALH
  - Intake opens after TDC . . . . . 16°
  - Intake closes after BDC . . . . . 25°
  - Exhaust opens before BDC . . . . . 28°
  - Exhaust closes before TDC . . . . . 19°

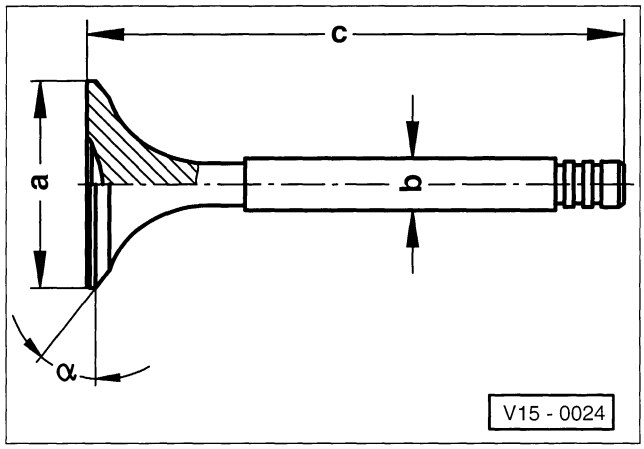


The in and out movement of camshaft is known as axial play and is measured with cam followers removed and only the first and last bearing caps installed.

Set up a dial gauge on sprocket end of camshaft and check camshaft clearance by moving camshaft as far as it can go in each direction (**arrow**).

Specification

- Camshaft axial clearance. . . . . 0.15 mm (0.006 in.)

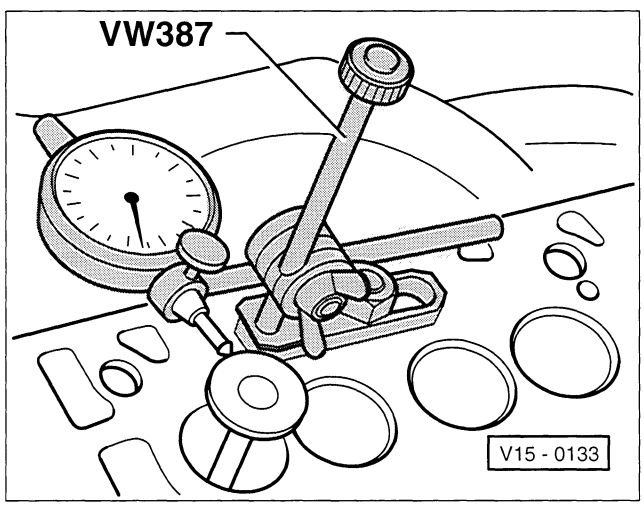


Valves

Valves should not be re-worked on a machine. Only lapping by hand with valve compound is permitted. Valve dimensions listed in **Table a** apply to valve shown at left which is representative of both intake and exhaust valves.

Table a. Valve Dimensions

Engine: 1.9L Diesel	
Valve head diameter (**a**)	
intake	35.95 mm (1.415 in.)
exhaust	31.45 mm (1.238 in.)
Valve stem diameter (**b**)	
intake	6.963 mm (0.274 in.)
exhaust	6.943 mm (0.273 in.)
Valve length (**c**)	
intake	96.85 mm (3.813 in.)
exhaust	96.85 mm (3.813 in.)
Valve face angle (α)	
intake	45°
exhaust	45°



Valve guides

Special tools and a press are required to replace valve guides. Check valve guide wear with a new valve and a dial indicator (VW 387 shown). Insert valve until stem end is flush with end of guide. Rock valve back and forth to check total travel.

Specification

- Valve guide (wear limits-maximum play) with new valve
  intake and exhaust valve guide . . 1.3 mm (0.051 in.)

Always use an intake valve in an intake guide and an exhaust valve in an exhaust guide. Inspect valve seats to ensure that cylinder head can be reconditioned before installing new valve guides. Press out worn original valve guides with Volkswagen special driver tool 3121 from camshaft side of head. Replacement valve guides have a shoulder on the camshaft side to limit installed depth and must be pressed out from combustion chamber side.

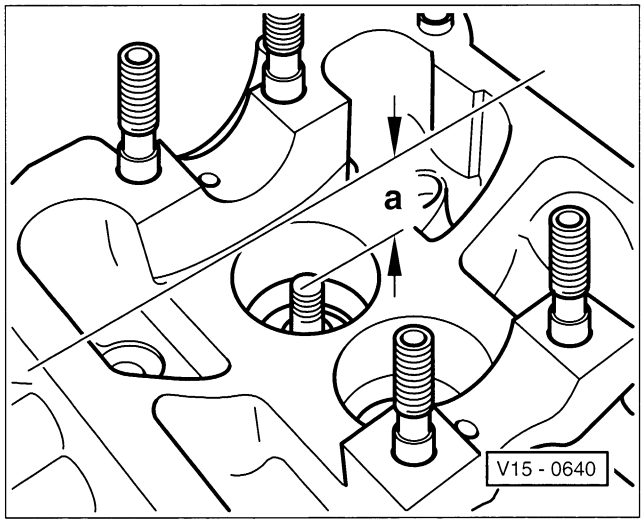
When installing new valve guides, lubricate with clean engine oil and press in from camshaft side down to shoulder. The cylinder head must be cold for this operation. Once the shoulder of the valve guide contacts cylinder head, do not allow pressure on guide to exceed 2000 psi (1 ton) otherwise cylinder head or guide will be damaged. When guide has been replaced, ream it to proper size and continue with reworking of valve seats.

NOTE —

Due to close tolerances found in valve guides, it is recommended that Volkswagen special tool 3121 be used for removal and installation and special tool 3120 be used to ream valve guide to size. Be sure to use appropriate cutting fluid during reaming operation.

Valve seats

When resurfacing valve seats, there is a limit to the amount of material that can be removed to bring the seat back into specification. If too much material is removed, final assembly will leave too little space for hydraulic cam follower to function properly. The maximum refacing dimension, that is, the maximum amount of material that can be removed from valve seat, is calculated from measurement shown at left



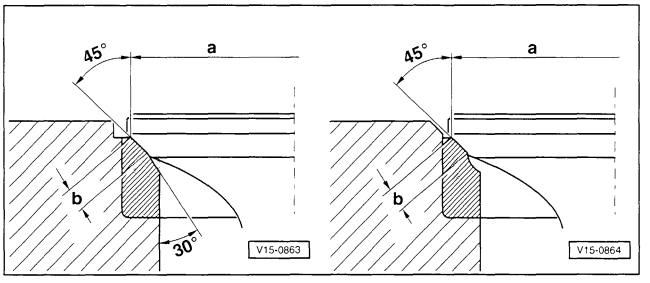
- Measure distance (**a**) between top of valve stem and gasket surface of cylinder head and subtract the minimum dimension, as given in **Table b**. The difference is the maximum amount of material that can be removed from the valve seat.

Table b. Minimum Dimensions for Calculating Valve Seat Refacing Dimensions

Engine	Intake	Exhaust
1.9L Diesel	35.8 mm (1.409 in.)	36.1 mm (1.421 in.)

NOTE —

Use care when reworking exhaust valve seats to avoid changing the shape of the port. The 30° lower valve seat chamfer is necessary to ensure that intake channel flow characteristics are maintained.



Valve seat dimensions for reworking valves are given in **Table c** and correspond to valve dimensions shown.

- Intake valve shown at far left
- Exhaust valve shown at near left

Table c. Valve Seat Dimensions

1.9L Engine	Intake	Exhaust
Seat diameter (**a**)	35.7 mm (1.406 in.)	31.4 mm (1.236 in.)
Seat width (**b**)	1.6 mm (0.063 in.)	approx. 2.7 mm (0.106 in.)
Valve seat angle	45°	45°
Correction angle, lower	30°	N/A

QUALITY REVIEW

When you have finished working under hood and around other areas of the vehicle it is advisable to take a moment to quality check or review your work. This helps to ensure that operation or repair has been completed properly with all affected systems functioning within normal parameters. This may include the following:

- Make sure that radiator fan cycles properly and that coolant level and concentration are correct.
- Ensure that all cable ties and hose clamps that were removed as part of repair are replaced.
- Clean off any diesel fuel that may have spilled onto rubber hoses and belts. It will cause deterioration.
- Check and adjust all other applicable fluid levels.
- Make sure that there are no fluid leaks.
- Make sure that there are no air, vacuum or exhaust leaks.
- Make sure that all components involved in repair are positioned correctly and function properly.
- Male sure all tools, shop cloths, fender covers, and protective tape are removed.
- Clean grease from painted surfaces and steering wheel.
- Unlock anti-theft radio and reset clock.

In addition to above noted points, ECM and TCM may need to be checked using Volkswagen supplied VAG 1551 or 1552 scan tool as mentioned at the start of this repair.

15c Cylinder Head and Valvetrain (2.0L Engine)

GENERAL 15c-1

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CYLINDER HEAD SERVICE 15c-3
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- External cylinder head assembly, (engine code: AEG, AVH late production) 15c-7
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- Hydraulic cam followers, checking 15c-13
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- Timing belt for camshaft drive, installing (engine code: AEG, AVH, AZG, BEV) 15c-20
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b. Minimum Dimensions for Calculating Valve Seat Refacing Dimensions 15c-38
c. Valve Seat Dimensions 15c-39

GENERAL

This section covers cylinder head and valvetrain service and repair work for the 4-cylinder, 2 valve per cylinder, 2.0 liter gasoline engine. For information on short block engine rebuilding and internal engine specifications, see **13a Crankshaft/Cylinder Block (4-cylinder)**.

Most of the operations described in this repair group require special equipment and experience. If you lack the skills, tools, or a suitable workplace for servicing or repairing the cylinder head, we suggest that you leave these repairs to an authorized Volkswagen dealer or other qualified shop.

Engine Codes

- AEG, AVH, AZG, BBW, BEV . 2.0L 4-cylinder gasoline

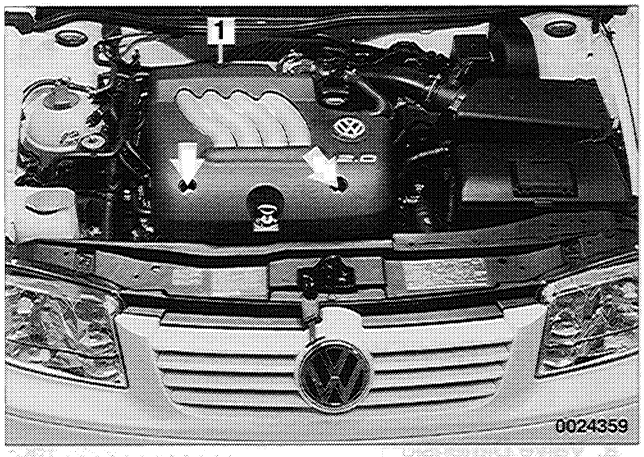
DIAGNOSTIC TESTING

The tests that follow can be used to help isolate engine problems, to better understand a problem before starting expensive and extensive repairs, or to just periodically check engine condition.

Compression test

A compression test will tell a lot about the overall condition of the engine without the need for taking it apart. Testing is relatively simple and straightforward. AEG engine is shown, other engine codes are similar.

– Remove dipstick and place on clean cloth.



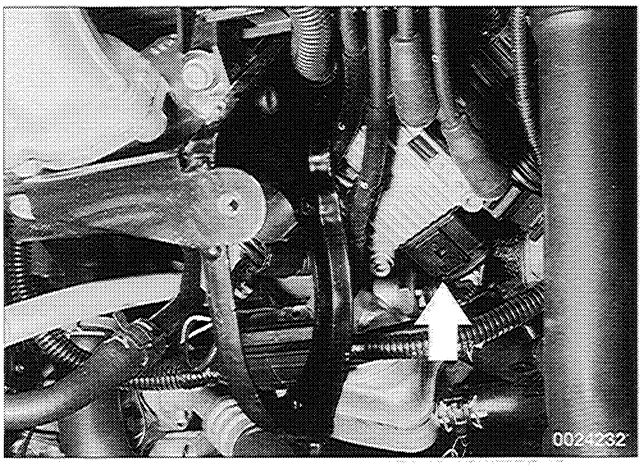
➢ Remove two plastic caps and retaining nuts (**arrows**) on upper sound absorber panel. Loosen rear retaining nut (**1**) slightly. Remove dipstick and lift cover up slightly and pull forward.

NOTE —
On later model 2.0L engines, with only a retaining nut at the back of engine cover, first remove oil dipstick. Then grasp engine cover with both hands at sides, towards the front, and lift up and then slide cover forward towards radiator and out of rear retaining nut grommet.

– Replace dipstick and warm-up engine until it is a minimum of 30°C (86°F).

– Disconnect spark plug wires from spark plugs by gently pulling on boot, do not pull on wire. Label all wires to avoid confusion during reinstallation.

– Use compressed air to clear area around spark plugs. Remove all spark plugs and lay aside in proper order.



➢ Disable ignition system.

- **AEG** engines: unplug 4-pin harness connector (**arrow**) from ignition coil power output stage.
- **AVH, AZG, BBW, BEV** engines: unplug 6-pin harness connector from ignition coil power output stage.

NOTE —
Secondary air pump shown removed for clarity on AEG engine.

> ***CAUTION —***
> *Failure to disable ignition system during testing can result in damage to Motronic ECM or ignition power output stage due to high voltage developed in ignition coil.*

– Remove fuse 32 for fuel injectors.

– Fit compression tester into spark plug hole.

– Have a helper:

- depress clutch pedal fully
- put transmission in neutral or park
- depress accelerator pedal to floor (AEG engine only)
- crank engine over with starter motor

NOTE —
Cranking the engine with ignition system disabled and components disconnected may cause Diagnostic trouble codes (DTCs) to be stored in engine management system memory.

- Engine should be cranked a minimum of 4 to 5 revolutions.
- Record readings, release pressure in gauge and repeat procedure for each cylinder.
- Compare readings to specification.

Specification

- Compression pressures (2.0L engine)
  - new . . . . . 10 to 13 bar (145 - 189 psi)
  - wear limit . . . . . .7.5 bar (110 psi)
  - maximum difference between cylinders . . . . . 3 bar (44 psi)

- When all cylinders have been checked, reinstall spark plugs and wires, connect harness connector for ignition coil power output stage and install upper engine cover.

Tightening torque

- Spark plug to cylinder head . . . . . 30 Nm (22 ft-lb)

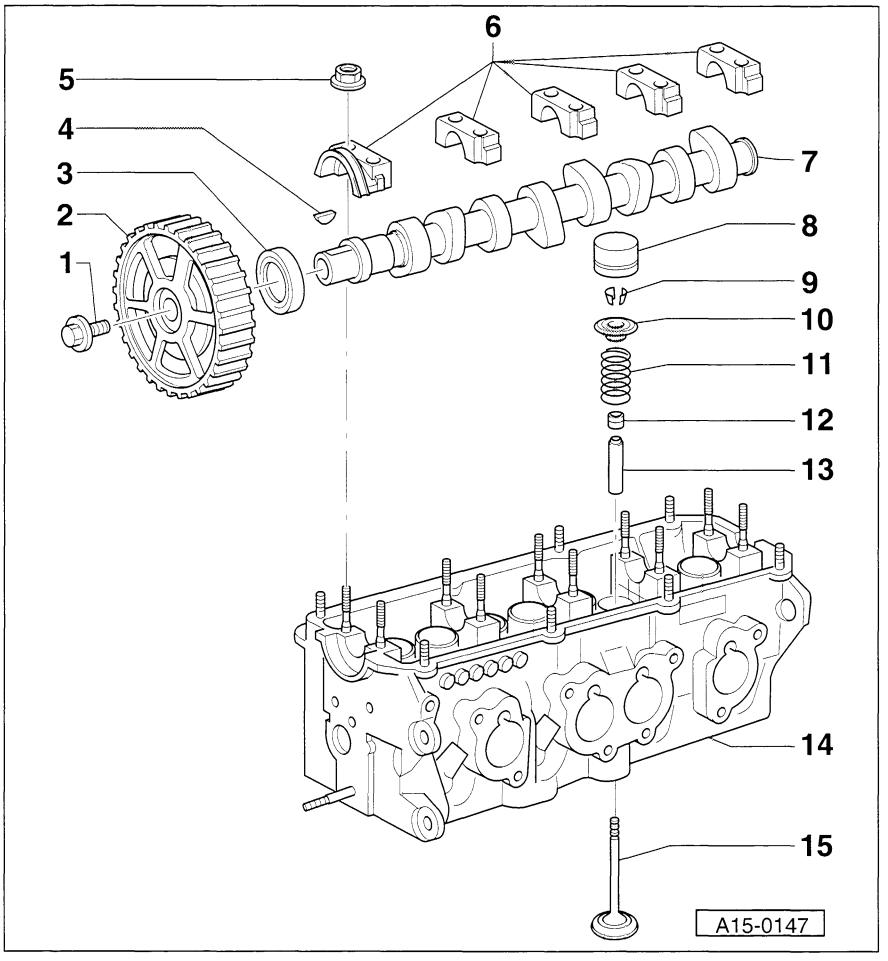
Cylinder leakdown test

The most conclusive diagnosis of low compression symptoms requires a cylinder leak-down test. Using a special tester and a supply of compressed air, each cylinder is pressurized. The rate at which air leaks out of the cylinder, as well as the sound and location of escaping air can more accurately pinpoint the magnitude and source of the leakage. Any engine compression diagnosis that will require major disassembly should first be confirmed by a cylinder leak-down test. Because this test requires special equipment and experience, it may be desirable to have it performed by a Volkswagen dealer or other qualified repair shop. Leakdown limit specifications are usually supplied by the equipment manufacturer.

CYLINDER HEAD SERVICE

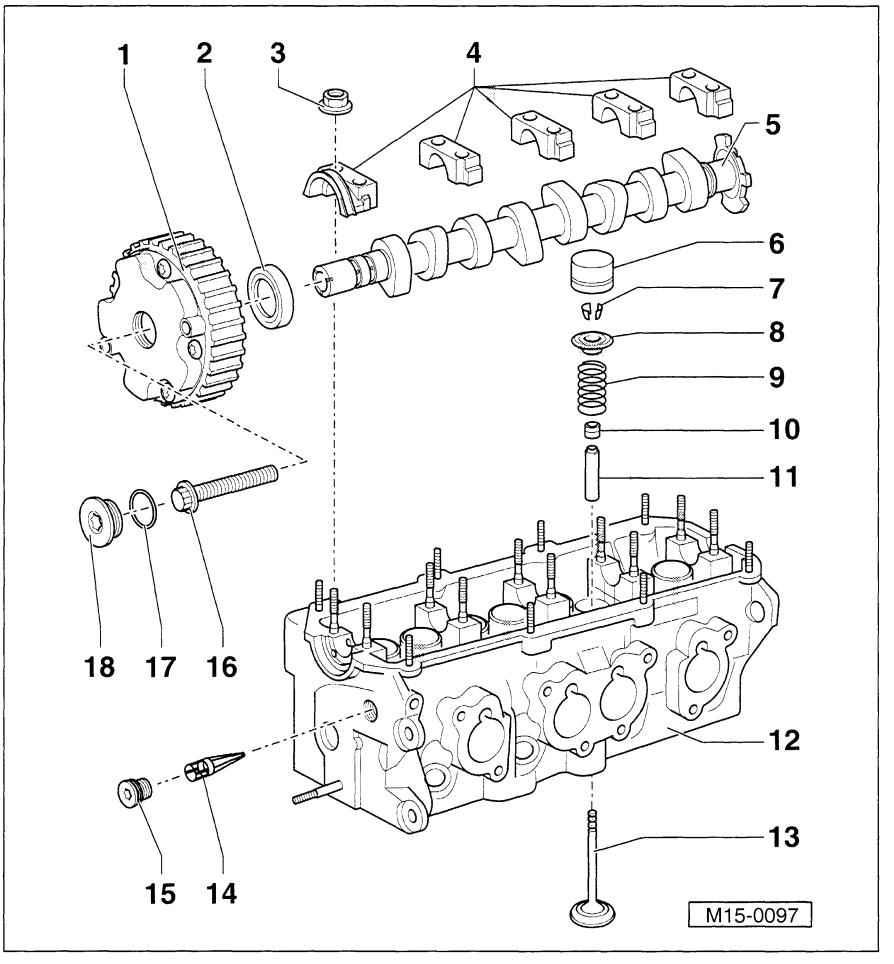
Many cylinder head repairs can be accomplished without removing the cylinder head from the engine. The cylinder head cover (valve cover) gasket, camshaft, camshaft oil seal, valve guide oil seals, valve springs, and camshaft followers are all accessible with the cylinder head installed. This heading describes those repairs that can be done with the cylinder head installed.

Internal cylinder head assembly (engine code: AEG, AVH, AZG, BEV)



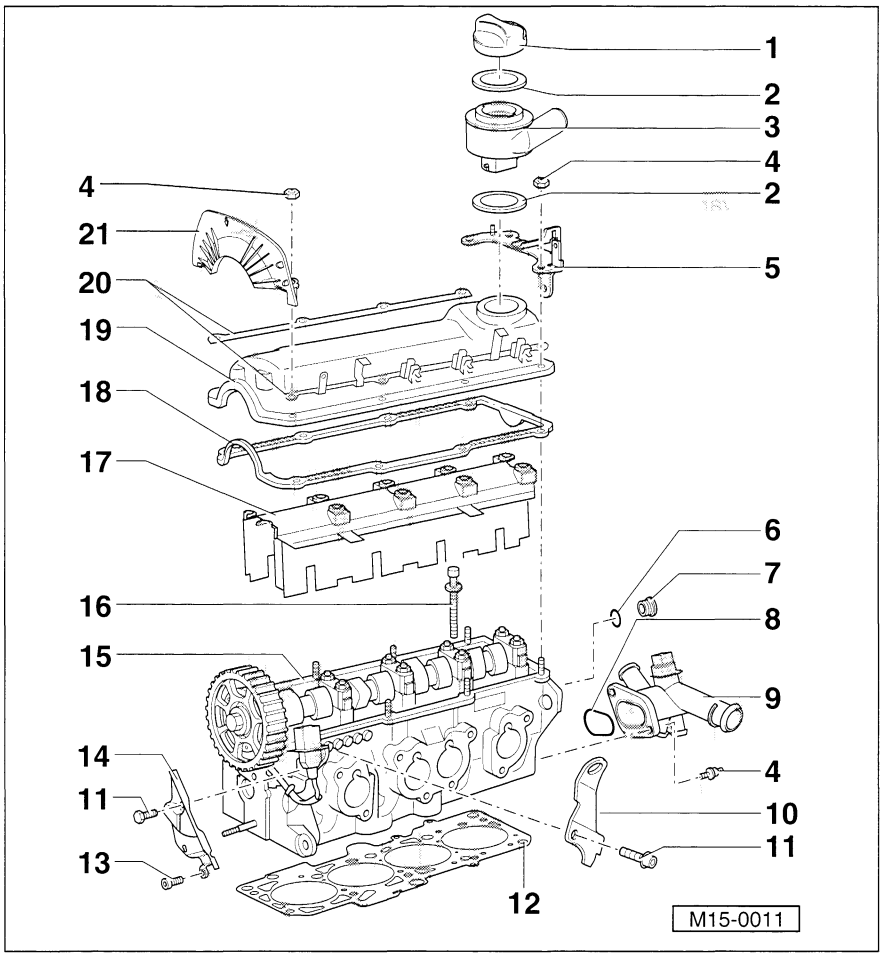
1. **Camshaft sprocket bolt**
   - Tighten to 100 Nm (74 ft-lb)
   - Use 3415 counterholder to loosen and tighten
2. **Camshaft sprocket**
3. **Oil seal**
4. **Woodruff key**
   - Ensure tight fit
5. **Bearing cap nut**
   - Tighten to 20 Nm (15 ft-lb)
6. **Bearing cap**
   - Lightly coat bearing cap 1 cylinder head mating surface with VW sealant AVM 174 004 01
7. **Camshaft**
   - Radial clearance, checking with plastigage
     Wear limit: 0.1 mm (.004 in.)
   - Run-out, wear limit: 0.05 mm (.002 in.)
8. **Hydraulic lifter**
   - Do not interchange
   - Equipped with hydraulic clearance compensation
   - Store with cam contact surface facing downwards
   - Oil contact surfaces
9. **Keepers**
10. **Valve spring retainer, upper**
11. **Valve spring**
12. **Valve stem seal**
13. **Valve guide**
    - Service version with shoulder to limit pressed-in depth
14. **Cylinder head**
15. **Intake and exhaust valves**
    - Do not rework! Only lapping is permitted

Internal cylinder head assembly (engine code: BBW)



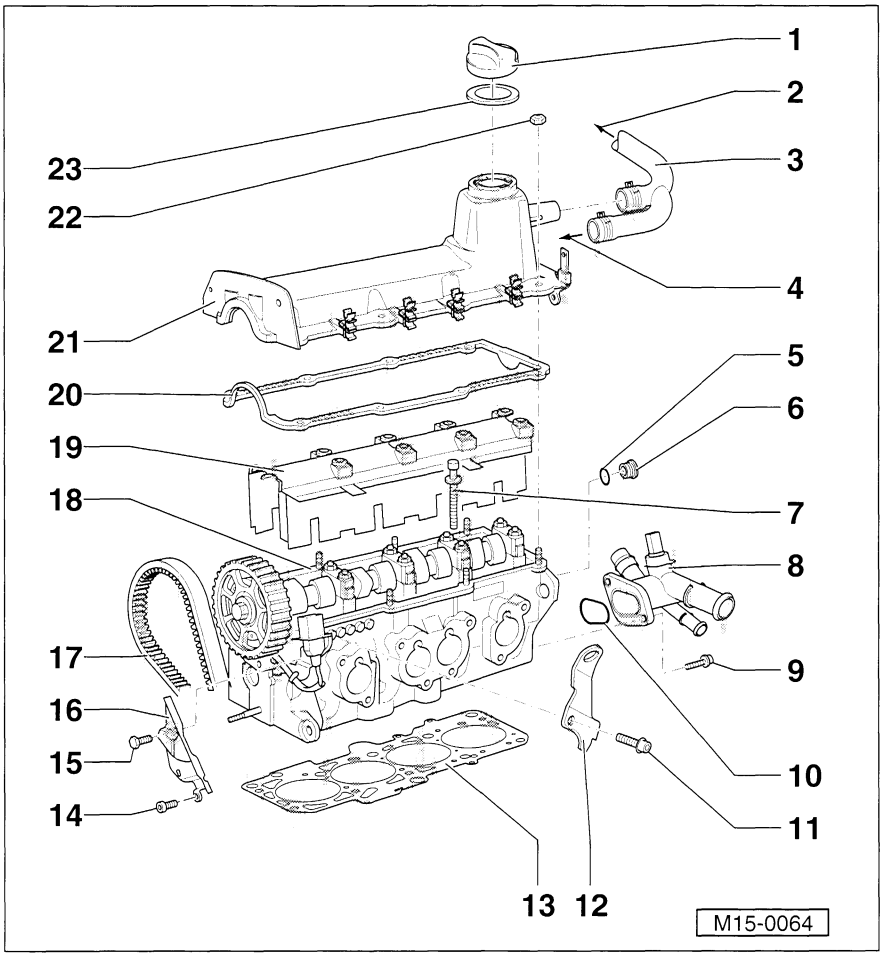
1. **Camshaft sprocket**
   - With camshaft timing adjustment (variable valve timing)
   - Do not disassemble, do not loosen bolts
   - Unit is not serviceable, replace as complete assembly only
2. **Oil seal**
3. **Bearing cap nut**
   - Tighten to 20 Nm (15 ft-lb)
4. **Bearing cap**
   - Lightly coat bearing cap 1 cylinder head mating surface with VW sealant AVM 174 004 01
5. **Camshaft**
   - With sensor wheel for Camshaft Position (CMP) Sensor
   - Radial clearance, checking with plastigage
     Wear limit: 0.1 mm (.004 in.)
   - Run-out, wear limit: 0.05 mm (.002 in.)
6. **Hydraulic lifter**
   - Do not interchange
   - Equipped with hydraulic clearance compensation
   - Store with cam contact surface facing downwards
   - Oil contact surfaces
7. **Keepers**
8. **Valve spring retainer, upper**
9. **Valve spring**
10. **Valve stem seal**
11. **Valve guide**
    - Service version with shoulder to limit pressed-in depth
12. **Cylinder head**
13. **Intake and exhaust valves**
    - Do not rework! Only lapping is permitted
14. **Filter element**
    - Pull out with hooks
    - Check for debris and clean as required
15. **Sealing plug**
    - Always replace
    - Tighten to 12 Nm (9 ft-lb)
16. **Bolt**
    - Tighten to 130 Nm (96 ft-lb)
    - Loosen and tighten with T10172 and T10172/3
17. **O-ring**
    - Always replace
18. **Sealing plug**
    - Tighten to 12 Nm (9 ft-lb)

External cylinder head assembly (engine code: AEG, AVH early production)



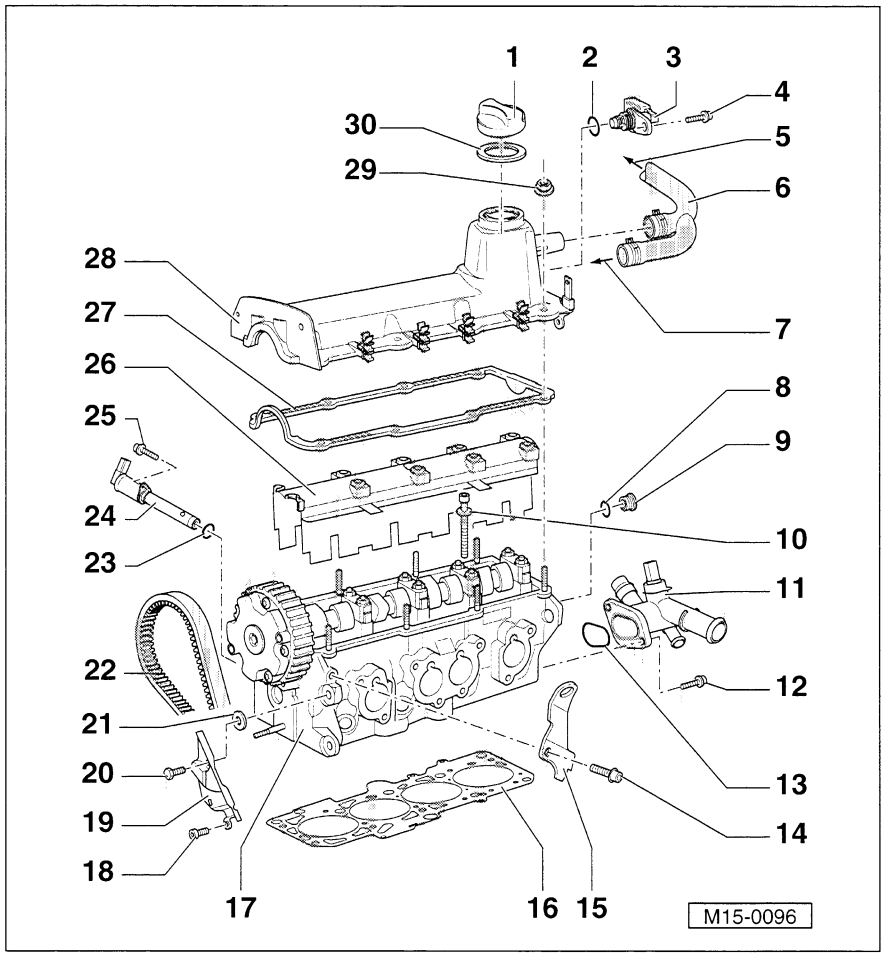
1. **Cap**
2. **Gasket**
3. **Vent housing**
   - Turn clockwise to remove
4. **Nut, bolt**
   - Tighten to 10 Nm (7 ft-lb)
5. **Bracket**
6. **O-ring**
   - Always replace
7. **Sealing plug**
   - Tighten to 15 Nm (11 ft-lb)
   - Always replace
8. **O-ring seal**
   - Always replace
9. **Coolant connection flange**
10. **Lifting eye**
11. **Bolt**
    - Tighten to 20 Nm (15 ft-lb)
12. **Cylinder head gasket**
    - Always replace
    - Always replace engine coolant when replacing gasket
13. **Bolt**
    - Tighten to 15 Nm (11 ft-lb)
14. **Timing belt guard, rear**
15. **Cylinder head**
    - Always replace engine coolant when replacing gasket
16. **Cylinder head bolt**
    - Always replace
    - Polydrive bolt uses tool 3452
    - Loosen and tighten in sequence only
17. **Oil deflector**
    - Replace if damaged
    - Apply sealant D 454 300 A2 to bearing cap/cylinder head mating surface before installing
18. **Valve cover gasket**
    - Replace if damaged
19. **Valve cover**
    - Also known as "cylinder head cover"
20. **Reinforcing strips**
21. **Upper rear timing belt (camshaft drive belt) guard**

External cylinder head assembly (engine code: AEG, AVH late production)



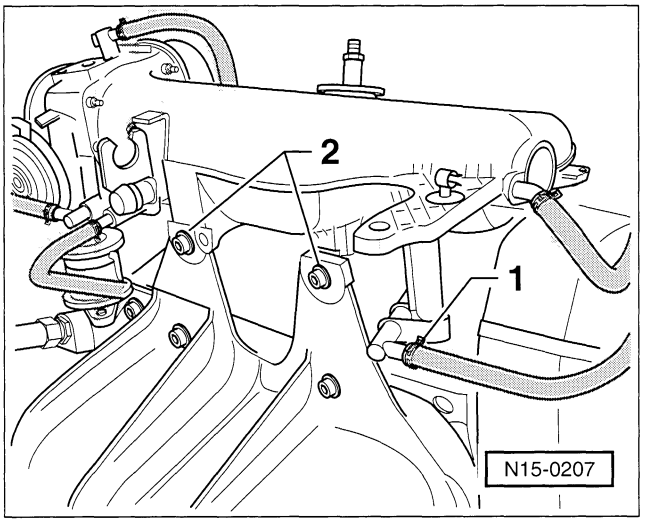
1. **Cap**
2. **Hose connection**
   - To intake manifold
3. **Molded hose**
   - Do not remove molded hose from intake hose
4. **Hose connection**
   - To intake manifold (from model year 2002 only)
5. **O-ring**
   - Always replace
6. **Sealing plug**
   - Tighten to 15 Nm (11 ft-lb)
   - Always replace
7. **Cylinder head bolt**
   - Always replace
   - Polydrive bolt uses tool 3452
   - Loosen and tighten in sequence only
8. **Coolant connection flange**
9. **Nut, bolt**
   - Tighten to 10 Nm (7 ft-lb)
10. **O-ring seal**
    - Always replace
11. **Bolt**
    - Tighten to 20 Nm (15 ft-lb)
12. **Lifting eye**
13. **Cylinder head gasket**
    - Always replace
    - Always replace engine coolant when replacing gasket
14. **Bolt**
    - Tighten to 15 Nm (11 ft-lb)
15. **Bolt**
    - Tighten to 15 Nm (11 ft-lb)
16. **Timing belt guard, rear**
17. **Timing belt**
    - Mark direction of rotation before removing
    - Check for wear
    - Do not kink
18. **Cylinder head**
    - Always replace engine coolant when replacing gasket
19. **Oil deflector**
    - Replace if damaged
20. **Valve cover gasket**
    - Replace if damaged
    - Apply sealant D 454 300 A2 to bearing cap/cylinder head mating surface before installing
21. **Valve cover**
    - Also known as "cylinder head cover"
22. **Nut**
    - Tighten to 10 Nm (7 ft-lb)
23. **Gasket**
24. **Cylinder head bolt**
    - Always replace
    - Polydrive bolt uses tool 3452
    - Loosen and tighten in sequence only

External cylinder head assembly (engine code: BBW, BEV)



1. **Cap**
2. **O-ring**
   - Always replace
   - Engine code BBW only
3. **Camshaft Position (CMP) sensor (G40)**
   - Engine code BBW only
4. **Bolt**
   - Tighten to 9 Nm (72 in-lb)
   - Engine code BBW only
5. **Hose connection**
   - To intake manifold
6. **Molded hose**
   - Do not remove molded hose from intake hose
   - Engine code BBW shown, BEV similar
7. **Hose connection**
   - To intake manifold
8. **O-ring**
   - Always replace
9. **Sealing plug**
   - Tighten to 15 Nm (11 ft-lb)
   - Always replace
10. **Cylinder head bolt**
    - Always replace
    - Polydrive bolt uses tool 3452
    - Loosen and tighten in sequence only
11. **Coolant connection flange**
12. **Nut, bolt**
    - Tighten to 10 Nm (7 ft-lb)
13. **O-ring seal**
    - Always replace
14. **Bolt**
    - Tighten to 20 Nm (15 ft-lb)
15. **Lifting eye**
16. **Cylinder head gasket**
    - Always replace
    - Always replace engine coolant when replacing gasket
17. **Cylinder head**
18. **Bolt**
    - Tighten to 15 Nm (11 ft-lb)
19. **Timing belt guard, rear**
20. **Bolt**
    - Tighten to 20 Nm (15 ft-lb)
21. **Washer/spacer**
    - Note part number/markings
22. **Timing belt**
    - Mark direction of rotation before removing
    - Check for wear
    - Do not kink
23. **O-ring**
    - Always replace
    - Engine code BBW only
24. **Valve for camshaft adjuster (N205)**
    - Engine code BBW only
25. **Bolt**
    - Tighten to 9 Nm (72 in-lb)
    - Engine code BBW only
26. **Oil deflector**
    - Replace if damaged
27. **Valve cover gasket**
    - Replace if damaged
    - Apply sealant D 454 300 A2 to bearing cap/cylinder head mating surface before installing
28. **Valve cover**
    - Also known as "cylinder head cover"
    - With cable guide
29. **Nut**
    - Tighten to 10 Nm (7 ft-lb)
30. **Gasket**

Cylinder head (valve) cover, removing and installing



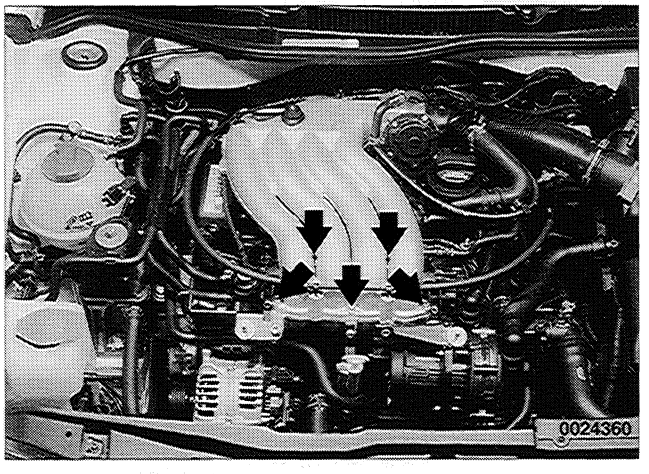
Several different styles of cylinder head (valve) covers are used on the 2.0L engine. Engine code AEG is shown, but the procedure for all engine codes is similar.

– Remove upper sound absorber panel and disconnect intake boot from throttle housing.

– Disconnect accelerator cable from throttle body (where applicable).

– Disconnect all hoses and electrical connectors from upper intake manifold.

➢ Remove bolts (**2**) from warm air deflector plate on back side of upper intake manifold.



➢ Remove upper intake manifold bolts (**arrows**).

– Carefully separate upper manifold from lower manifold. Cover open intake runner openings in lower manifold with clean shop rags or wide adhesive tape.

– Disconnect crankcase breather valve from cylinder head cover.

– Remove nuts from cylinder head cover.

– Unclip and remove upper camshaft drive belt cover. Remove small protection cover from back of camshaft drive sprocket.

– Remove both reinforcing strips from cylinder head cover.

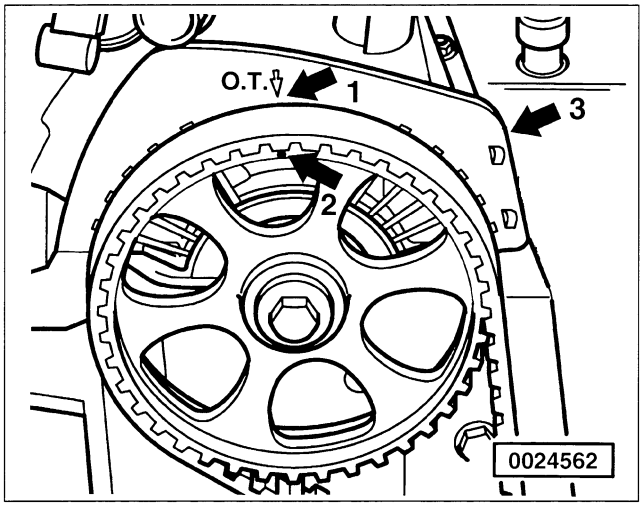
– Lift off cylinder head cover and gasket.

– Installation is reverse of removal noting the following additional points:

- Be sure to remove shop rags or tape from lower intake manifold runner openings.
- Use new gaskets where appropriate.
- Apply a small amount of sealer to area where the cylinder head cover gasket and number one camshaft bearing cap meet.

Tightening Torques

- Cylinder head cover to cylinder head (M6) . . . . . 10 Nm (89 in-lb)
- Upper intake manifold to lower manifold (M8) . . . . . 20 Nm (15 ft-lb)
- Warm air deflector to upper intake manifold (M8) . . . . . 25 Nm (18 ft-lb)



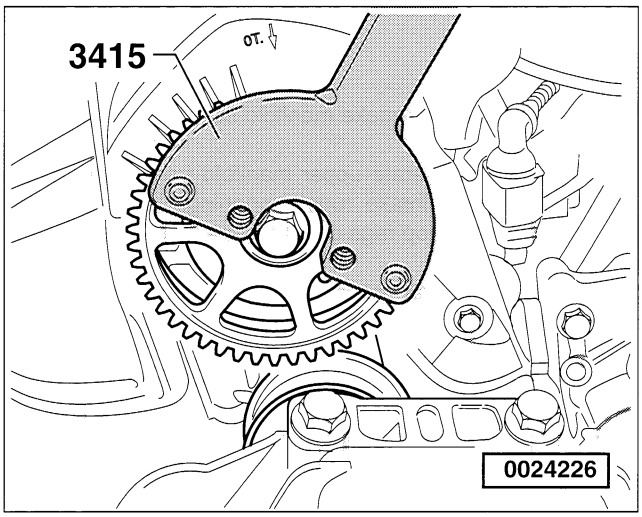
Camshaft oil seal, replacing

– Remove upper engine cover and unclip and remove timing belt guard, upper section. See **Timing belt – Camshaft drive**, given later.

➢ Set engine to TDC for cylinder 1 by turning crankshaft until timing mark (**lower arrow**) on camshaft sprocket aligns with mark (**upper arrow**) on timing belt upper rear guard.

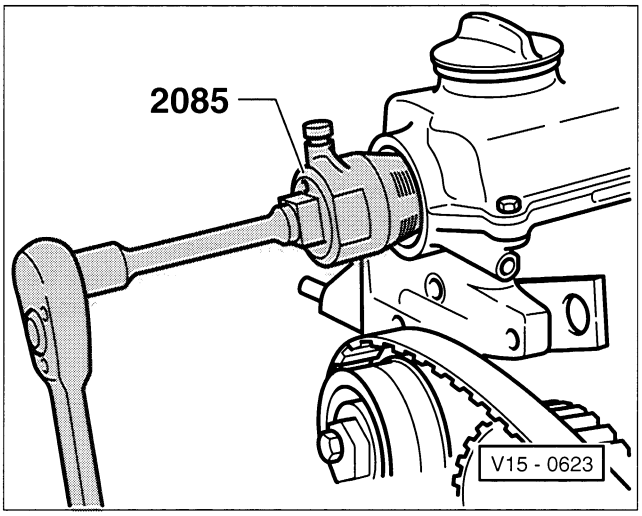
– Release tensioning roller and slide timing belt off of camshaft sprocket.

– Turn crankshaft back off of TDC slightly.

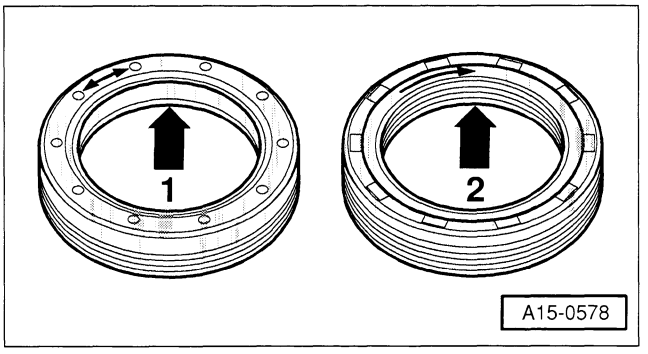


➢ Using a suitable spanner to counterhold the camshaft sprocket, remove camshaft sprocket bolt.

– Remove camshaft drive sprocket and woodruff key.



➢ Remove seal using a suitable seal extractor.



Oil seal type identification
An oil seal constructed of PTFE (Teflon ®) was phased-in gradually during production of some engine types. PTFE oil seals replace the older spring-type seals, but spring-type seals should never be used in place of the PTFE type.

- .PTFE (Teflon ®) seals (**right**) can be identified by the wider sealing lip (**arrow 2**). These seals are installed without lubricant of any kind on the seal.
- Spring-type seals (**left**) can be identified by the narrower sealing lip (**arrow 1**) and a tensioning spring behind the lip seal.

– Before installing new seal, clean oil from camshaft journal with clean cloth.

– Install new oil seal noting the following points:

- Install with closed end facing out.
- Use a suitable guide sleeve and installation tool.
- Press seal into bottom of recess.

– Install woodruff key and camshaft sprocket, hold sprocket with a spanner and torque bolt.

Tightening torque
- Camshaft sprocket to camshaft . . . 100 Nm (74 ft-lb)

– Turn crankshaft back to TDC.

– Install timing belt and adjust tension, see **Timing Belt–Camshaft Drive**, given later.

– Install upper camshaft drive belt cover, upper engine cover and any other removed components.

Camshaft, removing and installing

The camshaft can be removed and installed with the cylinder head installed. Removing the camshaft allows access to hydraulic cam followers, valve springs and valve stem oil seals.

– Remove upper engine cover and unclip and remove upper camshaft drive belt cover.

– Turn engine by hand until timing mark on camshaft sprocket aligns with mark on timing belt upper rear guard as shown earlier.

– Release tensioning roller and slide timing belt off of camshaft sprocket.

– Turn crankshaft back off of TDC slightly.

NOTE —
Turning the crankshaft away from TDC slightly minimizes the chances of contact between pistons and valves upon re-assembly.

– Using a suitable spanner, remove camshaft sprocket bolt as shown earlier.

– Remove camshaft drive sprocket and woodruff key.

– Remove cylinder head (valve) cover and gasket as described previously.

– Lift off plastic oil deflector to expose camshaft.

– Loosen and remove the bearing caps from positions 5, 1 and 3 in that order. Position 1 is closest to belt end of camshaft.

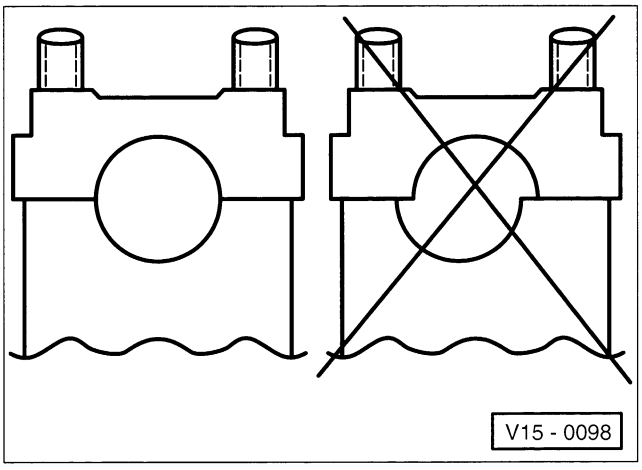
NOTE —
Mark each bearing cap before removing. Each cap is machined to each journal and must be reinstalled to that exact location to prevent damage.

– Loosen nuts on bearing cap 2 slightly and then loosen nuts on bearing cap 4 slightly. Loosen nuts alternately and evenly a little at a time on each of the two bearing caps. Remove nuts (and washers, if equipped), and remove bearing caps.

– Lift out camshaft and lay aside.

NOTE —
Once removed, camshaft should be checked for wear and other visible damage as described later under **Cylinder Head Components**.

– Oil bearing surfaces of cylinder head and camshaft and install camshaft into cylinder head with lobes for cylinder number 1 pointing up.



➤ Install bearing caps 2 and 4. Install nuts (and washers, if equipped) and tighten them alternatively and evenly so that camshaft is drawn down fully and evenly into bearing saddles. Torque to specification.

Tightening torque
- Camshaft bearing cap to cylinder head. . . . . 20 Nm (15 ft-lb)

CAUTION —
Be sure to install bearing caps correctly. The caps are bored off-center and only fit properly one way. Caps are matched to the cylinder head by the machining process and are not available separately. Broken caps will require replacement of cylinder head. If necessary test fit caps without camshaft to confirm installation direction.

– Install bearing cap number 1 with a small amount of sealer AMV 174 004 01 on cylinder head mating surface. Install all remaining bearing caps and torque to specification.

– Install plastic oil deflector.

– Install camshaft drive sprocket and woodruff key using a suitable spanner as shown earlier.

NOTE —
Ensure that camshaft lobes for cylinder #1 are still pointing up.

Tightening torque
• Camshaft sprocket to camshaft . . . 100 Nm (74 ft-lb)

– Install cylinder head (valve) cover and rear upper timing belt guard.

– Install toothed camshaft drive belt and adjust tension, see **Timing Belt - Camshaft Drive** given later.

– Install upper camshaft drive belt cover, upper engine cover and any other removed components.

– Be sure to quality check your work, see **Quality Review** at end of this repair group.

Hydraulic cam followers, checking

The 2.0 liter engine installed in the Jetta, Golf and GTI is equipped with hydraulic cam followers which are also known as lifters. The cam followers are pumped up by engine oil pressure, expanding as necessary to fill the gap between the valve stem and camshaft lobe. This occurs continuously and automatically to keep valve in proper adjustment at all times.

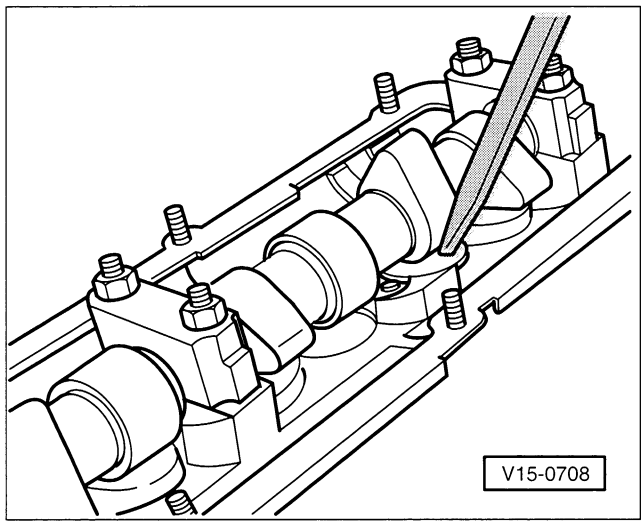
Some valve noise at start-up and during warm-up period is normal at times due to hydraulic cam followers that have bled down while engine was not running. Before checking noisy cam followers, check that engine oil is new and fresh, of correct weight, and that level is correct. Allow 2 minutes with a warm engine running at a fast idle for lubrication system to properly pump up cam followers.

Cam followers should only be checked when engine is warm. Run engine until radiator fan has switched on at least one time. Increase engine speed to 2,500 rpm and hold it there for approximately 2 minutes. If hydraulic cam followers are still noisy, shut engine off and proceed as follows while engine is still warm.

– Remove cylinder head (valve) cover. See **Cylinder head (valve) cover, removing and installing**, given earlier.

– Turn engine by hand until both camshaft lobes of cylinder #1 are pointing approximately up.

NOTE —
Hydraulic cam follower clearance can be checked on any cam follower (lifter) that is not being depressed by the camshaft lobe.



➤ Check clearance between cam follower and cam lobe on cylinder #1 by lightly depressing cam follower with a wooden or plastic wedge and inserting a feeler gauge into gap. If clearance exceeds specified limit, the lifter is faulty and should be replaced.

Specification

- Hydraulic cam follower maximum clearance (2.0L engine) . . . . . 0.2 mm (0.008 in.)

– Turn engine by hand and repeat procedure until all cam followers have been checked.

– Replace a faulty cam follower by removing camshaft as previously described and pulling the follower from the cylinder head. Faulty hydraulic cam followers can be replaced individually but only as a complete assembly.

CAUTION —

After installing new cam followers, engine should not be started for at least 30 minutes. New cam followers are usually at full extended height and must be allowed to bleed down to their proper height once installed. Failure to do so may cause the valves to strike the pistons resulting in serious damage.

NOTE —

Store removed hydraulic cam followers in order on a clean surface with camshaft contact surface facing down to minimize bleed down. Cover with a clean lint-free shop cloth.

Valve stem oil seals, replacing

The sign of faulty valve stem seals is excessive oil consumption and oil smoke from the exhaust. This is usually most noticeable during periods of high manifold vacuum such as deceleration. If compression and leak-down testing confirm the integrity of the piston rings, but engine consumes oil, it is likely that faulty valve stem seals are present. It should also be noted that worn valve stem seals could be due to worn valve guides and that worn valve guides are the major cause of oil consumption. See **Cylinder Head Components** for more information on checking valve guides.

Replacing valve stem oil seals requires removal of camshaft, cam followers, and valve springs. This can be done with cylinder head installed or removed. In either case, several Volkswagen special tools are required to compress valve springs and remove and install the seals.

Working with cylinder head installed:

– Remove cylinder head cover, camshaft, and hydraulic cam followers as described earlier.

– Remove spark plugs and apply a continuous supply of compressed air with a minimum of 6 bar (87 psi) into first spark plug hole with an adapter. This must be done to hold valves in place while the springs are removed. Continue under **Working with cylinder head installed**.

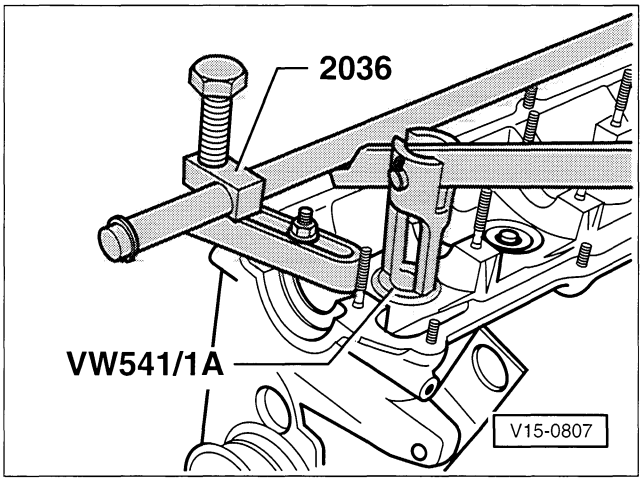
> ***CAUTION —***
> *Compressed air supply must be able to maintain at least 6 bar (87 psi) during this repair. If air supply is interrupted while valve spring is removed, valve will fall into cylinder and may require cylinder head removal to retrieve.*

Working with cylinder head removed:

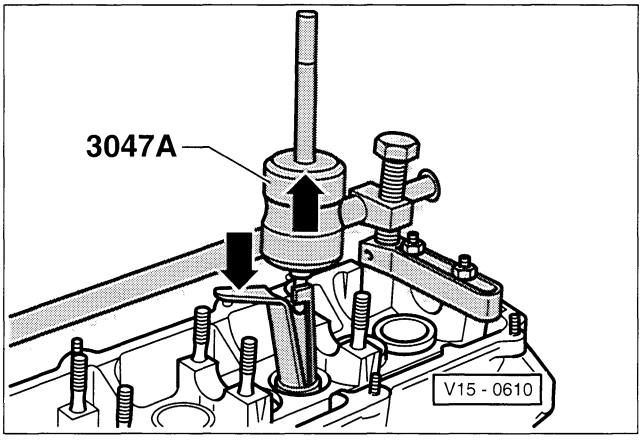
– Secure cylinder head to workbench. Use care to avoid damage to head gasket surfaces.

– Remove camshaft and hydraulic cam followers as described earlier. Continue with step 5.

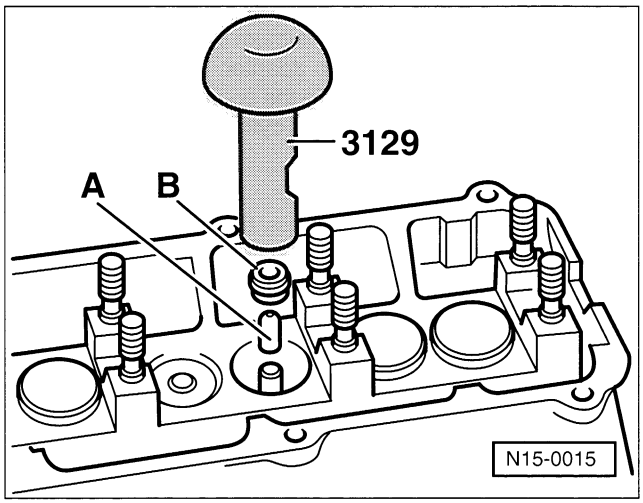
Working with cylinder head removed or installed:



➢ Install appropriate valve spring compressor tools. Compress spring for the first cylinder and remove spring retainer, both keepers, and valve spring. If spring will not compress, lightly tap tool to release stuck keepers. Use a small magnet to retrieve keepers.



➢ Remove valve stem seals with special slide hammer tool. Push down on tool (**left arrow**) while sliding hammer up (**right arrow**).



➢ Begin installation of new seal by temporarily fitting a protective plastic fitting sleeve (**A**) over valve stem. This sleeve is usually included with new seal set and will prevent damage to seal due to sharp edges of keeper grooves. Lubricate new seal (**B**) with clean engine oil and fit it to installation tool.

– Push tool (with seal) down over valve stem until seal is fully seated on guide. Remove tool and protective fitting sleeve.

– Reinstall valve spring, retainer and keepers.

– Repeat for second valve on cylinder.

– When both valve seals have been replaced on the first cylinder, transfer compressed air adapter (if working with cylinder head installed) to next cylinder and repeat process until all valve seals have been replaced.

– Remaining installation is reverse of removal.

CAUTION —
To prevent cylinder head or camshaft damage, be sure to follow the camshaft installation procedure when tightening camshaft bearing caps. See **Camshaft, removing and installing**.

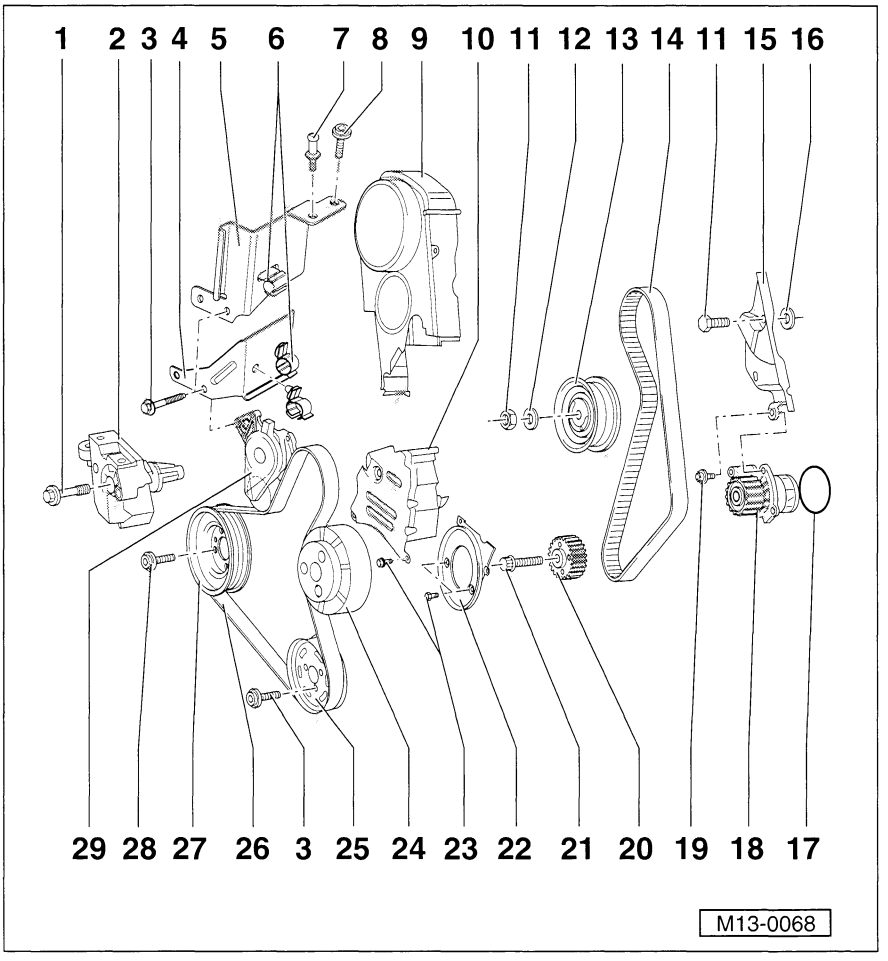
Tightening torque
• Spark plug to cylinder head . . . . . 30 Nm (22 ft-lb)

– Be sure to quality check your work, see **Quality Review** at end of this repair group.

TIMING BELT - CAMSHAFT DRIVE

The timing belt and its related parts are shown in the following views. The timing belt is also known as a camshaft drive belt or toothed belt. The belt should be inspected at regular intervals as described in **Maintenance**. Although no replacement interval is specified by the manufacturer for this engine type, the publisher recommends replacement of the belt and tensioner at 90,000 miles or every 6 years, based on field experience. This will help prevent damage to the engine due to belt stretch and the long term effects of heat.

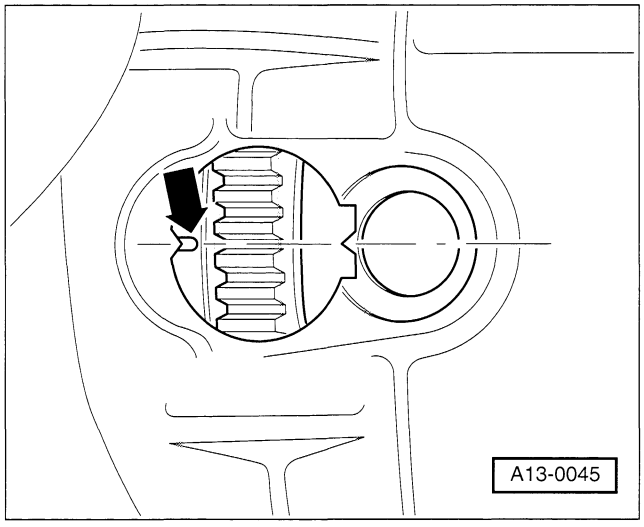
Drive belts, assembly



1. **Bolt**
   - Tighten to 45 Nm (33 ft-lb)
2. **Engine support**
3. **Bolt**
   - Tighten to 25 Nm (18 ft-lb)
4. **Bracket**
   - Configuration depends on engine version
5. **Bracket**
   - Configuration depends on engine version
6. **Hose clip**
7. **Stud, engine cover**
   - Configuration depends on engine version
   - Tighten to 10 Nm (7 ft-lb)
8. **Bolt, engine cover**
   - Configuration depends on engine version
   - Tighten to 20 Nm (15 ft-lb)
9. **Timing belt guard, upper section**
10. **Timing belt guard, center section**
11. **Bolt**
    - Tighten to 20 Nm (15 ft-lb)
12. **Washer**
13. **Tensioner**
    - Semi-automatic timing belt tensioning roller
14. **Timing belt**
    - Mark engine direction of rotation before removing
    - Check for wear
    - Do not kink
15. **Timing belt guard, rear**
16. **Washer/spacer**
    - Note part number/markings
17. **O-ring**
    - Always replace
18. **Coolant pump**
19. **Bolt**
    - Tighten to 15 Nm (11 ft-lb)
20. **Timing belt drive sprocket (crankshaft)**
21. **Bolt**
    - Tighten to 90 Nm (66 ft-lb) + ¼ turn (90°)
    - Always replace
    - Threads and shoulder must be free of grease
    - Counterhold with 3145
22. **Timing belt guard, lower section**
23. **Bolt**
    - Always replace
    - Tighten to 10 Nm (7 ft-lb)
24. **Pulley (A/C compressor clutch)**
    - For A/C compressor
25. **Pulley**
    - For power steering pump
26. **Ribbed belt**
    - Mark engine direction of rotation before removing
    - Check for wear
    - Do not kink
27. **Belt pulley/vibration damper**
    - Can only be installed in one position, holes are offset
    - Note position when installing timing belt
28. **Bolt**
    - Tighten to 40 Nm (30 ft-lb)
29. **Tensioner, ribbed belt**
    - Loosen ribbed belt by turning with open-ended wrench on cast/machined area

Timing belt for camshaft drive, removing and installing, (engine codes AEG, AVH, AZG, BEV)

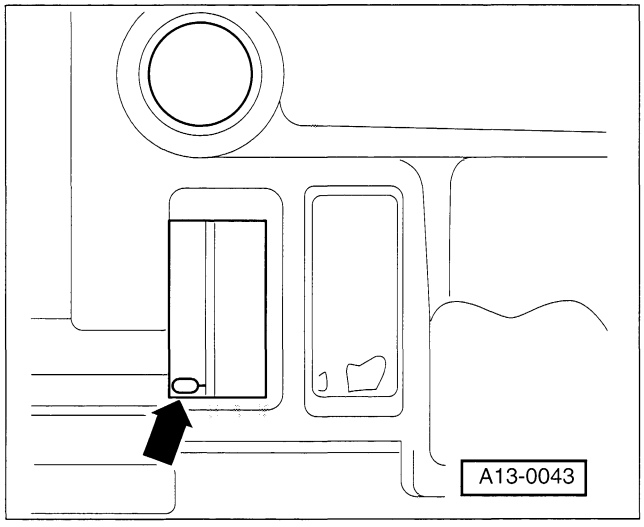
Removing



- Remove lower sound absorber panel (belly pan).
- Remove upper engine cover.
- Remove ribbed V-belt and tensioner.
- Remove upper timing belt cover.
- Set engine to TDC for cylinder 1 by turning crankshaft until the timing mark on flywheel or torque converter aligns with mark on transmission case. The timing mark on the camshaft sprocket must also align with the corresponding marks on the rear of the cover or guard.

Manual transmission vehicles

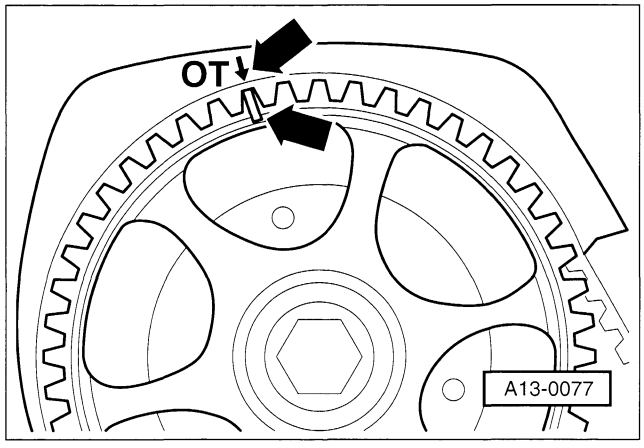
Confirm that engine is set to TDC for cylinder #1 by checking that timing mark on flywheel (**arrow**) lines up with notch at inspection hole on manual transmission.



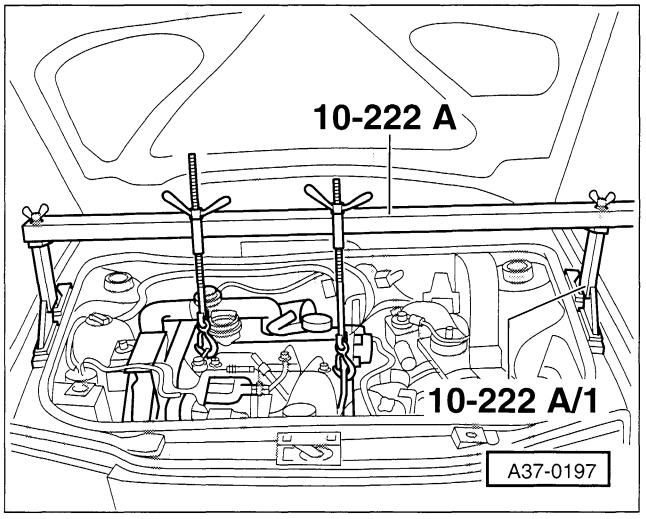
Automatic transmission vehicles

Confirm that engine is set to TDC for cylinder #1 by checking that timing mark on torque converter (**arrow**) lines up with edge of inspection hole on automatic transmission.

All vehicles



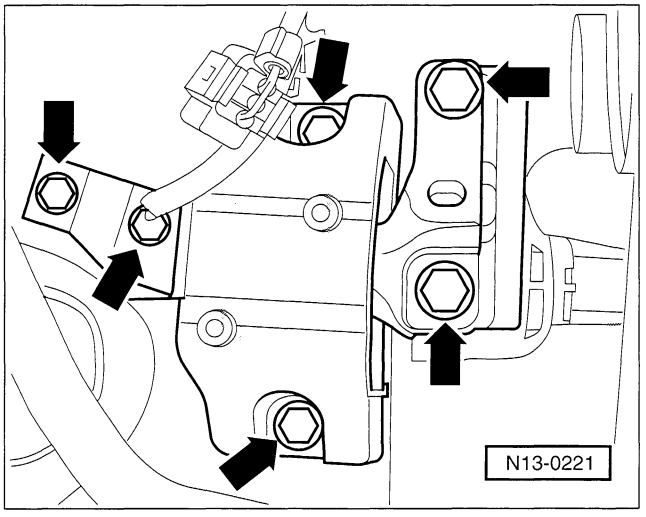
Confirm that mark on camshaft sprocket (**lower arrow**) aligns with mark on cylinder head (valve) cover (**upper arrow**).



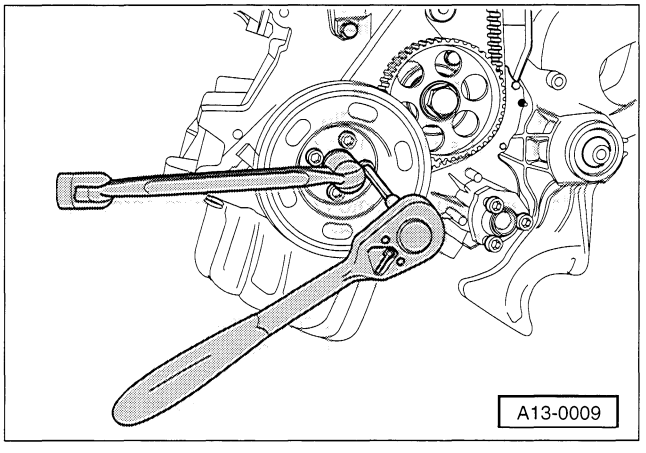
➢ Support engine with a suitable fixture that is designed to support the weight of engine and transmission without damaging body.

– Lift supporting device slightly, so that weight of engine and transmission is on supporting device.

– Unbolt reservoirs for coolant and power steering fluids. Leave fluid lines attached to reservoirs and position out of way.

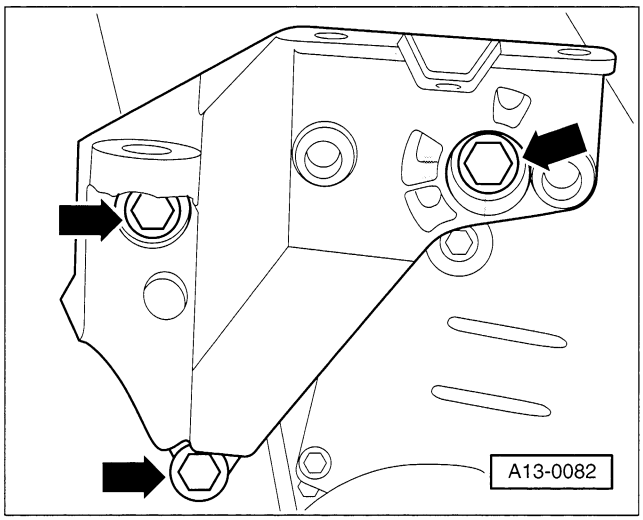


➢ Remove right side engine mount bolts (**arrows**) from body and carrier on engine.



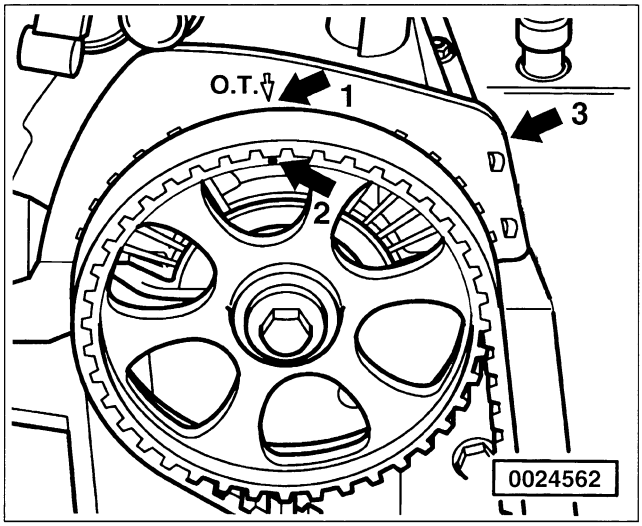
➢ Remove 4 bolts holding vibration dampener/ ribbed belt pulley to timing belt sprocket and remove belt pulley. Counterhold center bolt as shown to loosen outer bolts.

– Remove center and lower sections of timing belt guard.



- Remove right side engine mount bracket from the block. There will not be sufficient room to withdraw bolts (**arrows**), so the mount and bolts are all removed at the same time.
- Mark running direction of belt.
- Remove lower timing belt cover.
- Loosen securing nut on tensioner to release it and remove belt.

Timing belt for camshaft drive, installing (engine code: AEG, AVH, AZG, BEV)



- Check that mark on camshaft sprocket (**2**) is aligned with mark (**1**) on cylinder head cover (**3**). This brings camshaft to TDC for cylinder number 1.

> ***CAUTION —***
> - *Due to engine design, care must be used when turning camshaft with timing belt removed. If valves are allowed to open with piston at TDC, serious internal damage will result.*
> - *Belt tension must not be adjusted on a hot engine. Allow to cool sufficiently before proceeding. Engine temperature must be no hotter than warm to touch.*

- Ensure that engine is at TDC for cylinder number 1 by checking marks on flywheel or torque converter against reference points on transmission as shown during removal.



- If engine is not installed in vehicle, temporarily fit timing belt pulley/vibration damper and timing belt guard, and align marks (**arrow**) as shown.
- Install timing belt onto crankshaft drive sprocket, coolant pump and camshaft drive sprocket.

> ***NOTE —***
> *If re-using an old belt, be sure to note running direction marks placed on it before removal.*

- Install bolts into right side engine mount bracket and install onto cylinder block.

Tightening torques

- Right side engine mount bracket to cylinder block (M10) . . . . . 45 Nm (33 ft-lb)

– Install center and lower sections of timing belt guard.

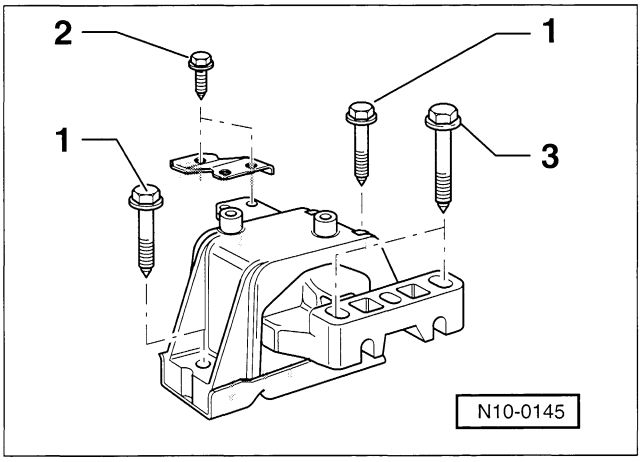
– Install vibration dampener/ribbed belt pulley to timing belt drive sprocket.

Tightening torques

- Vibration dampener/ribbed belt pulley to timing belt drive sprocket (M8) . . . . . 25 Nm (18 ft-lb)

– Ensure that crankshaft is at TDC for cylinder 1 by aligning mark on flywheel or torque converter with mark in transmission inspection hole as shown earlier.

– Ensure that camshaft is still at TDC for cylinder number 1.



Install right side engine mount using new stretch bolts as noted.

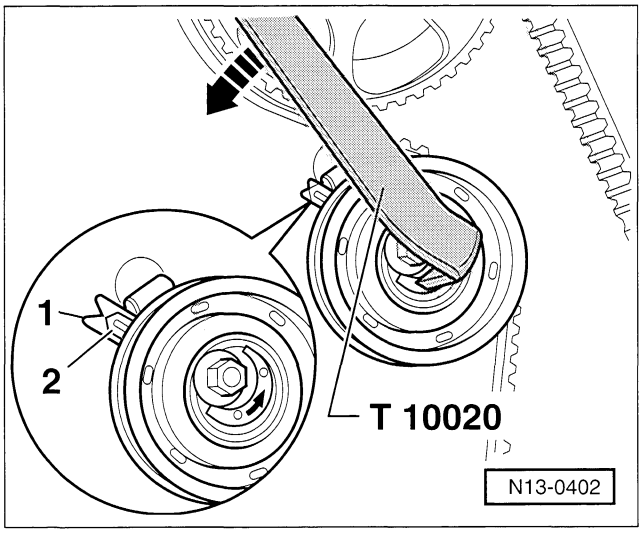
1. **Mount to body bolt**
   - 40 Nm (30 ft-lb) plus 90° (¼ turn)
   - always replace
2. **Mount bracket to body bolt**
   - 25 Nm (18 ft-lb)
3. **Mount to engine bracket bolt**
   - 60 Nm (44 ft-lb) plus 90° (¼ turn)
   - always replace

– Ensure proper engine mount alignment.

– Remove engine support fixture.

– Install timing belt onto tensioner and check for correct placement of belt on all sprockets. Securing nut should be just tight enough to allow movement of center section.

– Ensure that camshaft and crankshaft are still at TDC.



Tension timing belt by turning center section eccentric of tensioner with a 2 pin spanner wrench (VW special tool T10020 shown) until notch (**1**) and indictor pointer (**2**) line up. When marks line up, tighten securing nut.

Tightening torques

- Timing belt tensioner (M8) . . . . . 20 Nm (15 ft-lb)

– Ensure that marks on camshaft sprocket and dampener/pulley still align with their respective TDC marks. If they do not align, repeat until they do.

NOTE —
Some movement of sprockets and their marks is to be expected as belt tension is adjusted. Keep in mind that the smallest possible increment of adjustment is one whole tooth of the belt or sprocket.

– With all marks in proper alignment, rotate crankshaft two revolutions in running direction and re-check belt tension marks on tensioner.

NOTE —
It is important that the last 45° (1/8 turn) of crankshaft rotation is made without interruption.

– Install timing belt guard, upper section.

– Install ribbed belt tensioner and belt.

Tightening torque
- Ribbed belt tensioner to bracket (M8) . . . . . 25 Nm (18 ft-lb)

– Install lower sound absorber panel (belly pan) and upper engine cover.

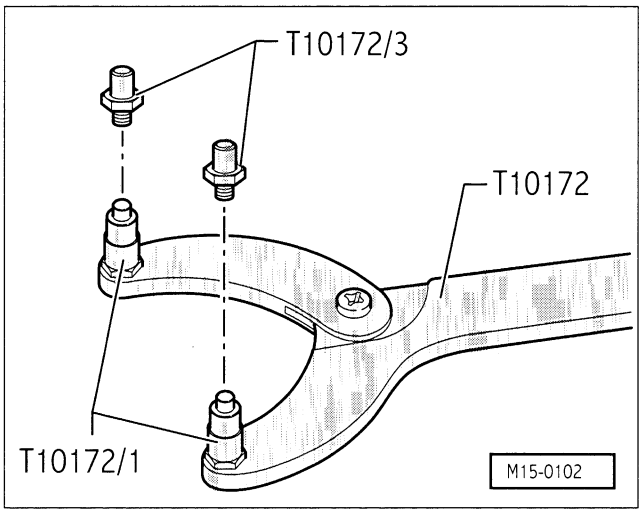
– Install any remaining parts and quality check your work, see **Quality Review** at end of this repair group.

Timing belt for camshaft drive, removing and installing, (engine code: BBW)

Due to the nature of the variable valve timing on engine code BBM, replacement of the timing belt requires adjustment of the valve timing.

NOTE —
If the timing belt is to be taken off the camshaft sprocket, e.g. when removing the camshaft or the cylinder head, the following must be considered:
- *Engine bracket, tensioning element for ribbed belt, vibration damper/belt pulley and timing belt guard (except for upper part) can remain installed.*
- *To remove the timing belt from the camshaft sprocket, unscrew the tensioning roller and slide up to the engine bracket.*
- *Engine MUST be no warmer than "hand touch" warm.*

Removing



Tool T10172 along with pins T10172/3 are required to counterhold camshaft sprocket.

– Remove upper engine cover.

– Remove lower sound absorber panel (belly pan) from right side.

– Remove ribbed V-belt and tensioner.

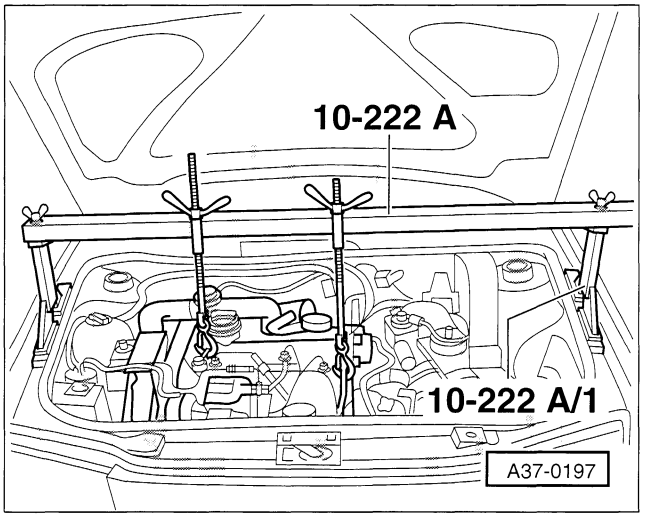
– Remove upper section of intake manifold.

– Remove timing belt guard upper section.

– Unbolt reservoirs for coolant and power steering fluids. Leave fluid lines attached to reservoirs and position out of way.

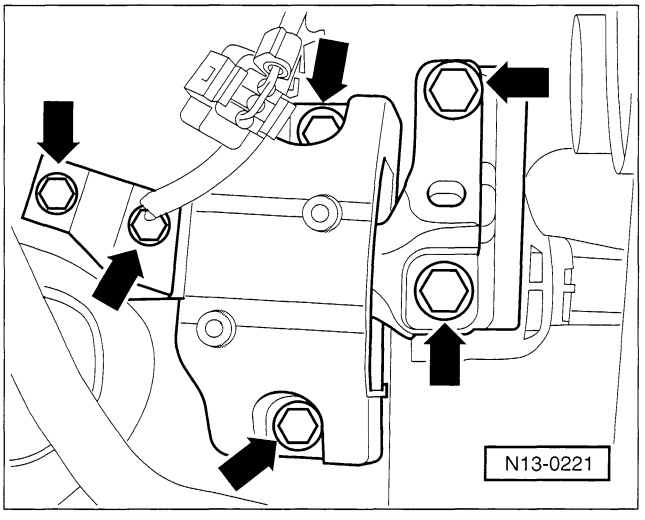
– Disconnect connector of camshaft timing adjustment valve (N205).

– Remove cylinder head (valve) cover.

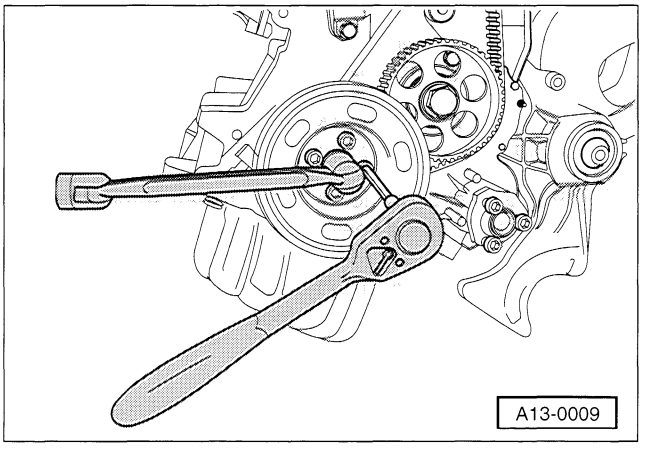


➢ Support engine with a suitable fixture that is designed to support the weight of engine and transmission without damaging body. Tools from 10-222 support bracket are shown.

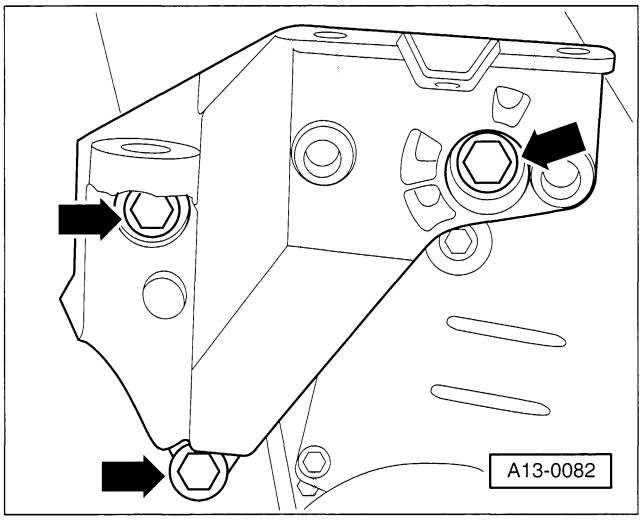
– Lift supporting device slightly, so that weight of engine and transmission is on supporting device.



➢ Remove right side engine mount bolts (**arrows**) from body and carrier on engine.



➢ Remove 4 bolts holding vibration dampener/ ribbed belt pulley to timing belt sprocket and remove belt pulley. Counterhold center bolt as shown to loosen outer bolts.

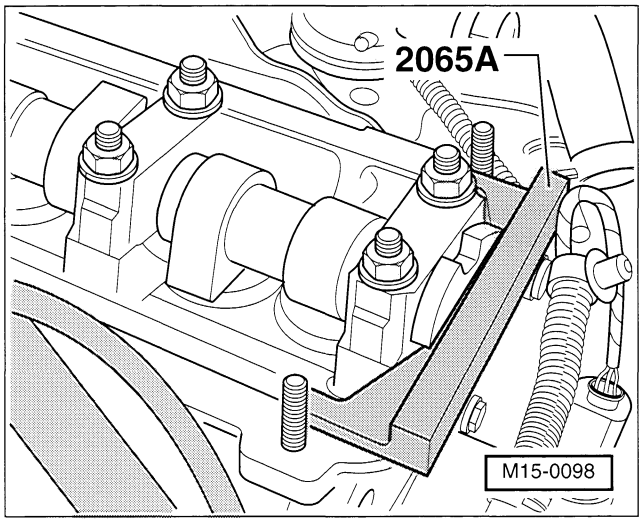


➤ Remove right side engine mount bracket from the block. There may not be sufficient room to withdraw bolts (**arrows**), so the mount and bolts are all removed at the same time.

– Remove center and lower sections of timing belt guard.

– Mark running direction of belt.

– Turn crankshaft until camshaft is at TDC for cylinder 1 by aligning mark on cylinder head (valve) cover as shown earlier.

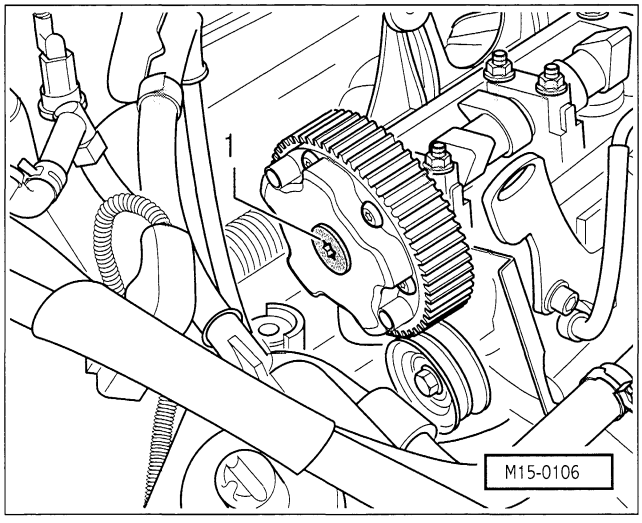


➤ Fit adjustment bar 2065A into slot on rear on camshaft to ensure proper positioning at TDC. Remove tool.

– Loosen tensioner to release it and remove belt.

– Turn crankshaft one quarter (¼) turn opposite the running direction.

Timing belt for camshaft drive, installing (engine code: BBW)



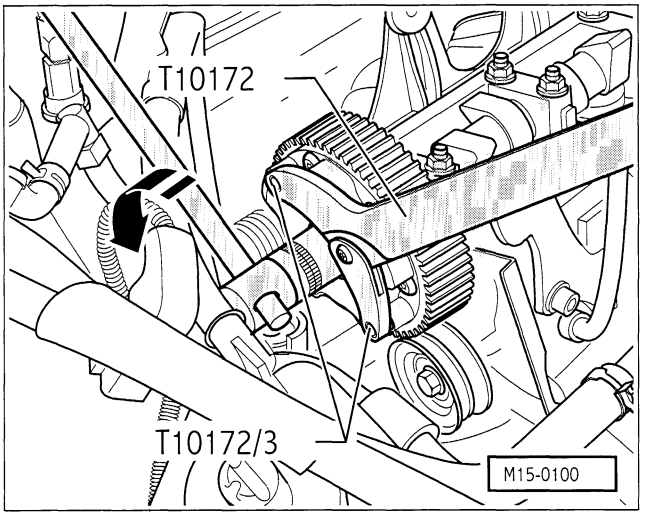
NOTE —

- *Ensure that pistons are not at TDC (as in final step of removal, above).*
- *Do not use tool 2065A to counterhold camshaft during loosening and tightening operations; camshaft damage will result. It should only be used for checking camshaft position. Always use T10172 with pins T10172/3 for loosening and tightening.*

➤ Place a flat container under camshaft sprocket to collect oil leakage when sealing plug (**1**) is loosened.

– Unscrew sealing plug (**1**) carefully and collect leaking oil. Only use counterholding tools as shown. Do not rotate crankshaft, if possible.

– Clean oil from camshaft sprocket with a suitable cloth.



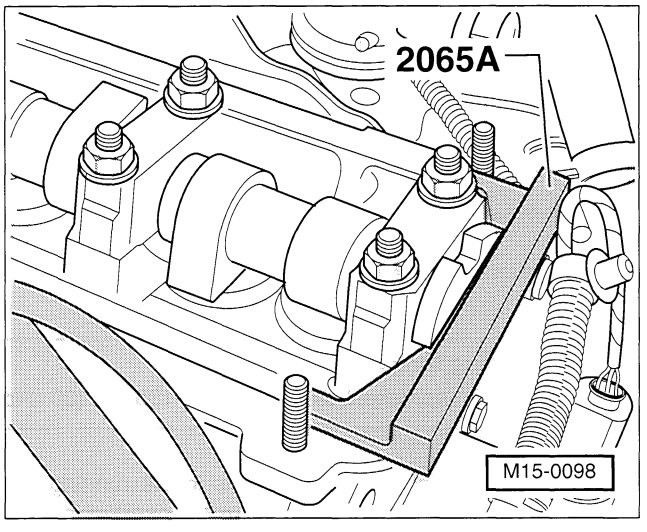
➤ Remove camshaft pulley bolt with T10172 and T10172/3. Do not rotate crankshaft, if possible.

– Remove camshaft sprocket and clean with a suitable cloth.

NOTE —

- *The teeth on the camshaft sprocket and the camshaft sprocket/camshaft contact surfaces must be free of oil.*
- *In this condition, the factory recommends replacement of the camshaft seal. It is identified as an inexpensive preventative measure when replaced at this time.*

– Install camshaft sprocket and bolt onto camshaft so that sprocket can be turned by hand.

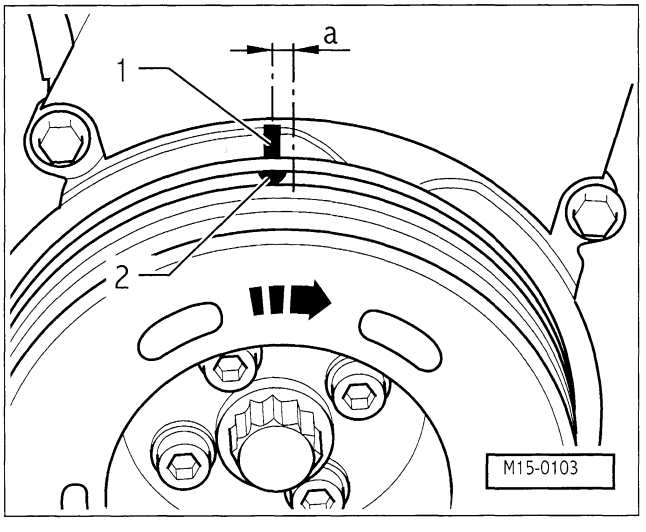


➤ Fit adjustment bar 2065A into slot on rear on camshaft to ensure proper positioning at TDC. If setting bar 2065A does not fit into slot, tighten bolt holding sprocket with T10192 and turn camshaft until it does. Loosen bolt sufficiently to allow sprocket to be turned by hand.

– Install timing belt onto crankshaft pulley and coolant pump (but not on camshaft sprocket). If re-using belt, be sure to observe previously made markings for direction.

– Install lower and center timing belt guards.

– Install vibration dampener/ribbed belt pulley.

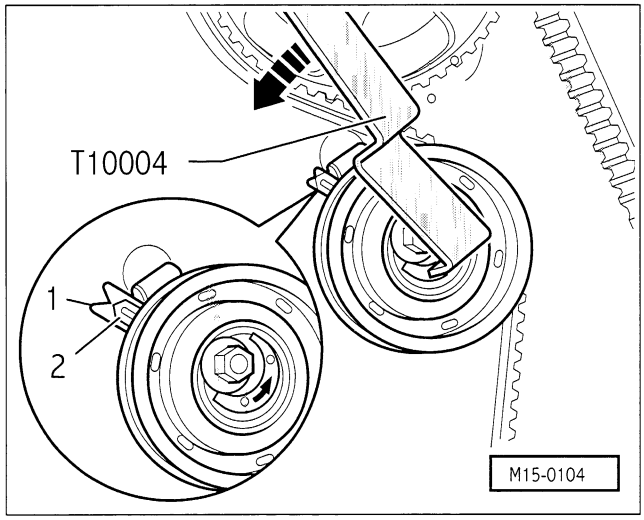


➤ Slowly turn crankshaft in the running direction until TDC for cylinder 1 is reached.

- Notch (**2**) on vibration dampener/ribbed belt pulley must align with notch (**1**) on timing belt guard, upper part. Disregard (**a**) at this time

– Turn camshaft sprocket so that T10172 with pin T10172/3 can be inserted

– Install timing belt onto tensioner camshaft sprocket.



➢ With 2-pin wrench (**T10004** shown), turn tensioner on eccentric all the way to the limit stop five (5) times in each direction. Tension the timing belt

- Turn the eccentric part of the tensioner all the way to left (**direction** of **arrow**) with the 2-pin wrench (**T10004**) against the limit stop.
- Ease back on the tension until the notch (**1**) and the pointer (**2**) align. Use a mirror if needed.
- Tighten securing nut.

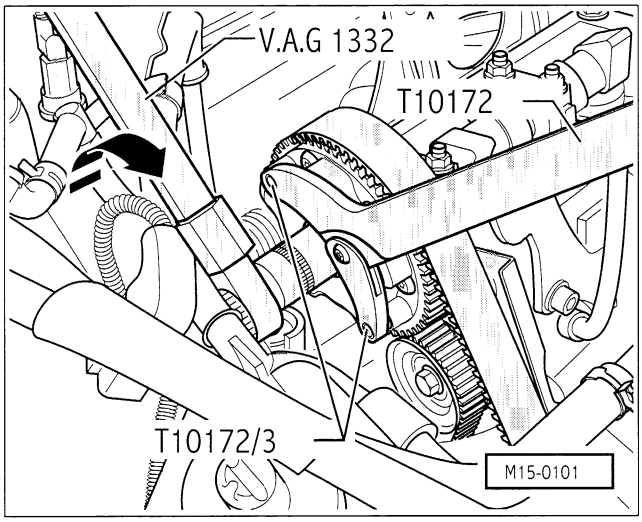
Tightening torques

- Timing belt tensioner (M8) . . . . . 20 Nm (15 ft-lb)

– Check crankshaft to ensure TDC position for cylinder 1. Position as needed.

NOTE —

If the crankshaft is positioned after TDC No. 1 cylinder, turn the crankshaft again a bit against the engine direction of rotation and set to TDC No. 1 cylinder.



➢ Counterhold crankshaft with T10172 and preliminarily tighten camshaft bolt to 40 Nm (30 ft-lb). Setting bar 2065A is still in place at this point.

– Remove setting bar 2065A from camshaft.

– Tighten camshaft bolt while counterholding with T10192.

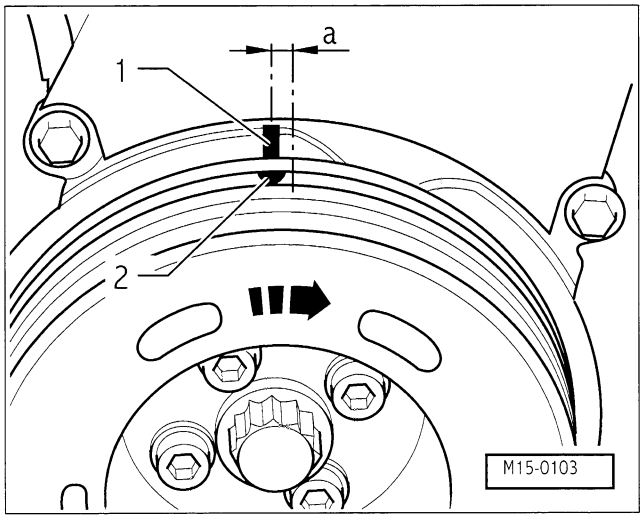
Tightening torques

- Camshaft sprocket bolt. . . . . 130 Nm (30 ft-lb)

– Turn crankshaft two full rotations in the running directions until setting bar 2065A can be inserted into camshaft slot. Verify that crankshaft is at TDC with setting bar 2065A installed.

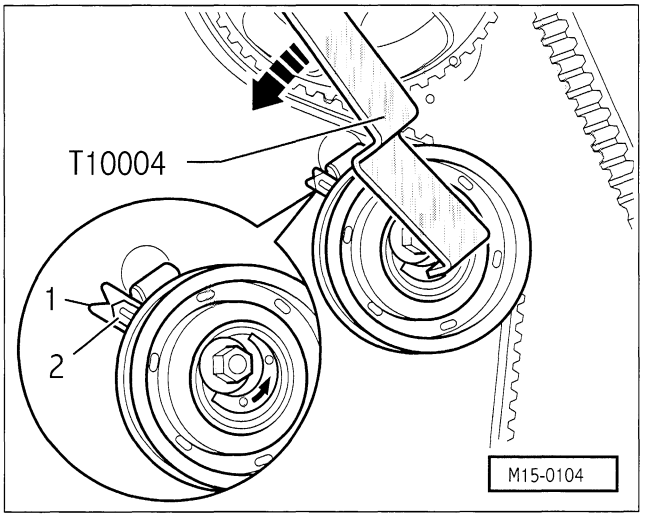
NOTE —

- *It is essential that the last 45° (1/8 turn) is performed without stopping (in one smooth motion).*
- *If the crankshaft has been turned too far, turn the crankshaft 90° (1/4 turn) back and repeat. Set the camshaft to TDC No. 1 cylinder again and insert the setting bar 2065 A.*

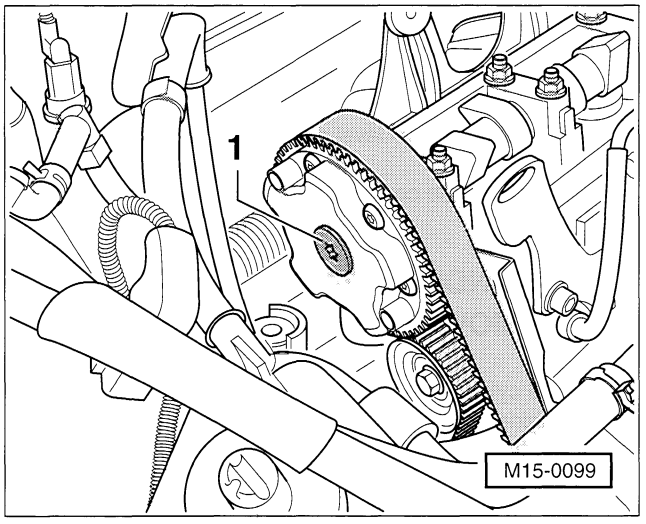


➢ Verify that notch (**2**) on vibration dampener/ribbed belt pulley aligns with area between notch (**1**) and (**a**) on timing belt guard, upper part. Distance between these two points is a maximum of 5 mm (0.197 in).

– If crankshaft **is not** aligned within the area (**a**), repeat adjustment until obtained.



➤ If crankshaft **is** aligned within the area (**a**) in previous step, check timing belt tension and readjust as required. Indicator and notch must align as shown in inset.



➤ Replace O-ring on sealing plug and install into camshaft sprocket.

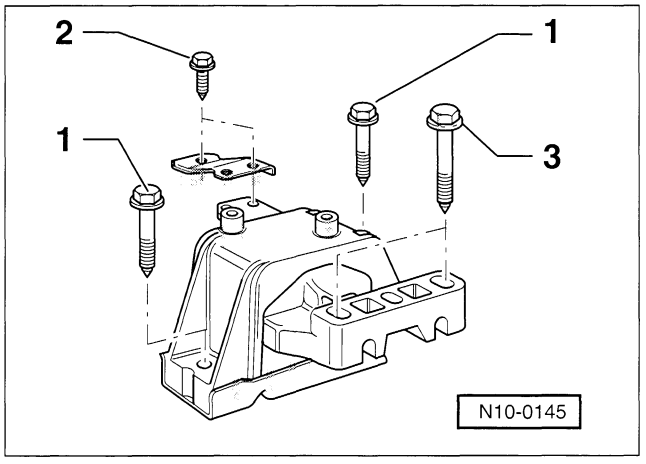
Tightening torque

- Camshaft sprocket plug . . . . . 25 Nm (18 ft-lb)

– Install engine mount bracket to engine block.

NOTE —

- *Insert bolts into engine bracket before installing engine bracket.*
- *Tighten all bolts of the engine bracket, with the tightening torque mentioned, before installing the engine mounting*



➤ Install right side engine mount using new stretch bolts as noted.

1. **Mount to body bolt**
   - 40 Nm (30 ft-lb) plus 90° (¼ turn)
   - always replace
2. **Mount bracket to body bolt**
   - 25 Nm (18 ft-lb)
3. **Mount to engine bracket bolt**
   - 60 Nm (44 ft-lb) plus 90° (¼ turn)
   - always replace

– Ensure proper engine mount alignment.

– Remove engine support fixture.

– Install timing belt guard upper section.

– Install ribbed belt tensioner and belt.

Tightening torque
- Ribbed belt tensioner to bracket (M8) . . . . . 25 Nm (18 ft-lb)

– Install coolant expansion tank.

– Install power steering reservoir.

– Install cylinder head (valve) cover.

– Connect connector of camshaft timing adjustment valve.

– Install intake manifold upper part.

– Start engine and run briefly at idle speed to allow oil pressure to reach camshaft adjuster and effect timing changes.

– Install right side sound insulation.

– Check engine oil level and top off, as needed.

– Install engine cover(s).

CYLINDER HEAD, REMOVING AND INSTALLING

The cylinder head can be removed and installed with the engine in the vehicle. Note that cylinder head bolts are stretch type fasteners and should never be reused. In addition, whenever cylinder head or cylinder head gasket is replaced, coolant must also be replaced, see **19 Engine–Cooling System**.

Cylinder head, removing

NOTE —
- *Disconnecting battery cables will erase fault codes and basic settings in the engine management and automatic transmission control unit memories. Some driveability problems may be noticeable until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. See* **24b Fuel Injection – Motronic (2.0L engine)** *for additional information. In some instances proper diagnosis will require the use of a scan tool such as Volkswagen VAG 1551 or 1552, VAS 5051 or 5052, or appropriate computer software program. Use and operation of this tool is outside the scope of this repair manual.*
- *Cylinder head will be removed with the exhaust manifold and lower section of intake manifold still attached.*

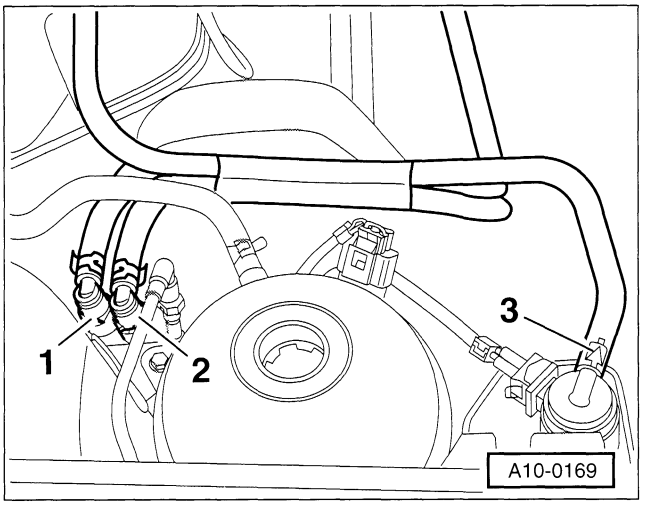
WARNING —

- *Do not start work on a hot engine. Allow to cool sufficiently before proceeding. Engine temperature must be no hotter than warm to touch. Cylinder head warpage can result due to uneven cooling rates.*
- *When working in the engine compartment, due to the cramped, tight conditions, pay attention to the following points*
- *Route all lines (e.g. for fuel, hydraulics, EVAP system, coolant, refrigerant, brake fluid and vacuum, etc.) as well as electrical wiring so that the original positions are maintained. Ensure sufficient clearance to all moving or hot components.*
- *Make sure there is sufficient clearance to all moving or hot components.*
- *Be sure to replace all tie wraps cut during removal and install new ones to prevent lines and wiring harnesses from chaffing or contacting engine parts.*

– With ignition switched off, disconnect battery negative terminal from battery.

NOTE —

Be sure to have anti-theft radio code on hand before disconnecting battery.



– Position crankshaft so that pistons are NOT at TDC.

– Remove upper engine cover.

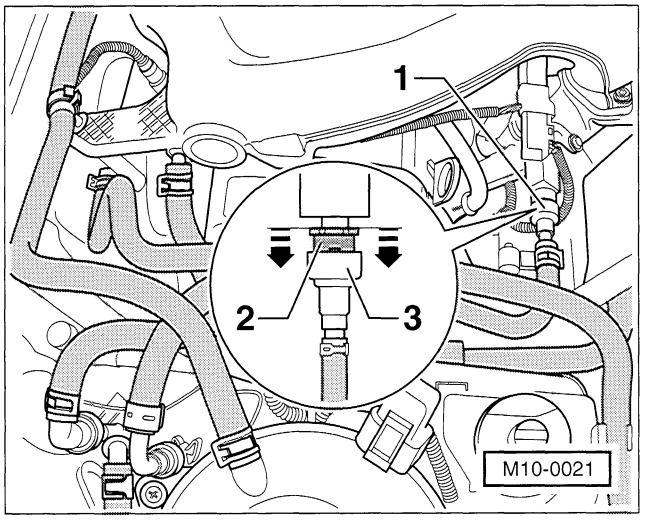
– Remove lower sound absorber panel (belly pan).

– Drain engine coolant, see **19 Engine–Cooling System**.

➢ Engine codes **AEG**, **AVH**, **AZG**: disconnect fuel supply line (**1**), fuel return line (**2**).

WARNING —

Fuel will be expelled when disconnecting fuel hoses. Wrap a cloth around fuel line fittings before disconnecting them. Do not smoke or work near heaters or other fire hazards. Have a fire extinguisher handy.



– Disconnect hose (**3**) from solenoid valve for Evaporative Emission (EVAP) Canister Purge Regulator Valve N80.

➢ Engine codes **BBW, BEV**: disconnect fuel supply line (**1**) by sliding ring (**2**) in union (**3**).

WARNING —

Fuel will be expelled when disconnecting fuel hoses. Wrap a cloth around fuel line fittings before disconnecting them. Do not smoke or work near heaters or other fire hazards. Have a fire extinguisher handy.

– Seal off disconnected fuel and vacuum lines to prevent contamination.

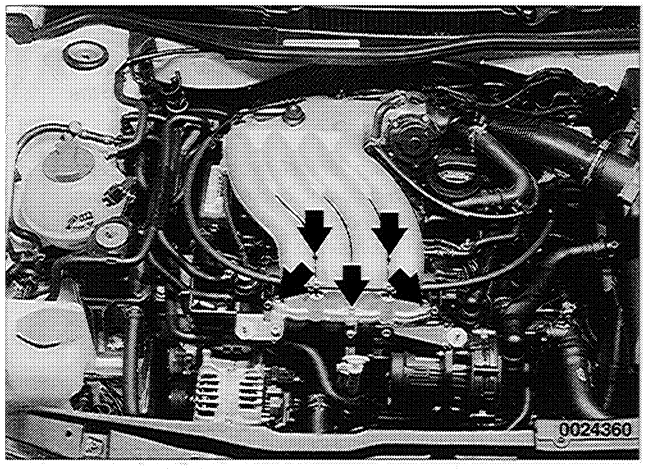
– Remove air cleaner assembly and connecting hoses to throttle housing.

– Disconnect accelerator cable from throttle control module linkage and cable retainers. (AEG engine only).

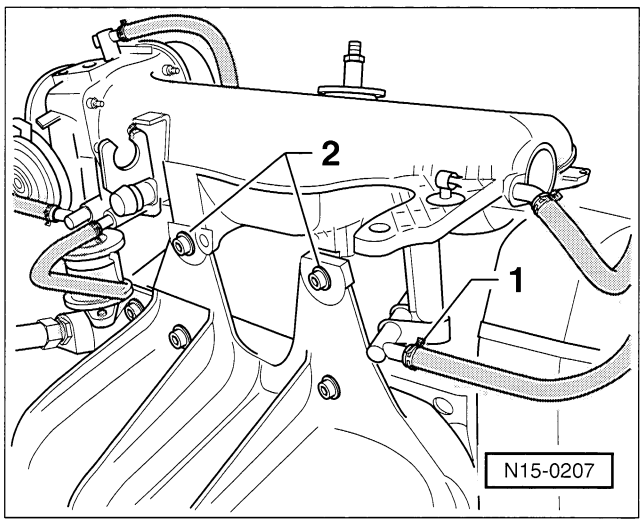
– Unplug wiring harness connector from throttle control module.

– Remove 2 coolant hoses from throttle control module that connect to the reservoir and cylinder head.

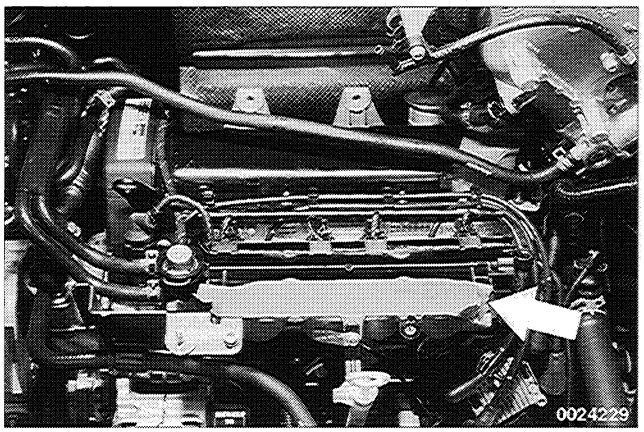
– Disconnect vacuum hose connection for power brake booster on the back of intake manifold and any remaining electrical and vacuum connections on intake manifold.



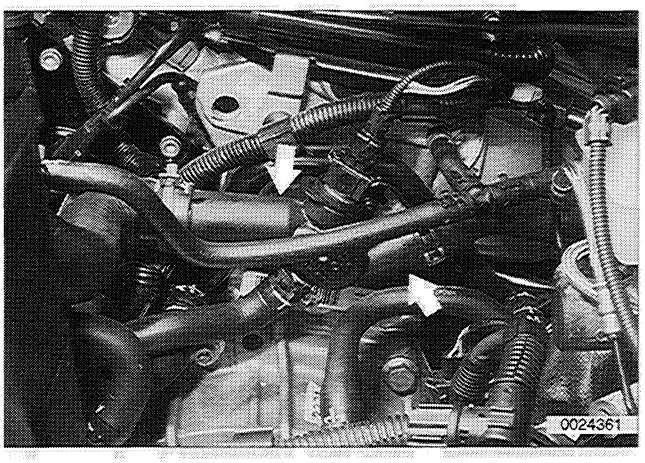
➢ Loosen and remove bolts (**arrows**) holding upper and lower sections of intake manifold together (AEG engine shown).



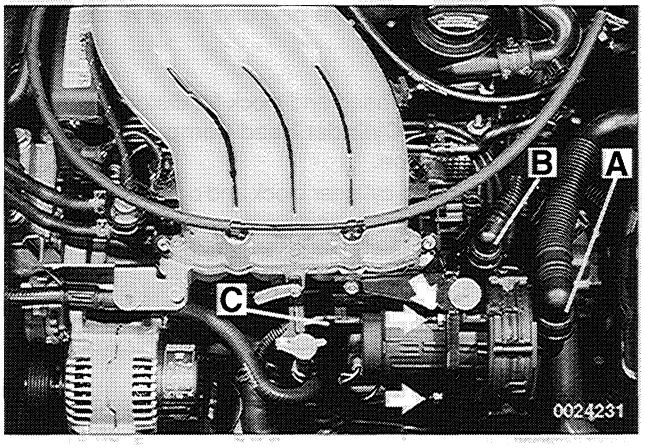
➢ On the rear upper section of intake manifold, remove vent line (**1**) and mounting bolts (**2**) for warm air deflector plate.



➢ Lift off upper section of intake manifold and lay aside. Block off exposed open ports on lower section with suitable shop cloth or wide tape (**arrow**) or other suitable material.



➢ Unbolt (**arrows**) coolant connection flange from end of cylinder head and carefully move aside. The coolant hoses stay connected.



➢ Disconnect intake (**A**) and pressure hoses (**B**) from Secondary Air Injection pump. Unbolt nuts (**arrows**) holding pump to bracket and disconnect harness connector (**C**). Remove pump from mounting bracket. (AEG engine shown).

– Disconnect electrical components/connections as applicable including:

- Fuel Injectors (and unclip wiring from holders)
- Camshaft Position Sensor
- Valve for camshaft adjuster
- Engine coolant temperature sensor
- Knock sensor
- Spark Plug Wires

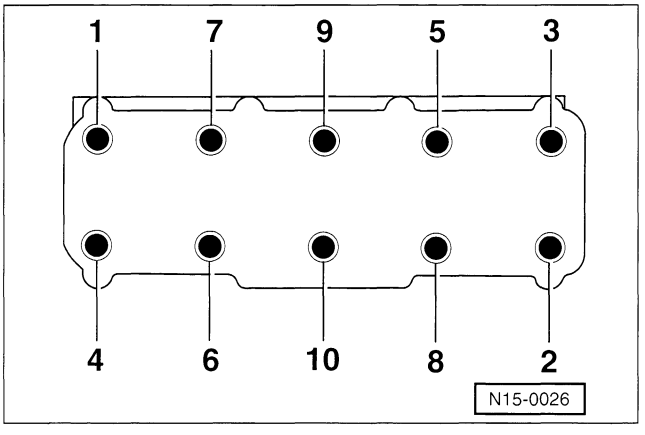
– Remove ribbed V-belt from tensioner and remove tensioner.

– Remove upper timing belt cover.

– Ensure that engine is at TDC for cylinder number 1/

– Release timing belt tensioning roller and take timing belt off camshaft sprocket.

– Turn crankshaft slightly against running direction off of TDC.



– Remove upper bolt from rear timing belt guard where it is attached to cylinder head.

– Unbolt front exhaust pipe from exhaust manifold, see **26 Exhaust System and Emission Controls**.

– Remove cylinder head (valve) cover as described earlier.

➢ Slightly loosen socket head bolts slightly in sequence shown using 3452. Do not completely loosen and remove bolts until all 10 have been loosened. Do not reuse head bolts.

– Carefully lift off cylinder head and place in a clean area. If head is stuck, use a soft-faced mallet or pry gently with a wooden stick. Protect cylinder block from dirt contamination by covering cylinder bores, coolant and oil passages with clean cloths or other suitable materials.

> ***CAUTION —***
> *Some of the valves will be open. Use extra care when removing and handling to avoid damage. Place cylinder head on bench or table so that weight of cylinder head will not rest on valves.*

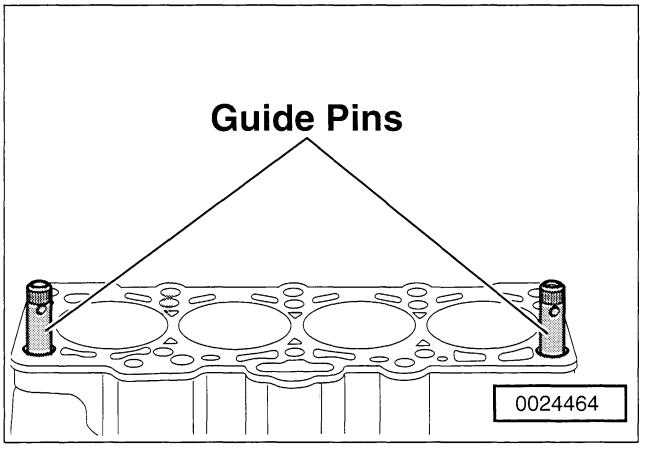
Cylinder head, installing

Before proceeding with installation of cylinder head, whether an original or a new unit, observe the following important points:

- Check cylinder head and block for distortion and warpage, see **Cylinder Head Components**, given later in this section.
- Carefully clean cylinder block and cylinder head sealing surfaces being sure to avoid scratching them during cleaning process. Do not use metal scrapers or wire brushes.
- When using abrasive paper do not use any grades coarser than 100 grit (such as 80 grit). Lower numbers are coarser.
- If cylinder head will not be reinstalled immediately, take precautions to prevent rust from forming on cylinder block walls and gasket sealing surfaces.
- When cleaning old gasket material off of cylinder block, take precautions to keep old gasket material and abrasive particles and dirt out of cooling and oiling system passages. Place a clean shop cloth over cylinders to prevent contamination from getting between cylinder wall and piston.
- Do not take new cylinder head gasket out of packaging until ready to use. Handle new gasket with extreme care as any damage will lead to leaks.
- There MUST NOT BE any oil or coolant in head bolt holes in cylinder block. Any fluids in holes creates danger of hydrolock while torquing which could lead to structural damage of cylinder block. Use thread chasers to remove foreign material as required. Be sure that all 10 bolt holes are clean and dry.
- When all traces of old gasket material have been removed from cylinder block and head, carefully remove all traces of metal particles, abrasives and lint. All gasket sealing surfaces and bolt holes must be clean and dry to ensure a proper seal.
- Always use new cylinder head bolts and a new cylinder head gasket.
- Do not use any gasket sealer on new cylinder head gasket.
- If installing a Volkswagen supplied replacement (exchange) cylinder head, be sure to inspect for and remove any plastic packaging materials used to protect the head and the open valves.

Cylinder head, installing (continued)

– Position crankshaft so that pistons are at TDC and then back off of TDC slightly.



➢ Install guide pins (tool 3450/2A) into two head bolt holes of cylinder block. Pins allow for proper alignment of the head on the block. preventing slippage and damage to head gasket.

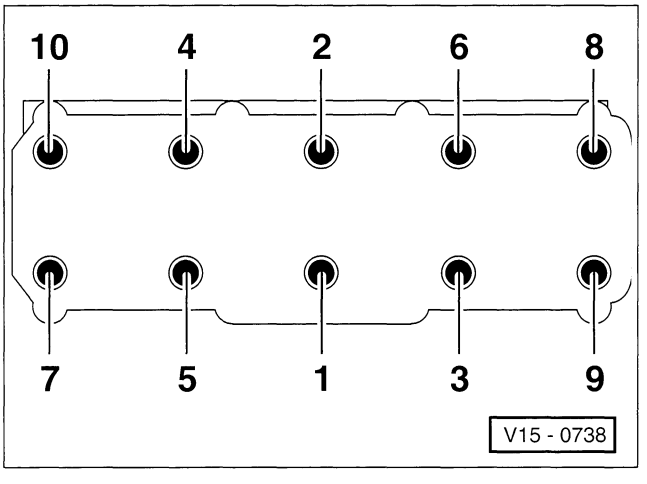
NOTE —
Old head bolts can be modified and made into special tools foe this purpose. Cut off the socket head and leave approximately 25 mm (1 in) of material above the threads. Cut a screwdriver slot with a hacksaw in the unthreaded end. Use a long screwdriver and a pencil magnet to remove when head is in position with other 8 bolts installed.

– Install new cylinder head gasket onto block with numbers and letters facing up. Be sure that none of the wiring or any vacuum hoses are caught between cylinder head and block.

– Carefully install the cylinder head onto block over alignment pins and screw in 8 of the new head bolts. Tighten bolts hand-tight only.

NOTE —
Replacement head bolts may require a different hex head socket tool than original bolts (12 pt. vs. 6 pt.).

– Remove alignment pins from bolt holes with tool and install remaining 2 new head bolts. Tighten these bolts hand-tight.



➢ Tighten the 10 cylinder head bolts in three stages following tightening order.

Tightening torque

- Cylinder head to cylinder block
  (stretch bolt – always replace)
  stage I . . . . . 40 Nm (30 ft-lb)
  stage II . . . . . additional ¼ turn (90°)
  stage III . . . . . additional ¼ turn (90°)

– Lubricate camshaft and followers and install cylinder head (valve) cover.

– Install timing belt, adjust tension and belt timing as given earlier according to engine version. See **Timing belt for camshaft drive, installing**.

– Install upper bolt for rear timing belt guard where it is attached to cylinder head.

– Install upper timing belt cover.

– Install ribbed V-belt tensioner and belt.

- Remove whatever material was used to seal exposed lower section of intake manifold and install upper section of intake manifold. Re-attach vacuum fitting and warm air deflector plate.

- Reconnect all coolant flanges and lines.

- Reconnect all vacuum hoses connections.

- Reconnect fuel supply and return hoses and vacuum hose to leak detection pump.

- Reconnect accelerator cable (where applicable) and check for smooth operation and full throttle.

- Reconnect all disconnected electrical components and connections including spark plug wires.

- Refill cooling system with fresh coolant in appropriate ratio. See **19 Engine–Cooling System.**

> ***CAUTION —***
> - *Use only Volkswagen original anti-freeze when filling cooling system. Use of any other anti-freeze may be harmful to cooling system. Do not use an anti-freeze containing phosphates.*
> - *Do not use tap water in cooling system. Use distilled water only to mix anti-freeze.*

- Install air cleaner assembly and connecting hoses.

- Attach front exhaust pipe to exhaust manifold with new nuts. See **26 Exhaust System and Emission Controls**.

- Install lower sound absorber panel (belly pan).

- Install upper engine cover.

- Reconnect battery only after all parts/electrical connections have been reinstalled and reconnected.

- Ensure that engine oil and all fluids are at correct levels.

- Perform procedure following interruption of voltage supply, see **27 Engine Electrical**.

- Adapt Transmission Control Module (TCM) to Basic Settings, see **37 Automatic Transmission**.

- Start engine and let it idle. Inspect for oil and coolant leaks. Ensure that radiator fan cycles properly. Road test as required.

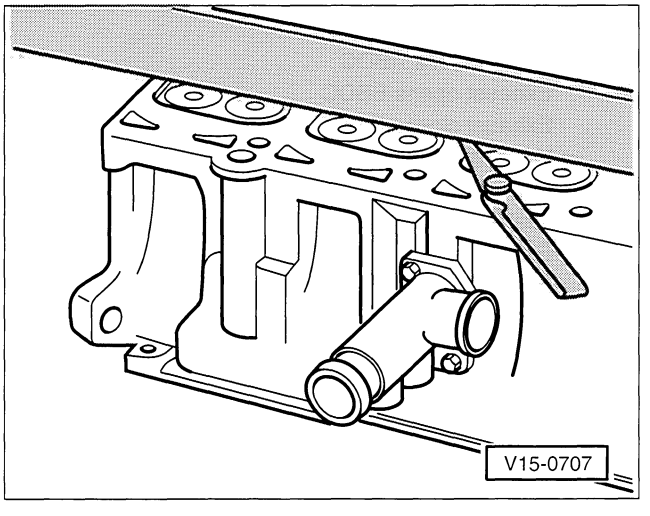
- Be sure to quality check your work, see **Quality Review** at end of this repair group.

Tightening torques

- Cylinder head cover to cylinder head (M6) . . . . . 10 Nm (89 in-lb)
- Upper intake manifold bolts to lower manifold (M8) . . . . . 20 Nm (15 ft-lb)
- Warm air deflector to upper intake manifold (M8) . . . . . 25 Nm (18 ft-lb)
- Cylinder head to cylinder block (stretch bolt - always replace)
  stage I . . . . . 40 Nm (30 ft-lb)
  stage II . . . . . additional ¼ turn (90°)
  stage III . . . . . additional ¼ turn (90°)
- Front exhaust pipe to exhaust manifold (special nuts - always replace)(M10) 40 Nm (30 ft-lb)
- Coolant outlet flange to cylinder head (M6) . . . . . 10 Nm (89 in-lb)
- Rear timing belt guard to cylinder head (M8) . . . . . 20 Nm (15 ft-lb)
- Ribbed belt tensioner to bracket (M8)25 Nm (18 ft-lb)
- Timing belt tensioner (M8) . . . . . 20 Nm (15 ft-lb)
- Secondary air pump to support bracket nut (M6) . . . . . 10 Nm (89 in-lb)

CYLINDER HEAD COMPONENTS

This section provides specifications and special information necessary to repair the cylinder head that has been removed from the Volkswagen 2.0L engine. Special service tools and machine shop services are required for most cylinder head repairs.



NOTE —

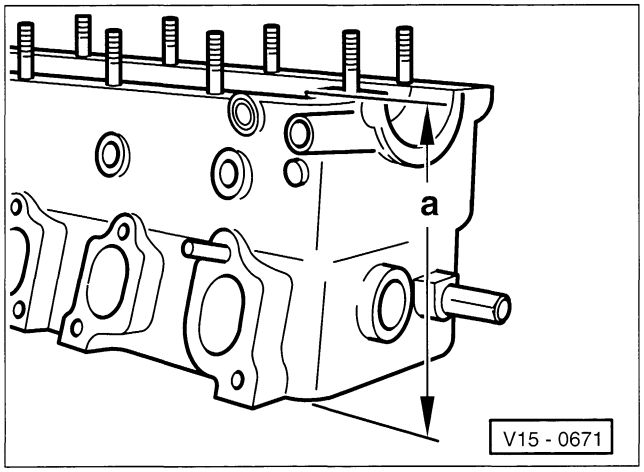
- *The information given under this heading assumes that the cylinder head is removed. For cylinder head removal procedures, see* **Cylinder head, removing** *given earlier.*

Cylinder head and camshaft

Check cylinder head for warpage and distortion with an accurate straight edge and a feeler gauge. Measurements should be made no further than 100 mm (4 in) apart.

Specification

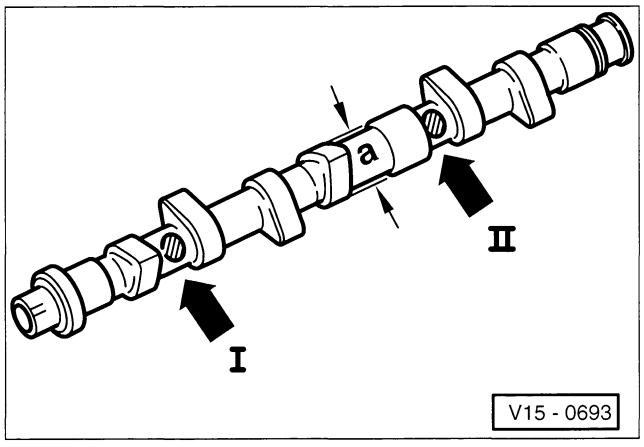
- Maximum cylinder head distortion/warpage . . . . . 0.1 mm (0.004 in.)



The cylinder head can be resurfaced provided that the distance from valve cover gasket surface to head gasket surface is never less than specified. Resurfacing cylinder head will require that the valves be set deeper into the seat by the same amount as was removed by surfacing operation. This can be done by reworking valve seats. Machining too much material off of this surface will change compression ratio and will affect engine emissions.

Specification (all engine codes)

- Minimum cylinder dimension (valve cover gasket surface to head gasket surface) . . . . . 132.6 mm (5.22 in.)



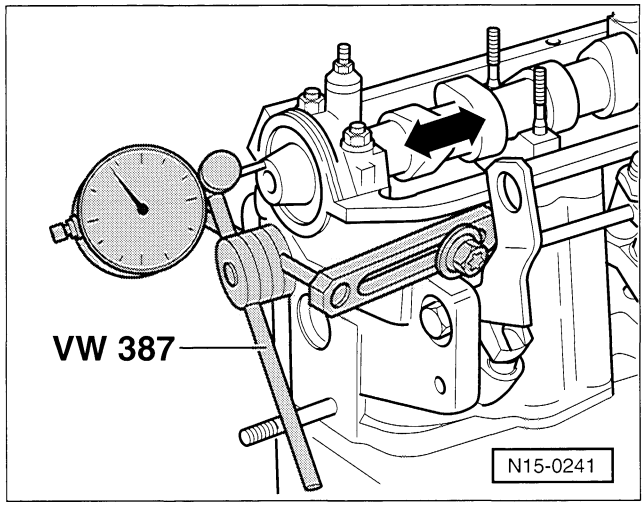
Some 2.0L camshafts are identified by markings cast into it during manufacture:

- **a** is the base diameter = 34 mm
- For AEG engine:
  Arrow I should show the letter -B-
  Arrow II should show the number -050-
- For AVH and AZG engine
  Arrow I should show 50 E/50 P
  Arrow II should show no apparent markings

– Information regarding valve timing for the 2.0L engines is no longer supplied by the manufacturer. The specifications provided below are from early editions of Factory supplied data.

Specification

- Valve timing at 1 mm valve lift, engine code AEG
  Intake opens ATDC . . . . . 5°
  Intake closes ABDC . . . . . 41°
  Exhaust opens BBDC . . . . . 37°
  Exhaust closes BTDC . . . . . 1°
- Valve timing at 1 mm valve lift, engine code AVH, AZG
  Intake opens ATDC . . . . . 6°, 20'
  Intake closes ABDC . . . . . 42°, 45'
  Exhaust opens BBDC . . . . . 35°, 80'
  Exhaust closes BTDC . . . . . 0°, 45'



– The in and out movement of the camshaft is known as axial play and is measured with cam followers (hydraulic lifters) removed and only the first and last bearing caps installed.

A dial gauge is set up on the sprocket end of the camshaft and the camshaft clearance is checked by moving (**arrow**) camshaft as far as it can go in each direction.

Specification

- Camshaft axial clearance. . . . . 0.15 mm (0.006 in.)

Valves

Valves should not be re-worked on a valve grinding machine. Only lapping by hand with valve compound is permitted. Valve dimensions are listed in **Table a**.

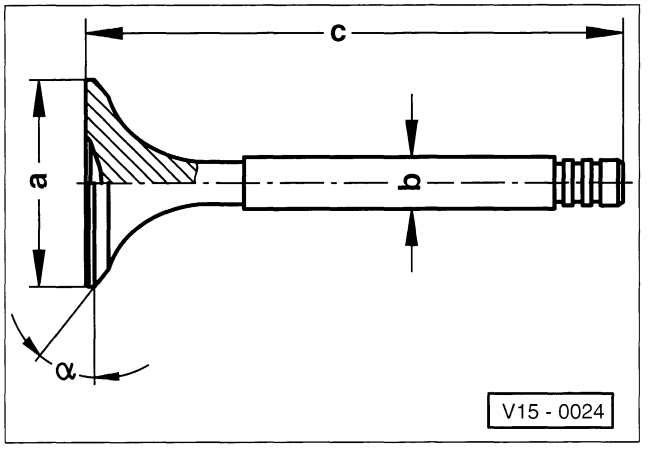
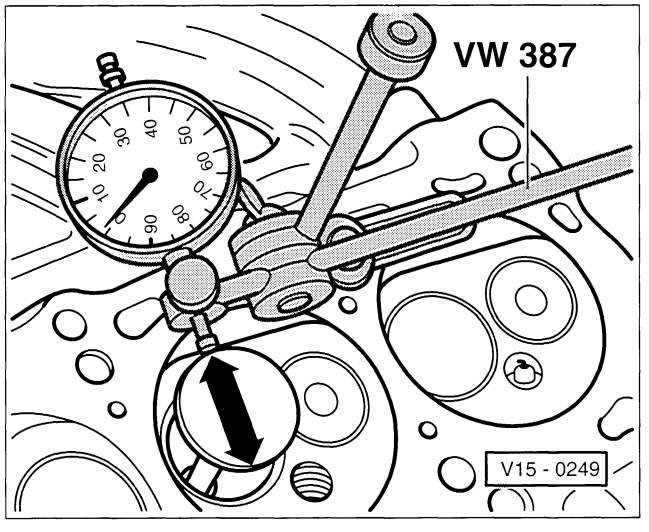


Table a. Valve Dimensions

Dimension	AEG engine (original equipment)	AVH, AZG, BBW, BEV engines (AEG replacements)
Valve head diameter (**a**)		
intake	39.5 mm ± 0.15 mm (1.555 in. ± 0.006 in)	39.5 mm ± 0.15 mm (1.555 in. ± 0.006 in)
exhaust	32.9 mm ± 0.15 mm (1.295 in. ± 0.006 in.)	32.9 mm ± 0.15 mm (1.295 in. ± 0.006 in.)
Valve stem diameter (**b**)		
intake	6.98 mm ± 0.007 mm (0.275 in. ± 0.0003 in.)	6.92 mm ± 0.002 mm (0.272 in. ± 0.00008 in)
exhaust	6.96 mm ± 0.007 mm (0.274 in. ± 0.0003 in.)	6.92 mm ± 0.002 mm (0.272 in. ± 0.00008 in)
Length (**c**)		
intake	91.85 mm (3.616 in.)	91.85 mm (3.616 in.)
exhaust	91.15 mm (3.588 in.)	91.15 mm (3.588 in.)
Face angle (α)		
intake	45°	45°
exhaust	45°	45°

Note:
Replacement intake valves supplied by Volkswagen/Audi carry the same part number for all engine codes due to supersessions.
Replacement exhaust valves supplied by Volkswagen/Audi carry the same part number for all engine codes

Valve guides



NOTE —
Special tools and a press are required to replace valve guides.

Check valve guide wear with a new valve. Always use an intake valve in an intake guide and an exhaust valve in an exhaust guide.Insert valve until stem end is flush with end of guide. Rock valve back and forth (**arrow**) to check total travel.

Inspect valve seats to ensure that cylinder head can be reconditioned before installing new valve guides. Press out worn original valve guides with Volkswagen special driver tool 3121 from camshaft side of head. Replacement valve guides have a shoulder on the camshaft side to limit the installed depth and must be pressed out from combustion chamber side.

When installing new valve guides, lubricate with clean engine oil and press in from camshaft side down to shoulder. The cylinder head should be cold for this operation. Once the shoulder of valve guide contacts the cylinder head, do not allow the pressure on the guide to exceed 2000 psi (1 ton) otherwise cylinder head or guide will be damaged. When guide has been replaced, ream it to proper size and continue with reworking of valve seats.

Specification

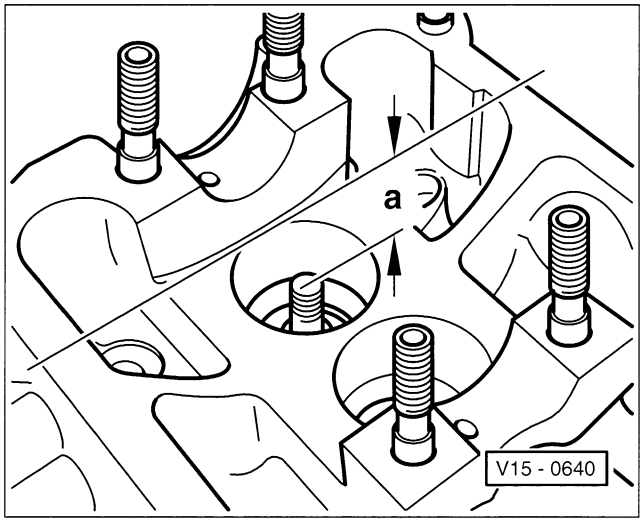
- Valve guide (wear limits-maximum play)
  with new valve
  intake valve guide . . . . . 1.0 mm (0.039 in.)
  exhaust valve guide . . . . . 1.3 mm (0.051 in.)

NOTE —

Due to close tolerances found in valve guides, it is recommended that Volkswagen special tool 3121 be used for removal and installation and special tool 3120 be used to ream valve guide to size.

Valve seats

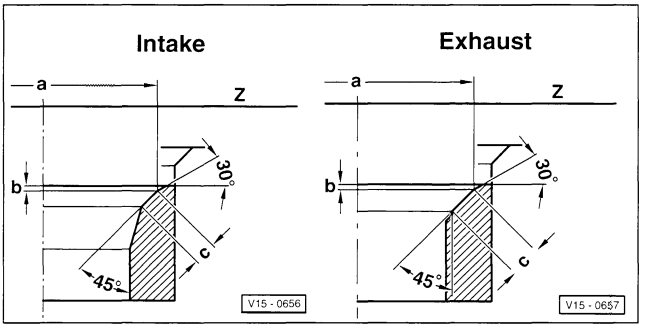
When resurfacing valve seats, there is a limit to the amount of material that can be removed to bring the seat back into specification. If too much material is removed, the final assembly will leave too little space for the hydraulic cam follower to function properly. The maximum refacing dimension, that is, the maximum amount of material that can be removed from the valve seat, is calculated from measurement shown in Fig. 39.



Measure distance (**a**) between top of valve stem and gasket surface of cylinder head and subtract the minimum dimension, as given in **Table b**. The difference is the maximum amount of material that can be removed from valve seat.

Table b. Minimum Dimensions for Calculating Valve Seat Refacing Dimensions

Engine Codes	Intake	Exhaust
AEG, AVH, AZG, BBW, BEV	33.8 mm (1.331 in.)	34.1 mm (1.343 in.)



Valve seat dimensions for reworking valves are given in **Table c** and correspond to valve dimensions at left.

NOTE —
Use care when reworking exhaust valve seats to avoid changing the shape of the port. This can upset the flow characteristics of the valve.

Table c. Valve Seat Dimensions

2.0L Engine	Intake	Exhaust
Seat diameter (**a**)	39.2 mm (1.543 in.)	32.4 mm (1.276 in.)
Maximum refacing dimension (**b**)	Calculated, see above	Calculated, see above
Seat width (**c**)	1.8 to 2.2 mm (0.071 to 087 in.)	2.2 to 2.6 mm (0.071 to 0.102 in.)
Valve seat angle	45°	45°
Correction angle, upper	30°	30°

NOTE —
Z shows cylinder head surface reference.

QUALITY REVIEW

When you have finished working under the hood and around other areas of the vehicle it is advisable to take a moment to quality check or review your work. This helps to ensure that the operation or repair has been completed properly with all affected systems functioning within normal parameters. This may include the following:

- Make sure that radiator fan cycles properly and that coolant level and concentration are correct.
- Ensure that all cable ties and hose clamps that were removed as part of repair are replaced.
- Check and adjust all other applicable fluid levels.
- Make sure that there are no fluid leaks.
- Make sure that there are no air, vacuum or exhaust leaks.
- Make sure that all components involved in repair are positioned correctly and function properly.
- Male sure all tools, shop cloths, fender covers, and protective tape are removed.
- Clean grease from painted surfaces and steering wheel.
- Unlock anti-theft radio and reset clock.

In addition to the above noted points, the Engine Control Module (ECM) and Transmission Control Module (TCM) may need to be checked using the Volkswagen supplied VAG 1551 or 1552 scan tool as mentioned at the start of this repair.

15d Cylinder Head and Valvetrain (2.8L Engine)

GENERAL 15d-2

DIAGNOSTIC TESTING 15d-2
- Compression test 15d-2
- Cylinder leakdown test 15d-4

CYLINDER HEAD SERVICE (AFP ENGINE) 15d-5
- External cylinder head assembly 15d-5
- Internal cylinder head assembly 15d-6
- Cylinder head gasket, sealing 15d-7
- Cylinder head (valve) cover, removing and installing 15d-7
- Camshafts, removing 15d-10
- Camshafts, installing 15d-11
- Hydraulic cam followers 15d-14
- Hydraulic cam followers, checking 15d-14
- Valve stem oil seals, replacing 15d-15

CAMSHAFT DRIVE CHAINS (AFP ENGINE) 15d-17
- Camshaft drive chains, assembly 15d-17
- Valve timing, checking 15d-18
- Camshaft drive chains, removing 15d-19
- Camshaft drive chains, installing 15d-21

CYLINDER HEAD REMOVING AND INSTALLING (AFP ENGINE) 15d-25
- Cylinder head, removing 15d-25
- Cylinder head, installing 15d-28

CYLINDER HEAD COMPONENTS (AFP ENGINE) 15d-31
- Cylinder head and camshafts 15d-31
- Camshafts and cam followers 15d-32
- Valves 15d-33
- Valve guides 15d-33
- Valve seats 15d-34

CYLINDER HEAD SERVICE (BDF ENGINE) 15d-35
- External cylinder head assembly 15d-36
- Camshaft sprocket cover assembly 15d-37
- Internal cylinder head assembly 15d-38
- Cylinder head (valve) cover, removing and installing 15d-40
- Camshafts, removing 15d-43
- Camshafts, installing 15d-46
- Valve stem oil seals, replacing 15d-48

CAMSHAFT DRIVE CHAINS (BDF ENGINE) 15d-50
- Camshaft drive chains, assembly 15d-50
- Valve timing, checking 15d-51
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GENERAL

This engine section covers cylinder head and valvetrain service and repair work for the 6-cylinder (VR6) 2.8 liter engine. For information on short block engine repair and internal engine specifications, see **13b Crankshaft/Cylinder Block (6-cylinder)**.

Most of the operations described in this repair group require special equipment and experience. If you lack the skills, tools, or a suitable workplace for servicing or repairing the cylinder head, we suggest you leave these repairs to an authorized Volkswagen dealer or other qualified shop.

CAUTION —
Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using a VAG 1551/1552 or equivalent scan tool.

Engine Codes

- AFP . . . . . .2.8L 12-valve 6-cylinder gasoline
- BDF . . . . . .2.8L 24-valve 6-cylinder gasoline

DIAGNOSTIC TESTING

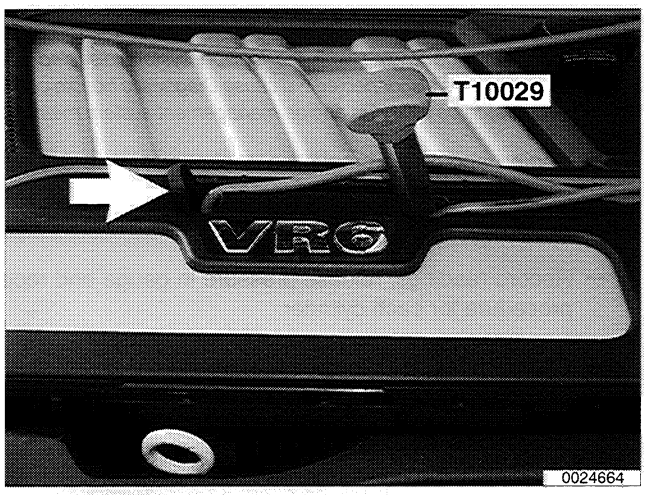
The tests that follow can help isolate engine problems to better understand a problem before starting expensive repairs, or just to periodically check engine condition.

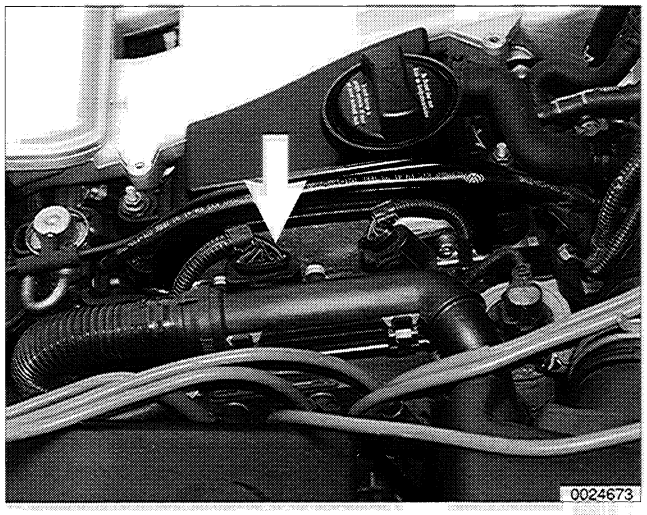
Compression test

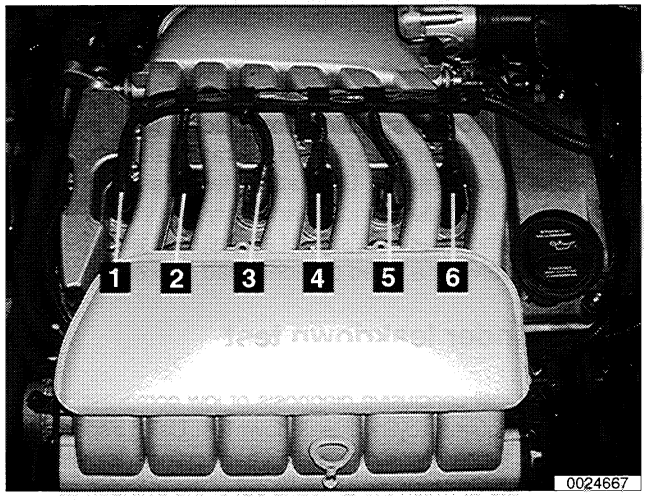
A compression test will tell a lot about the condition of the engine without the need for taking it apart. The test is relatively simple, requiring only a compression tester, a spark plug wire removal tool and a spark plug wrench. For the most accurate test results, the battery should be fully charged and engine should be warm.

NOTE —
Because engine temperature may affect compression, the most accurate results are obtained when the engine is at normal operating temperature.

– Warm-up engine until it is a minimum of 30°C (86°F). switch off ignition.







– Disconnect 2-pin harness connector from crankcase vent heating element on intake hose between mass air flow sensor and throttle valve control module and remove intake hose.

Engine code: AFP

➢ Engine code **AFP**:

- Disconnect spark plug wires from spark plugs with tool T10029 as shown. Disconnect other end of wire from ignition coil and remove wire.
- Remove upper engine cover.

NOTE —
*It may not be necessary to use special tool T10029 if spark plug wires are equipped with removal loops (**arrow**) that allow the spark plug wires to be removed by hand.*

➢ With ignition off, disable ignition system by disconnecting 5-pin harness connector (**arrow**) from coil pack on back of cylinder head.

Engine code: BDF

– Remove engine cover by gently pulling upward.

➢ Disconnect and label individual ignition coil connectors.

– Remove ignition coils using special tool T10095.

Continued for all 6-cylinder engines

– Use compressed air to clear the area around the spark plugs. Remove spark plugs and lay aside in proper order.

NOTE —
Due to the limited clearance around the recessed spark plugs, VW special tool no. 3122B is available to easily remove and install the plugs. Commercially available thin-wall spark plug sockets with extensions may also be suitable.

– Remove fuse for the voltage supply to fuel injectors.

- **AFP** engine: remove fuse #32
- **BDF** engine: remove fuse #29

– Fit compression tester into first spark plug hole.

– Have a helper:

- depress clutch pedal fully
- put transmission in neutral or park
- depress accelerator pedal to the floor
- crank engine over with starter motor

NOTE —
Cranking the engine with the ignition system disabled and components disconnected will cause Diagnostic trouble codes (DTCs) to be stored in engine management system memory.

– Engine should be cranked a minimum of 4 to 5 revolutions or until compression tester shows no further pressure increase.

– Record readings, release pressure in gauge and repeat procedure for each cylinder.

– Compare readings to specification.

Specification

- Compression pressures (AFP/BDF engine)
  new . . . . . 10 to 13 bar (145 - 189 psi)
  wear limit . . . . . .7.5 bar (110 psi)
  maximum difference
  between cylinders . . . . . 3 bar (44 psi)

– When all cylinders have been checked, reinstall all removed components, including fuse for fuel injectors. Install upper sound absorber panel.

Tightening torque

- Spark plug to cylinder head . . . . . 25 Nm (18 ft-lb)

– Check DTC (Diagnostic Trouble Code) memory with a diagnostic scan tool. Re-set readiness codes if DTC memory as been erased or if engine control module was separated from permanent positive voltage supply.

Low compression suggests poorly sealed combustion chambers. Compression pressures which are relatively even but below specifications indicate worn piston rings and/or cylinder walls. Low but erratic values tend to indicate valve leakage. Dramatic differences, such as good values in some cylinders and very low values in one or two cylinders are the sign of a localized failure, such as a burnt valve or a failed cylinder head gasket.

Cylinder leakdown test

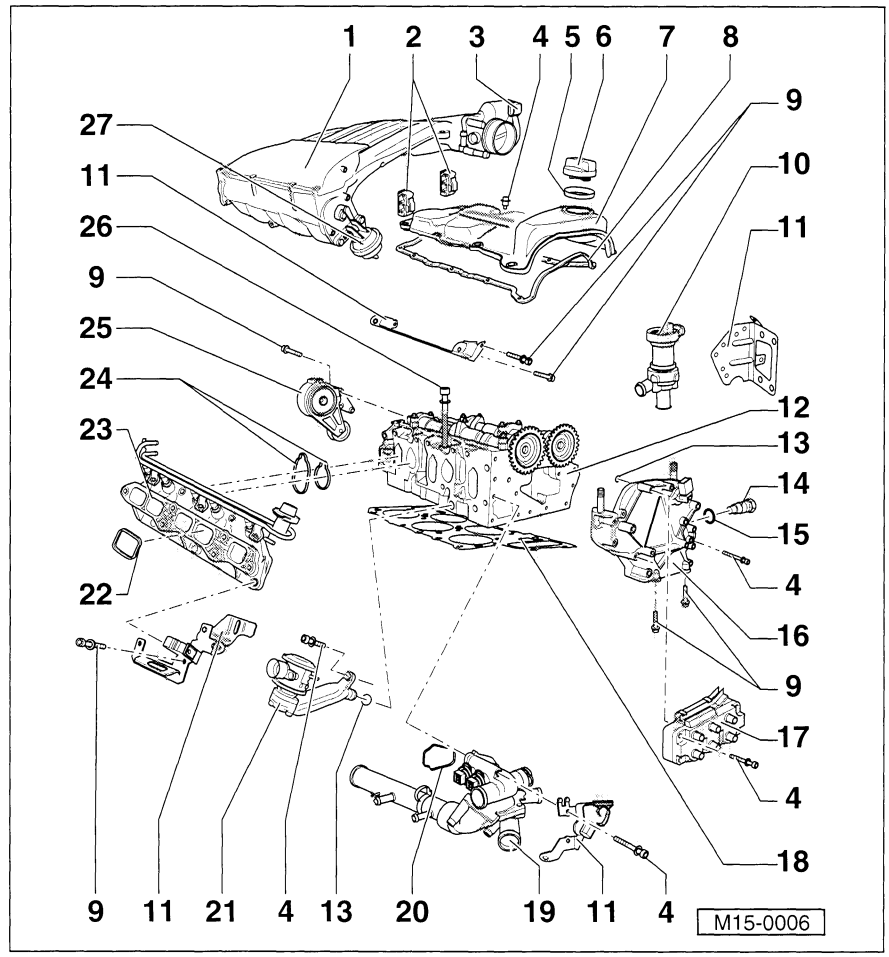
The most conclusive diagnosis of low compression symptoms requires a cylinder leak-down test. Using a special tester and a supply of compressed air, each cylinder is pressurized. The rate at which the air leaks out of the cylinder, as well as the sound and location of the escaping air can more accurately pinpoint the magnitude and source of leakage. Any engine compression diagnosis that will require major disassembly should first be confirmed by a cylinder leak-down test. Because this test requires special equipment and experience, it may be desirable to have it performed by a Volkswagen dealer or other qualified repair shop. Leakdown limit specifications are usually supplied by the equipment manufacturer.

CYLINDER HEAD SERVICE (AFP ENGINE)

Many cylinder head repairs can be accomplished without removing the cylinder head from the engine. The cylinder head cover (valve cover) gasket, camshaft, camshaft oil seal, valve guide oil seals, valve springs and cam followers are all accessible with cylinder head installed.

NOTE —
Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*

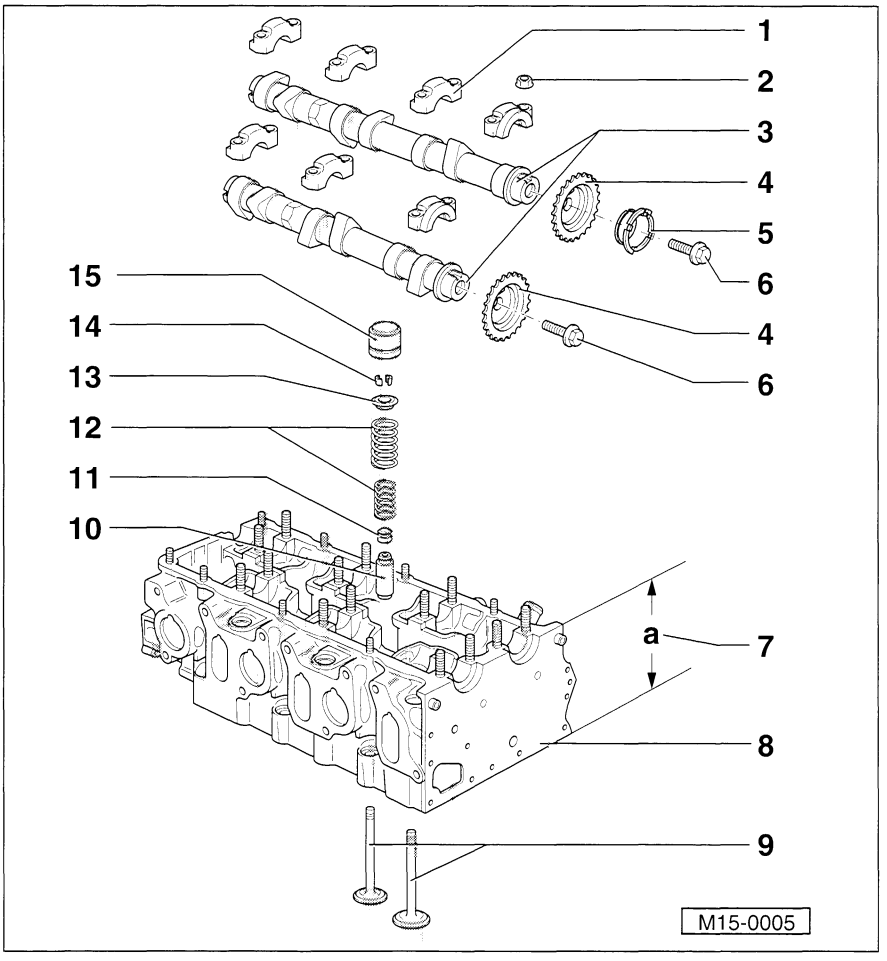
External cylinder head assembly



1. **Intake manifold, upper section**
   - Plastic construction
   - With performance port and rotary valve
   - During installation, always tighten lower section first, and then tighten at both supports
2. **Retainer, fuel lines**
3. **Throttle valve control module (J338)**
   - Electronically controlled (drive-by-wire)
   - Heated by engine coolant
   - With throttle drive (G186)
   - With Angle Sensor 1 for throttle drive (G187)
   - With Angle Sensor 2 for throttle drive (G188)
4. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
5. **Gasket, oil filler cap**
6. **Cap, oil filler**
7. **Cylinder head (valve) cover**
   - Apply D 454 300 A3 to recesses and corners before installing
8. **Gasket, cylinder head (valve) cover**
   - Replace if damaged
9. **Bolt**
   - Tighten to 25 Nm (18 ft-lb)
10. **Auxiliary coolant pump (V51)**
11. **Auxiliary coolant pump mounting bracket**
12. **Cylinder head**
    - Replace engine coolant if removing head
13. **O-ring**
    - Always replace
14. **Chain tensioner, upper**
    - Tighten to 40 Nm (30 ft-lb)
    - Turn engine only with chain tensioner installed
15. **Seal**
    - Always replace
16. **Cover, camshaft sprocket**
    - Can be removed and installed with cylinder head installed
    - Coat sealing surfaces with AMV 188 001 02
    - If only cover is removed, seal gasket prior to installation, see **Cylinder head gasket, sealing**
17. **Ignition coil pack (N152)**
18. **Cylinder head gasket**
    - Always replace
    - Metal construction
19. **Thermostat housing**
20. **Seal**
    - Always replace
21. **Combi valve**
    - For secondary air injection system
22. **Seal, upper/lower intake manifold**
    - Replace if damaged
23. **Intake manifold, lower section**
    - Plastic construction
24. **Seals, manifold/cylinder head**
    - Replace if damaged
25. **Tensioner, ribbed V-belt**
26. **Cylinder head bolt**
    - Quantity 20, 3 different lengths
    - Stretch bolts, always replace
    - Observe loosening and tightening sequence
27. **Vacuum actuator, rotary valve**

Internal cylinder head assembly (AFP ENGINE)

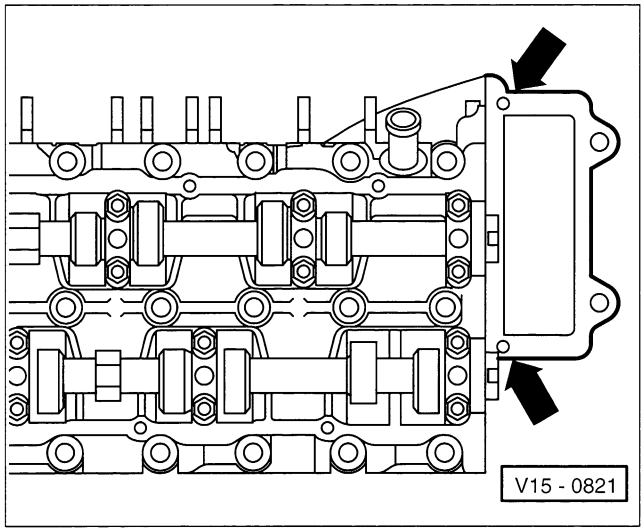
NOTE —
Special alignment tool 3268 is required for most AFP cylinder head work. This tool is used to accurately set the camshafts at TDC. This plastic tool is relatively inexpensive and should always be used any time camshaft drive chains are removed from camshaft sprockets.



1. **Bearing cap**
   - Note installation position and sequence
2. **Nut**
   - Tighten to 20 Nm (15 ft-lb)
3. **Camshafts**
   - Radial clearance checked with Plastigage®
     wear limit: 0.10 mm (0.004 in)
   - Run out: maximum 0.01 mm (0.0004 in)
4. **Camshaft chain sprockets**
5. **Shutter (pickup) wheel**
   - For camshaft position sensor
   - Note installation position
   - Contact area between camshaft sprocket and shutter wheel must be clean and dry at installation
6. **Camshaft chain sprocket bolts**
   - Tighten to 100 Nm (74 ft-lb)
   - Note 24 mm hex on camshaft to lock
   - Do not use plastic alignment tool 3268 to lock
   - Lightly oil bolt head contact surface before installing
7. **Cylinder head height**
   - Dimension **a**: minimum 139.5 mm (5.492 in.)
8. **Cylinder head**
9. **Valves**
   - Do not rework! Only lapping is permitted
10. **Valve guide**
11. **Valve stem seal**
12. **Valve springs**
    - Inner and outer
13. **Valve spring retainer**
14. **Valve keepers (cotters)**
15. **Hydraulic lifter**
    - Do not interchange
    - Equipped with hydraulic clearance compensation
    - Store with cam contact surface facing downwards
    - Oil contact surfaces

Cylinder head gasket, sealing

If the upper drive chain cover has been removed new sealant will need to be applied to cylinder head gasket surface.



➢ Remove old sealant from the 3 mm bores in the cylinder head gasket and flange (**arrows**).

- Bores may be only partially visible.
- Apply new sealant to 3 mm bores in the cylinder head gasket and to upper drive chain cover and flange.

NOTE —
Use Volkswagen sealant AMV 188 001 02 for all operations requiring sealant.

Cylinder head (valve) cover, removing and installing

– With ignition off, disconnect battery ground strap.

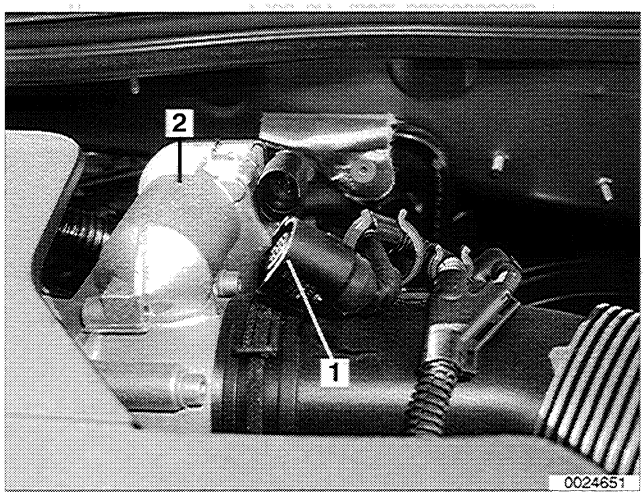
– Unplug spark plug wires from spark plugs with Volkswagen special tool T10029 or equivalent.

NOTE —
Volkswagen special tool T10029 is required to remove and install spark plug connectors without damaging the wires or wire seals.

– Unclip spark plug wires from guides.

– Remove upper sound absorber panel.

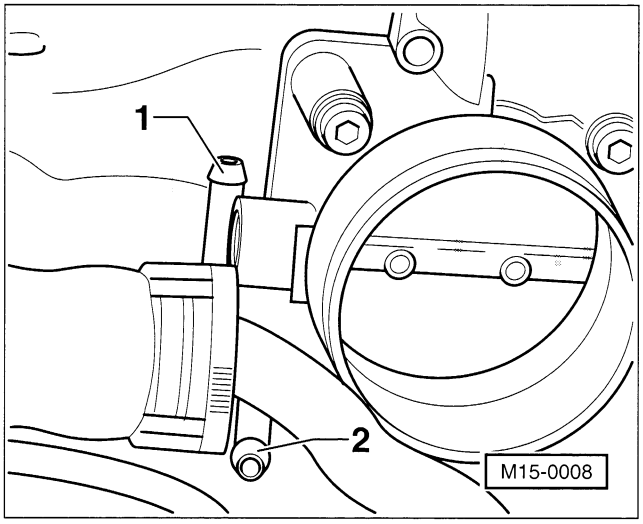
– Disconnect 2-pin harness connector from crankcase vent heating element on intake hose between mass air flow sensor and throttle valve control module. Remove intake hose.



➢ Disconnect the 6-pin harness connector (**1**) from the throttle valve control module (**2**).

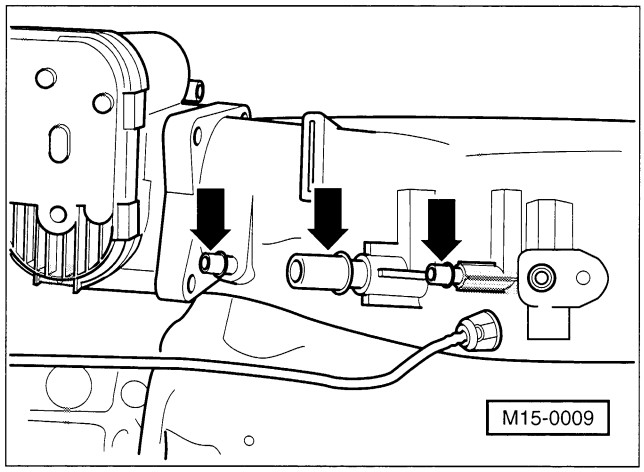
– Unbolt ground connection at throttle valve control module.

– Loosen coolant expansion tank cap to release pressure and re-tighten.



➤ Loosen hose clamps (**1** and **2**) and remove coolant hoses from throttle valve control module. Plug hose ends.

– Unclip fuel lines from guides at cylinder head cover.



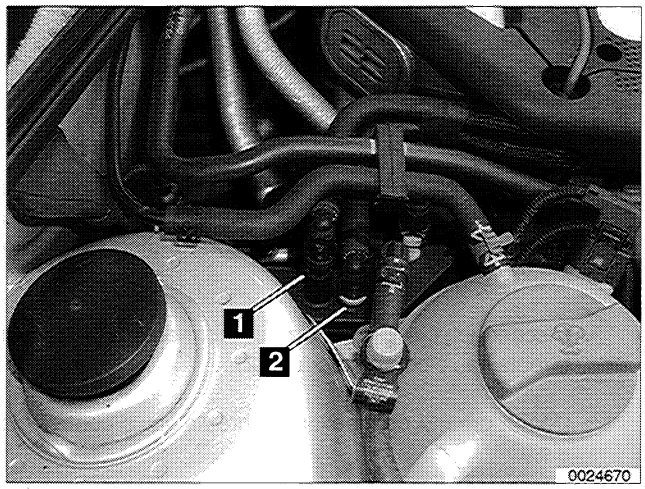
➤ Label and disconnect vacuum connections (**arrows**) on upper section of intake manifold.

– Unclip secondary air pump inlet hose and remaining lines from guides on upper section of intake manifold.

– Unbolt dipstick tube from upper section of intake manifold.

– Remove intake manifold support bolts from upper intake manifold section.

– Label and disconnect vacuum connections on rotary valve actuator.



➤ Disconnect fuel line from fuel pump, marked white (**1**) and fuel return line, marked blue (**2**) at fuel rail. Press coupling tabs together to disconnect.

> ***WARNING —***
> *Fuel will be expelled when disconnecting fuel hoses. Wrap a cloth around the fuel line fittings before disconnecting them. Do not smoke or work near heaters or other fire hazards. Have a fire extinguisher handy.*

– Seal off disconnected fuel and vacuum hoses lines to prevent contamination.

– Remove lower sound absorber panels (belly pan).

– Remove front bumper cover and move lock carrier to service position, see **50 Body–Front.**

– Remove ribbed V-belt.

– Remove retaining clamps from A/C refrigerant lines. Remove A/C compressor with refrigerant lines still attached, see **87 Air Conditioning**.

NOTE —
To prevent damage to condenser and to refrigerant lines/hoses, ensure that lines and hoses are not stretched, kinked or bent.

– Remove secondary air injection system combi valve.

– Remove bolts securing upper intake manifold to lower intake manifold.

– Remove upper intake manifold and lay aside taking care to avoid damage to rotary valve actuator.

– Cover open intake runners using clean shop rags or duct tape.

– Remove nuts from perimeter of cylinder head cover and lift off cylinder head cover and gasket.

– Installation is reverse of removal noting the following additional points:

- Use new gaskets where appropriate.
- Tighten upper intake manifold to lower intake manifold before tightening upper intake manifold support bolts.
- Refill with new coolant as required.
- Ensure that fuel line couplers are securely attached.

– Quality check your repair work, see **Quality Review** at the end of this repair group.

Tightening Torques

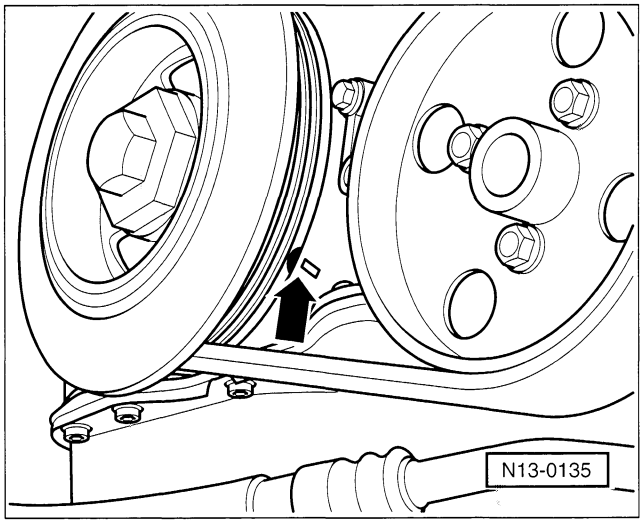
- Cylinder head cover to cylinder head 10 Nm (7 ft-lb)
- Upper intake manifold to lower intake manifold . . . . . 25 Nm (18 ft-lb)
- Upper intake manifold to supports . . 25 Nm (18 ft-lb)

Camshafts, removing

The camshafts can be removed with cylinder head installed. Removing camshafts allows access to hydraulic cam followers, valve springs, and valve stem oil seals.

NOTE —
Volkswagen special tool 3268, camshaft ruler, is specified for setting valve timing during camshaft installation. The tool is relatively inexpensive and highly recommended.

– With ignition off, disconnect battery ground strap.



➤ Using a socket wrench on crankshaft vibration damper center bolt, rotate engine clockwise by hand to set #1 cylinder at Top Dead Center (TDC).

- Timing mark on crankshaft vibration damper aligned (**arrow**) with marker on front engine cover.

– Remove ignition coil pack. See **28 Ignition System**.

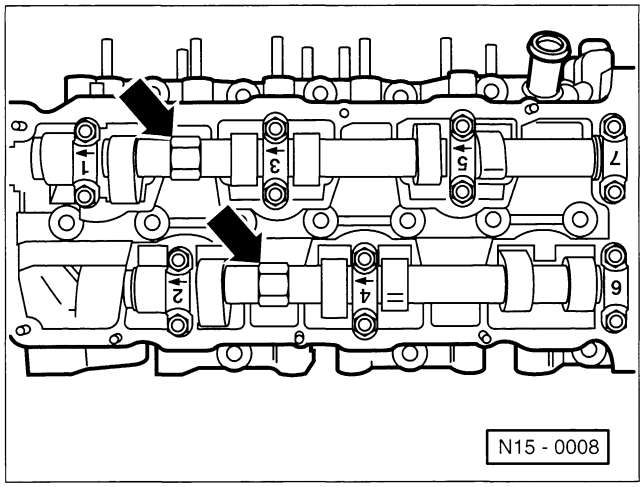
– Remove cylinder head (valve) cover as given earlier.

– Remove upper drive chain tensioner from camshaft sprocket cover.

– Disconnect 3-pin harness connector from camshaft position sensor.

– Remove camshaft sprocket cover from cylinder head together with camshaft position sensor.

NOTE —
*When removing cover, note the two M8 socket-head bolts threaded **up** through the lower cover.*



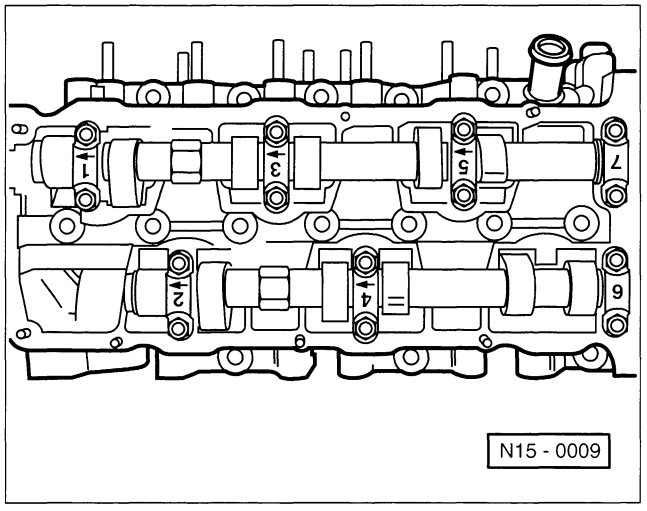
➤ Loosen camshaft sprocket bolts:

- Hold camshaft with 24 mm open end wrench on flat area (**arrow**) cast between camshaft lobes.
- Camshaft ruler 3268 will break if in place on end of camshaft.
- End of camshaft can be broken if metal holder is used while loosening sprocket bolts.

CAUTION —
Do not rotate the engine once the camshafts chains are removed from the camshafts. The pistons may contact the open valves.

– Remove sprockets from camshafts along with camshaft position sensor shutter wheel on exhaust side camshaft.

– Tie the double camshaft chain up using stiff wire.



➢ Remove the rear camshaft (exhaust side) for cylinders 1, 3, and 5, as follows:

- Remove bearing caps 1 and 7.
- Loosen nuts on caps 3 and 5 alternately and evenly, a little at a time so that valve spring tension is relieved evenly.
- When all tension is relieved, remove caps.
- Lift out camshaft and lay aside.

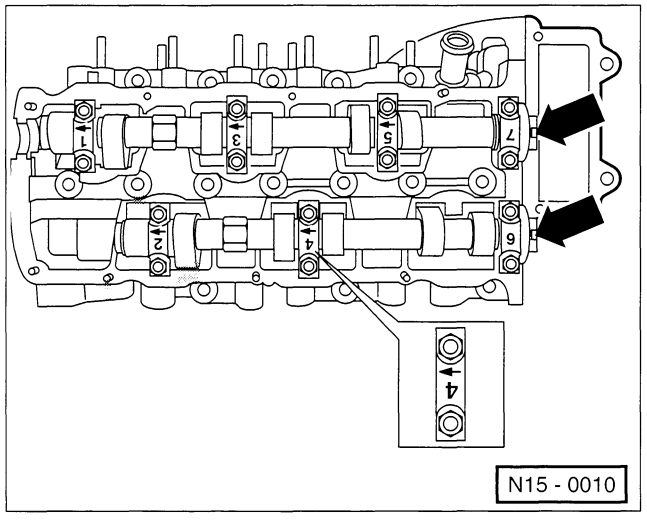
– Remove the front camshaft (intake side) for cylinders 2, 4, and 6, as follows:

- Remove bearing cap 4.
- Loosen nuts on caps 2 and 6 alternately and evenly, a little at a time so that valve spring tension is relieved evenly.
- When all tension is relieved, remove caps.
- Lift out camshaft and lay aside.

NOTE —

Once removed, camshafts should be checked for wear and other visible damage as described later under **Cylinder Head Components.**

Camshafts, installing



➢ Lubricate contact surfaces of camshafts and then install them into cylinder head so that camshaft sprocket alignment recesses are at facing up (**arrows**).

- Numbers must be readable from exhaust side and arrows must point towards vibration dampener end of engine (**inset**).

– Check that cylinder #1 is at Top Dead Center (TDC) as shown earlier.

NOTE —

- *To avoid uneven and accelerated wear, bearing caps must be reinstalled in their exact original positions.*
- *During installation, the numbers on camshaft bearing caps must be readable from exhaust side and arrows point toward vibration damper end (front) of engine.*

– Install bearing caps 3 and 5 onto exhaust side camshaft.

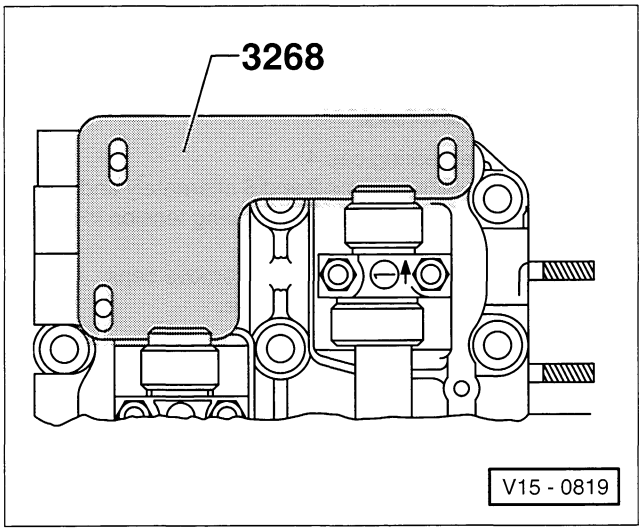
- Tighten nuts on caps 3 and 5 alternately and evenly, a little at a time so that valve spring is tensioned evenly and camshaft is drawn down fully into bearing saddle. Torque to specification.
- Install bearing caps 1 and 7. Torque to specification.

– Install bearing caps 2 and 6 onto intake side camshaft.

- Tighten nuts on caps 2 and 6 alternately and evenly, a little at a time so that valve spring is tensioned evenly and camshaft is drawn down fully into bearing saddle. Torque to specification.
- Install bearing cap 4. Torque to specification.

Tightening torque

- Camshaft bearing caps to cylinder head . . . . . 20 Nm (15 ft-lb)



– Clean camshaft sprocket cover at sealing surfaces and at cylinder head.

– Clean sealant from 3 mm bores in cylinder head gasket as shown earlier.

➤ Position camshafts so that special tool 3268 fits into slots in the end of the camshafts. Install 3268 fully into the cut-outs.

– Mount camshaft sprocket to shorter camshaft (cylinders 2, 4, and 6). Install mounting bolt hand-tight. Install chain to sprocket so that there is no slack between intermediate shaft sprocket and cam sprocket.

– Install the remaining sprocket into chain and onto camshaft so that all chain slack is at tensioner side of chain. Install mounting bolt together with camshaft position sensor shutter wheel. Hand tighten bolt.

CAUTION —
The mating surfaces between the camshaft position sensor wheel and the camshaft sprocket must be dry and free of oil before tightening the center bolt.

– Remove camshaft alignment tool from rear of camshafts.

– Tighten camshaft sprocket mounting bolts. Counterhold camshaft when torquing bolt as shown earlier.

CAUTION —
Do not tighten the camshaft bolts with the plastic alignment tool installed. It is easily broken.

Tightening torque
- Camshaft sprockets to camshaft (with bolt contact surface oiled) . . . . 100 Nm (74 ft-lb)

– Fill 3 mm bores in cylinder head gasket with sealant.

– Apply sealant to camshaft sprocket cover.

– Install new O-ring into camshaft sprocket cover insuring proper seating and install cover.

CAUTION —
Be sure to install a new O-ring in the rear of the camshaft sprocket cover. Lightly oil O-ring and install it into cover before installation.

– Install all camshaft sprocket cover bolts hand tight. Torque M8 bolts to specification first, torque M6 bolts last.

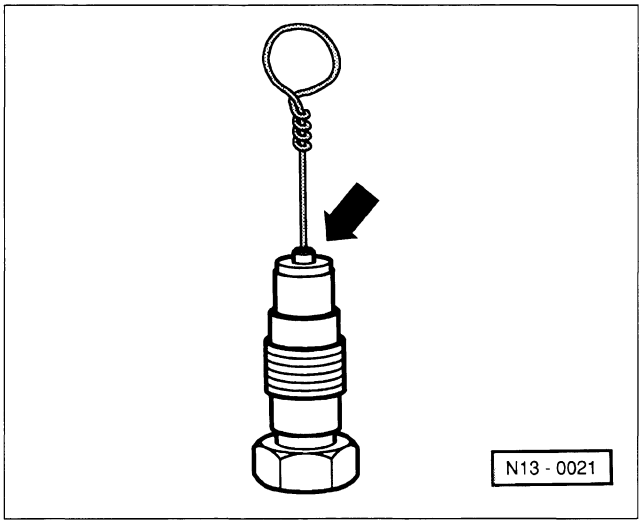
Tightening torques

- Camshaft sprocket cover to cylinder head or lower drive chain cover
  - M6 . . . . . 10 Nm (89 in-lb)
  - M8 . . . . . 25 Nm (18 ft-lb)
- Upper camshaft chain tensioner to camshaft sprocket cover . . . . . 30 Nm (22 ft-lb)

– Install upper chain tensioner using a new seal.

NOTE —

If the tensioner was taken apart, or if the piston has expanded out, it must be bled down. Use a thin wire through opening in tensioner piston. Push wire into piston while applying light pressure. When piston check valve opens, tensioner will collapse.



➤ Bleed tensioner by inserting thin wire (approximately 0.80 mm) into piston hole (**arrow**). Apply pressure to tensioner piston while pushing on wire. When piston check valve opens, piston will move into tensioner body.

– Turn the engine over by hand in normal engine rotation direction two full revolutions and realign the timing marks shown earlier.

– Install Volkswagen tool 3268 to the camshafts. If cam timing is setup correctly, the tool will slide smoothly into camshaft cutouts.

– Install cylinder head (valve) cover.

– Remainder of installation is reverse of removal noting the following additional points:

- Use new gaskets where appropriate.
- Tighten upper intake manifold to lower intake manifold before tightening upper intake manifold support bolts.
- Refill coolant as required.
- Ensure that fuel line couplers are securely attached.

– Quality check your repair work, see **Quality Review** at the end of this repair group.

CAUTION —

If new hydraulic cam followers were installed, the engine must not be run for at least 30 minutes. New cam followers are at a maximum height and should be allowed to bleed down or the valve heads could contact the pistons on start up.

Hydraulic cam followers

The AFP VR6 engine is equipped with hydraulic cam followers also known as valve lifters that automatically maintain proper valve clearance. The cam followers are pumped up by engine oil pressure, expanding as necessary to fill the gap between the valve and the camshaft lobe. This occurs continuously and automatically to keep the valve in proper adjustment at all times.

Some valve noise at start-up is normal at times, due to hydraulic cam followers that have bled down while engine was not running. Before checking noisy cam followers, check to see that engine oil is new and clean and that the level is correct. Allow 2 minutes with a warm engine running at a fast idle for the lubrication system to properly pump up cam followers.

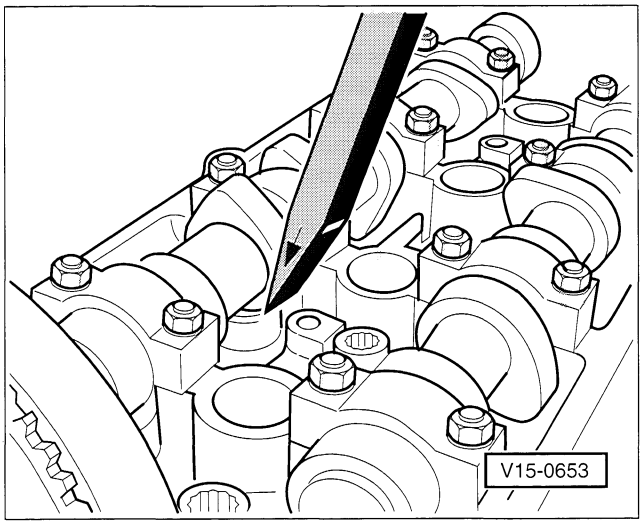
Cam followers should only be checked when engine is warm. Run engine until radiator fan has switched on at least one time. Increase engine speed to 2,500 rpm and hold it there for approximately 2 minutes. If hydraulic cam followers are still noisy, shut engine off and proceed as follows while engine is still warm.

Hydraulic cam followers, checking

– Remove cylinder head (valve) cover. See **Cylinder head (valve) cover, removing and installing**, given earlier.

– Turn engine by hand in the running direction until all camshaft lobes of cylinder #1 are pointing approximately up.

NOTE —
Hydraulic cam follower clearance can be checked on any cam follower (lifter) that is not being depressed by the camshaft lobe.



➤ Use a plastic wedge and lightly push down on the hydraulic cam follower. Use a feeler gauge to check clearance between cam follower and cam lobe on cylinder #1:

- Insert a 0.20 mm (0.008 in.) feeler gauge between camshaft lobe and follower. If clearance exceeds 0.20 mm (0.008 in.) replace follower.
- If clearance is less, or if no clearance is present, lightly depress cam follower with a wooden or plastic wedge and insert a feeler gauge between camshaft lobe and follower. If clearance exceeds 0.20 mm (0.008 in.), the lifter is faulty and should be replaced.

Specification

- Hydraulic cam follower maximum clearance (2.8L AFP engine) . . . . . 0.20 mm (0.008 in.)

– Turn engine by hand and repeat procedure until all cam followers have been checked.

– Replace a faulty cam follower by removing camshaft as previously described and pulling the follower from cylinder head. Faulty hydraulic cam followers can be replaced individually but only as a complete assembly.

> ***CAUTION —***
> *After installing new cam followers, the engine should not be started for at least 30 minutes. New cam followers are usually at full extended height and must be allowed to bleed down to their proper height once installed. Failure to do so may cause the valves to strike the pistons resulting in serious damage.*

> ***NOTE —***
> *Store hydraulic cam followers in order on a clean surface with camshaft contact surface facing down to minimize bleed down. Cover with a clean lint-free shop cloth.*

Valve stem oil seals, replacing

The sign of faulty valve stem seals is excessive oil consumption and oil smoke from the exhaust. This is usually most noticeable during periods of high manifold vacuum such as deceleration. If compression and leak-down testing confirm the integrity of the piston rings, but the engine consumes oil, it is possible that faulty valve stem seals are present. It should also be noted that worn valve stem seals could be due to worn valve guides and that worn valve guides are a major cause of oil consumption. See **Cylinder Head Components** for more information on checking valve guides.

Replacing valve stem oil seals requires removal of camshaft, cam followers, and valve springs. This can be done with cylinder head installed or removed. In either case, numerous Volkswagen special tools are required to compress the valve springs and remove and install seals.

Working with cylinder head installed:

– Remove cylinder head (valve) cover, camshafts, and hydraulic cam followers as described earlier.

– Remove spark plugs.

– Set engine to bottom dead center (BDC) for cylinder 1 by turning crankshaft.

– Apply a continuous supply of compressed air with a minimum of 6 bar (87 psi) into first spark plug hole with an adapter (VW special tool 653/3 shown below). This will hold valves in place while springs are removed.

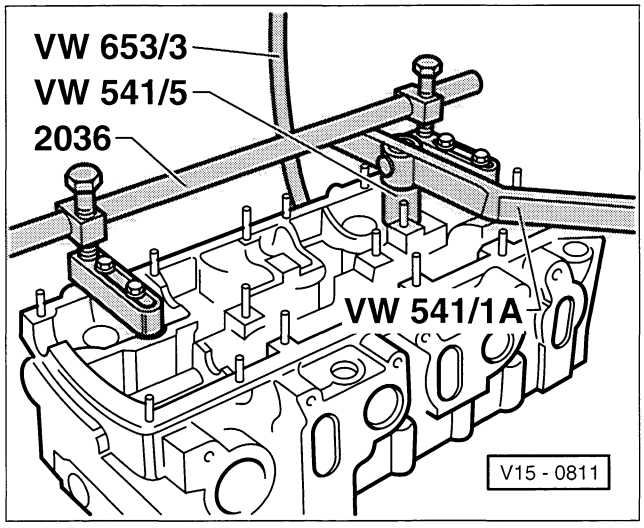
> ***CAUTION —***
> *Compressed air supply must be able to maintain at least 6 bar (87 psi) during this repair. If air supply is interrupted while valve spring is removed, valve will fall into cylinder and may require cylinder head removal to retrieve.*

Working with cylinder head removed:

– Secure cylinder head to workbench. Use care to avoid damage to head gasket surfaces.

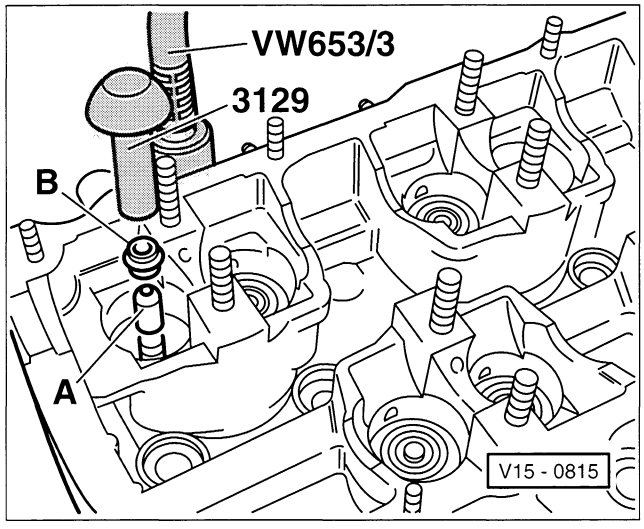
– Remove camshaft and hydraulic cam followers as described earlier.

Working with cylinder head removed or installed:



➢ Install appropriate valve spring compressor tools. Compress the spring for the first cylinder and remove spring retainer, both keepers, and valve spring. If spring will not compress, lightly tap tool to release stuck keepers. Use a small magnet to retrieve keepers.

– Remove valve stem seals with Volkswagen special slide hammer tool 3047A.



➢ Begin installation of new seal by temporarily fitting a protective plastic fitting sleeve (**A**) over the valve stem. This sleeve is usually included with new seal set and will prevent damage to the seal due to the sharp edges of the keeper grooves. Lubricate new valve seal (**B**) with clean engine oil and fit it to installation tool (**3129**).

– Push the installation tool (with new seal) down over valve stem until seal is fully seated on the guide. Remove tool and protective plastic fitting sleeve.

– Reinstall valve spring, retainer and keepers.

– Repeat for the second valve on the cylinder.

– When all valve seals have been replaced on the first cylinder, transfer compressed air adapter (if working with cylinder head installed) to the next cylinder and repeat the process until all valve seals have been replaced.

– Remaining installation is the reverse of removal.

> ***CAUTION —***
> *To prevent cylinder head or camshaft damage, be sure to follow camshaft installation procedure exactly when tightening the camshaft bearing caps. See* **Camshaft, removing and installing**.

Tightening torque

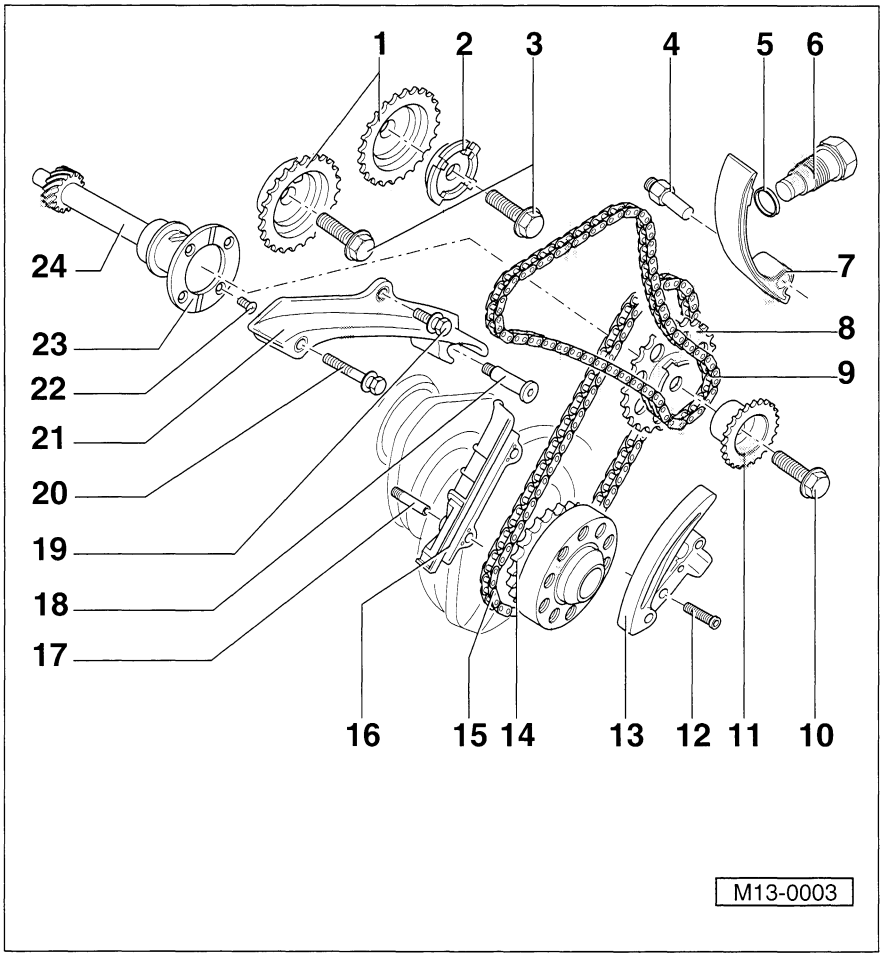
• Spark plug to cylinder head . . . . . 25 Nm (18 ft-lb)

– Be sure to quality check your work, see **Quality Review** at the end of this repair group.

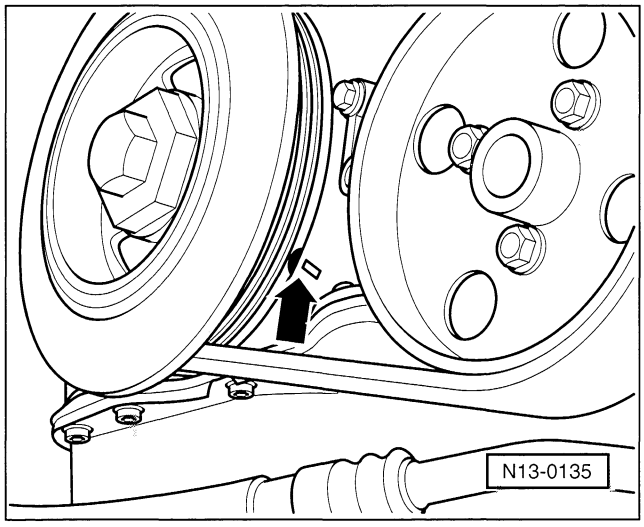
CAMSHAFT DRIVE CHAINS (AFP ENGINE)

NOTE —
Removal and installation of the camshaft drive chains requires that the transaxle be separated from the engine.

Camshaft drive chains, assembly



1. **Camshaft sprockets**
2. **Shutter wheel**
   - For camshaft position sensor
   - Note installation position
   - Contact area between camshaft sprocket and shutter wheel must be clean and dry at installation
3. **Bolts, camshaft chain sprocket**
   - Tighten to 100 Nm (74 ft-lb)
   - Note 24 mm hex on camshaft to lock
   - Do not use plastic alignment tool 3268 to lock
   - Lightly oil bolt head contact surface before installing
4. **Tensioner guide pivot pin**
   - Tighten to 18 Nm (13 ft-lb)
5. **Seal**
   - Always replace
6. **Chain tensioner, upper**
   - Turn engine only with chain tensioner installed
   - Bleed before installing as required
   - Tighten to 40 Nm (30 ft-lb)
7. **Tension bar**
8. **Intermediate shaft sprocket, inner, (lower chain)**
9. **Camshaft drive chain, upper**
   - Mark rotation direction before removal
10. **Bolt, intermediate shaft chain sprockets**
    - Tighten to 100 Nm (74 ft-lb)
    - Counter-hold with 3406 on vibration dampener to loosen and tighten bolt
11. **Intermediate shaft sprocket, outer, (upper chain)**
12. **Bolt**
    - Tighten to 10 Nm (89 in-lb)
13. **Chain tensioner assembly, lower**
    - Turn engine only with chain tensioner installed
    - Compress and lock ratchet mechanism with small screwdriver in locking hole before installing
    - After installing release the locking device in the chain tensioner and press the tensioning bar against the chain tensioner
14. **Crankshaft with integral chain sprocket**
    - Beveled (ground) tooth used as TDC timing mark when aligned with bearing cap joint
15. **Camshaft drive chain, lower (single row)**
    - Mark rotation direction before removal
16. **Guide rail, lower chain**
17. **Locating pin, guide rail (without collar)**
    - Tighten to 10 Nm (7 ft-lb)
18. **Locating pin, upper guide rail (with collar)**
    - Tighten to 10 Nm (7 ft-lb)
19. **Bolt**
    - Install using locking fluid "D6" or equivalent
    - Tighten to 20 Nm (15 ft-lb)
20. **Bolt**
    - Tighten to 20 Nm (15 ft-lb)
21. **Guide rail, upper chain**
22. **Screw**
    - Install using locking fluid "D6" or equivalent
    - Tighten to 10 Nm (7 ft-lb)
23. **Thrust washer**
    - Secures intermediate shaft
24. **Intermediate shaft**
    - Drives engine oil pump shaft



Valve timing, checking

– Remove lower sound absorber panels (belly pan).

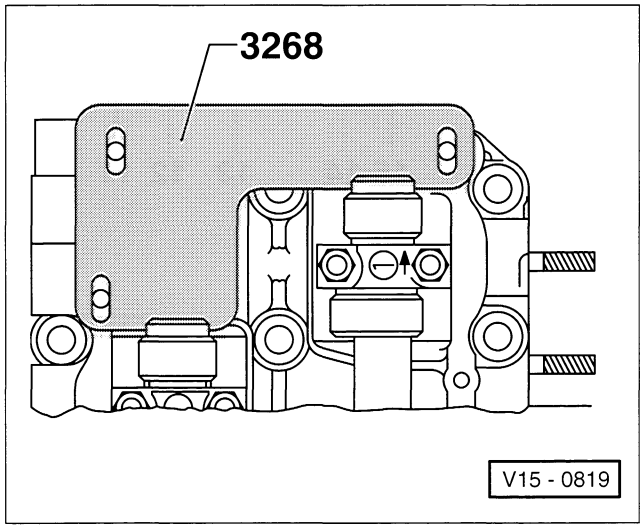
➤ Using a socket wrench on crankshaft vibration damper center bolt, rotate engine clockwise by hand to set the #1 cylinder at Top Dead Center (TDC).

- Align timing mark on crankshaft vibration damper with marker on front engine cover (**arrow**).

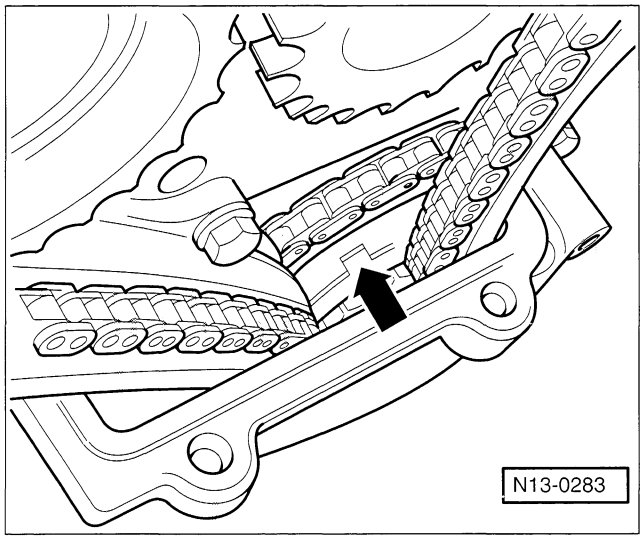
– Remove the cylinder head (valve) cover as given earlier.

– Remove upper drive chain tensioner from camshaft sprocket cover.

– Remove camshaft sprocket cover together with camshaft position sensor.



➤ Position camshafts so that Volkswagen special tool 3268 fits into slots in the rear end of camshafts. Install 3268 fully into cutouts.



➤ When marks on vibration damper align and camshaft ruler can be fully inserted in camshafts, it will be possible to see a slot (**arrow**) on the intermediate shaft sprockets. This indicates that the valve timing is correct.

– If valve timing is correct, reinstall all removed components.

– If valve timing is not correct, proceed with the following steps:

- Remove camshaft sprockets as described earlier in **Camshafts, removing**.
- Rotate camshaft until special tool 3268 fits into slots in rear of camshaft as shown above
- Install camshaft drive sprockets.

Camshaft drive chains, removing

– Depending on the nature of the repair work to be done, proceed with one of the following:
  - Remove engine and transaxle from vehicle and separate transaxle from engine. See **10 Engine, Removing and Installing**.
  - Remove transaxle from engine. With this method, engine remains in vehicle. See **34 Manual Transmission,** or **37 Automatic Transmission** for transmission removal and installation.

– Using a socket wrench on crankshaft vibration damper center bolt, rotate engine clockwise by hand to set the number 1 cylinder at Top Dead Center (TDC) as shown earlier.

– Remove cylinder head (valve) cover as given earlier.

– Remove upper drive chain tensioner from camshaft sprocket cover.

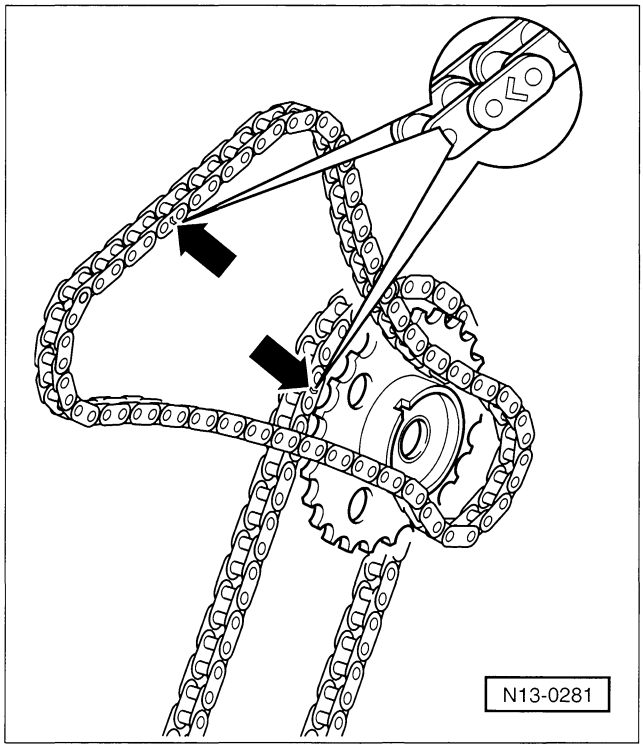
– Remove camshaft sprocket cover together with camshaft position sensor.

NOTE —
When removing cover, note the two M8 socket-head bolts threaded up through the lower cover and the small O-ring on the rear of cover.

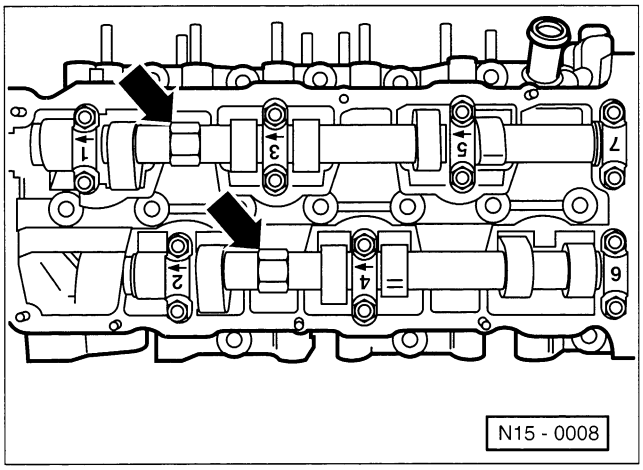
– Remove flywheel or driveplate. Discard mounting bolts. See **13 Crankshaft/Cylinder Block**.

– Remove lower drive chain cover from cylinder block and oil pan.

CAUTION —
Use care when removing the lower cover from the oil pan gasket and the cylinder head gasket. If the gaskets are damaged, they will need to be replaced.



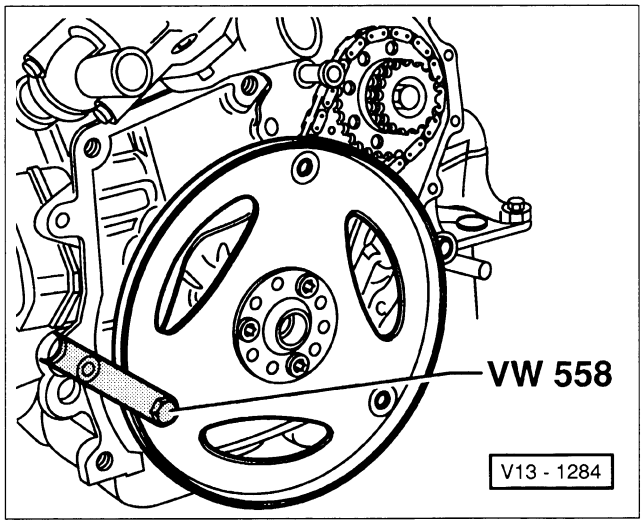
➤ Mark engine rotation direction on drive chains (**arrows**).



➢ Loosen camshaft sprocket bolts:

- Hold camshaft only with 24 mm open end wrench on flat area (**arrows**) cast between camshaft lobes.
- Camshaft alignment ruler 3268 will break if in place on end of camshaft while loosening sprocket bolts.
- End of camshaft can be broken if metal holder is used to loosen sprocket bolts.

– Remove both camshaft sprockets and upper camshaft drive chain.



➢ Temporarily install flywheel or driveplate using three old mounting bolts. Lock flywheel or driveplate using a holding tool (**VW 558** shown).

NOTE —
Special tool 3406 can also be used on the vibration damper to lock crankshaft.

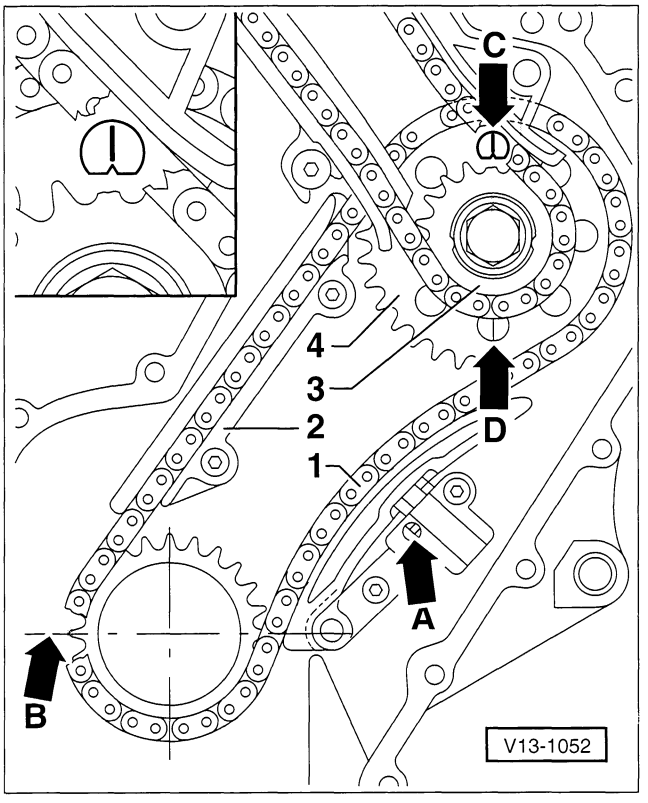
– With crankshaft locked, remove intermediate shaft sprocket mounting bolt.

– Remove lower drive chain tensioner.

– Remove intermediate shaft sprockets together with lower drive chain and lower guide rail.

– Remove flywheel or driveplate.

– Inspect tensioner assemblies and chain guides for wear or damage. Replace any worn or damaged parts.



Camshaft drive chains, installing

Adjust position of crankshaft relative to intermediate shaft. To position: Align ground-down tooth of drive chain sprocket on crankshaft (**B**) with main bearing cap joint to set TDC for cylinder 1.

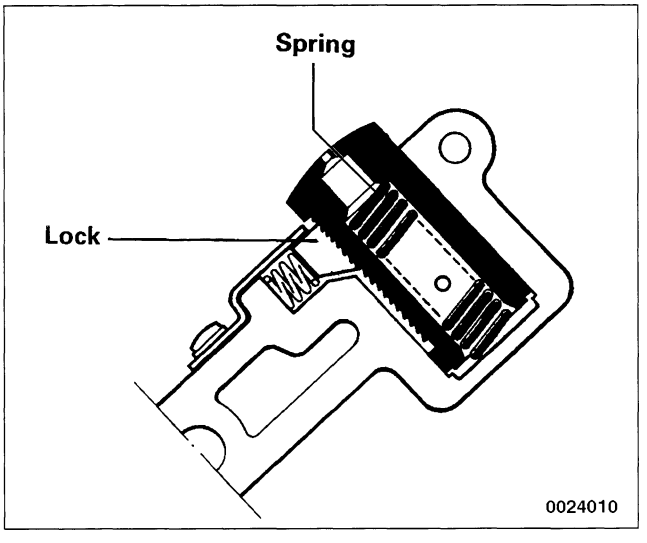
1. Camshaft drive chain, lower (single row)
2. Guide rail, lower chain
3. Intermediate shaft sprocket, outer
4. Intermediate shaft sprocket, inner

- Install both bolts without collar for guide rail (**2**) and tighten to 10 Nm (7 ft-lb).
- Install guide rail (**2**) with lower camshaft drive chain (**1**) and both chain sprockets (**3**) and (**4**).
- Marking on sprocket (**4**) for roller chain must align with notch (**C**) or (**D**) on thrust washer of intermediate shaft.
- During installation make sure that the roller chain runs completely straight in the guide plate from the crankshaft to the intermediate shaft.

NOTE —
Make sure all chain slack is on the tensioner side of chain and that sprocket positions have not been altered. Make sure intermediate shaft sprockets correctly engage shaft.

- Use small screwdriver to release tensioner ratchet lock at **A**. See below for more detail on this step.
- Tighten chain sprockets (**3**) and (**4**) on the intermediate shaft by hand.

Tightening torque
- Lower guide rail locating pin (w/o collar) to engine block . . . . . 10 Nm (7 ft-lb)



Compress lower chain tensioner and install.

- Use small screwdriver or similar tool to release drive chain tensioner ratchet lock while pushing on tension bar. Wedge tool against lock to prevent movement during installation.
- Install tensioner in compressed condition.
- Ensure that all chain slack is on the tensioner side and that chain is still properly aligned.
- Remove tool to release tension bar.

Tightening torque
- Lower chain tensioner to cylinder block . . . . . 10 Nm (7 ft-lb)

– Temporarily install flywheel or driveplate using three of the old bolts. Lock flywheel or driveplate using a holding tool as shown earlier.

– Tighten intermediate shaft sprocket mounting bolt. Recheck sprocket timing marks.

Tightening torque

- Intermediate shaft sprockets to intermediate shaft . . . . . 100 Nm (74 ft-lb)

– Position camshafts so that Volkswagen special tool 3268 fits into slots in the end of the camshafts. Install 3268 fully into the cutouts as shown earlier.

– If previously removed, install tensioner guide pivot pin and upper guide rail locating pin. Place upper guide rail into position and install the two mounting bolts. Place chain tensioner guide into position on pivot pin.

CAUTION —
Use care when working near the cylinder head gasket. If the gasket is damaged, it should be replaced.

NOTE —
Use Volkswagen locking fluid "D6" or equivalent on the shorter mounting bolt of the upper guide rail.

Tightening torques

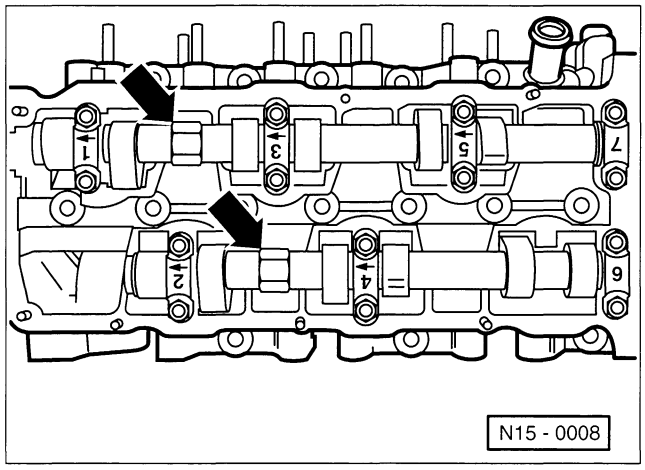
- Tensioner guide pivot pin to engine block . . . . . 18 Nm (13 ft-lb)
- Upper guide rail to engine block locating pin (with collar) . . . . . 10 Nm (7 ft-lb)
- Upper guide rail to cylinder head (D6 locking fluid on shorter bolt) . . . 25 Nm (18 ft-lb)

– Install the double-row chain onto the intermediate shaft sprocket, noting rotation direction marks made earlier.

– Mount camshaft sprocket to the shorter camshaft (cylinders 2, 4, and 6). Install mounting bolt hand-tight. Install chain to sprocket so that there is no slack between intermediate shaft sprocket and cam sprocket.

– Install remaining sprocket into the chain and onto the camshaft so that all chain slack is at tensioner side of chain. Install mounting bolt together with camshaft position sensor shutter wheel. Hand tighten bolt.

CAUTION —
The mating surfaces between the camshaft position sensor wheel and the camshaft sprocket must be dry and free of oil before tightening the center bolt.



➤ Remove camshaft alignment ruler 3268 from rear of camshafts. Counterhold camshafts with 24mm open end wrench at points for this purpose (**arrows**).

> ***CAUTION —***
> *Do not tighten the camshaft bolts with the camshaft alignment ruler 3268 installed. It is easily broken.*

Tightening torque

- Camshaft sprockets to camshaft (with bolt contact surface oiled) . . . . 100 Nm (74 ft-lb)

– Carefully clean off any old sealer from both sides of head gasket.

– Remove the temporarily installed flywheel or driveplate.

– Apply sealant to lower drive chain cover sealing surfaces including head gasket contact surface.

> ***CAUTION —***
> *Use care not to damage the crankshaft seal when installing the lower cover. Coat the seal with a light coat of engine oil before installing cover.*

Tightening torque

- Lower drive chain cover to engine block or oil pan (M6) . . . . . 10 Nm (7 ft-lb)

– Fill 3 mm bores in cylinder head gasket with sealant.

– Apply sealant to camshaft sprocket cover.

– Install new O-ring into camshaft sprocket cover insuring proper seating and install cover.

> ***CAUTION —***
> *Be sure to install a new O-ring to the rear of the cover. Lightly oil O-ring and install it into cover before installation.*

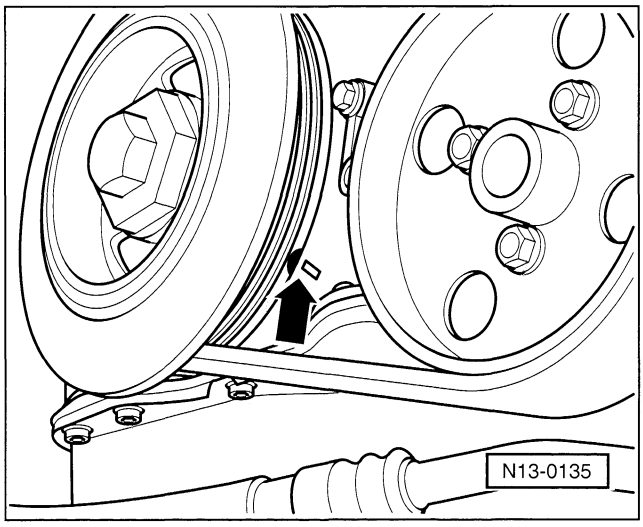
– Install all camshaft sprocket cover bolts hand tight. Torque M8 bolts to specification first, torque M6 bolts last.

Tightening torques

- Camshaft sprocket cover to cylinder head or lower drive chain cover
  M6 . . . . . 10 Nm (89 in-lb)
  M8 . . . . . 25 Nm (18 ft-lb)
- Upper camshaft chain tensioner to camshaft sprocket cover . . . . . 30 Nm (22 ft-lb)

– Install upper chain tensioner using a new seal.

NOTE —
If the tensioner was taken apart, or if the piston has expanded out, it must be bled down. Use a thin wire through the opening in the tensioner piston. Push the wire into the piston while apply light pressure. When the piston check valve opens, the tensioner will collapse.



➤ Turn the engine over by hand in normal engine rotation direction two full revolutions and realign the timing marks (**arrow**).

– Install Volkswagen tool 3268 to the camshafts. If the chains are setup correctly, tool will slide smoothly into camshaft cutouts.

CAUTION —
Do not run the engine if VW special tool no. 3268 does not fit into the camshaft cutouts—the chain assembly may not be installed correctly. If only very minor readjustment of the camshafts allows the tool to slide into place, the assembly is probably setup correctly. If any problems are encountered, reinstall the chains from the beginning of this procedure.

– Install cylinder head (valve) cover.

– Remainder of installation is reverse of removal noting the following additional points:

- Use new gaskets where appropriate.
- Tighten upper intake manifold to lower intake manifold before tightening upper intake manifold support bolts.
- Refill coolant as required.
- Use new mounting bolts on flywheel or driveplate.
- Ensure that fuel line couplers are securely attached.

– Depending on the repair, finish as follows:

- Attach engine and transaxle and install into vehicle. See **10 Engine, Removing and Installing**.
- Attach transaxle to engine that remained in vehicle and complete repair. See **34 Manual Transmission,** or **37 Automatic Transmission** for transmission installation.

– Quality check your repair work, see **Quality Review** at the end of this repair group.

Tightening torques

- Flywheel or driveplate to crankshaft (stretch bolts–**always replace**)
  stage I . . . . . 60 Nm (44 ft-lb)
  stage II . . . . . additional 1/4 turn (90°)

CYLINDER HEAD, REMOVING AND INSTALLING (AFP ENGINE)

The cylinder head can be removed and installed with engine in vehicle. Internal and external cylinder head assembly views given earlier, show views of the 2.8L cylinder head and related components. Note that the cylinder head bolts are stretch type fasteners and should never be reused. In addition, whenever the cylinder head or the cylinder head gasket is replaced, the coolant must also be replaced, see **19 Engine–Cooling System**.

If a failed head gasket or warped head is suspected, a compression test, as described earlier under **Diagnostic Testing,** may aid diagnosis and should be performed before the cylinder head is removed. A failed head gasket may be caused by a warped cylinder head. When replacing a failed head gasket, always check the cylinder head for straightness. See **Cylinder Head Components.**

Cylinder head, removing

WARNING —
Do not start work on a hot engine. Allow to cool sufficiently before proceeding. Engine temperature must be no hotter than warm to the touch. Cylinder head warpage can result due to uneven cooling rates.

NOTE —

- *Volkswagen special tool 3268, camshaft ruler, is specified for setting valve timing during camshaft installation. The tool is relatively inexpensive and highly recommended.*
- *It is advisable to read the entire procedure through before beginning the job.*
- *Disconnecting the battery cables will erase fault codes and basic settings in the engine management and automatic transmission control unit memories. Some driveability problems may be noticeable until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. See* **24b Fuel Injection – Motronic (2.8L engine)** *for additional information. In most instances proper diagnosis will require the use of a scan tool such as the Volkswagen supplied VAG 1551 or 1552. See* ***ST Scan Tool*** *at the back of this manual.*
- *Cylinder head will be removed with the exhaust manifold and the lower intake manifold still attached.*

– With ignition switched off, disconnect battery negative terminal from the battery.

NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.

– Remove the cylinder head (valve) cover as given earlier.

– Remove lower sound absorber panels (belly pan).

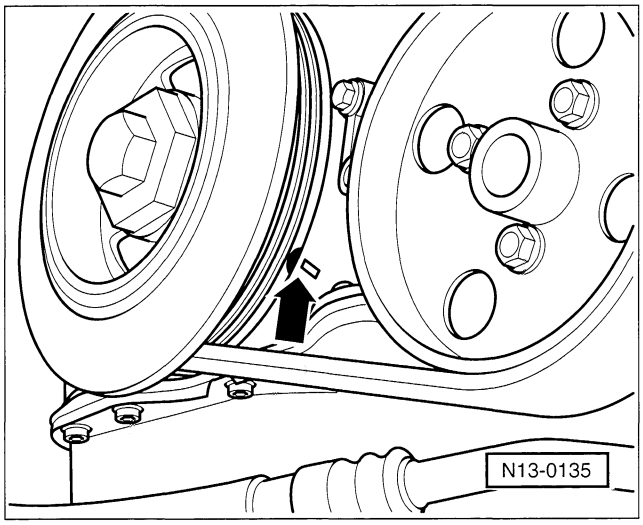
– Drain engine coolant, see **19 Engine–Cooling System**.

– Disconnect all coolant hoses from outlets on cylinder head.

> ***WARNING —***
> *Hot coolant can scald. Drain coolant only with the engine cold.*

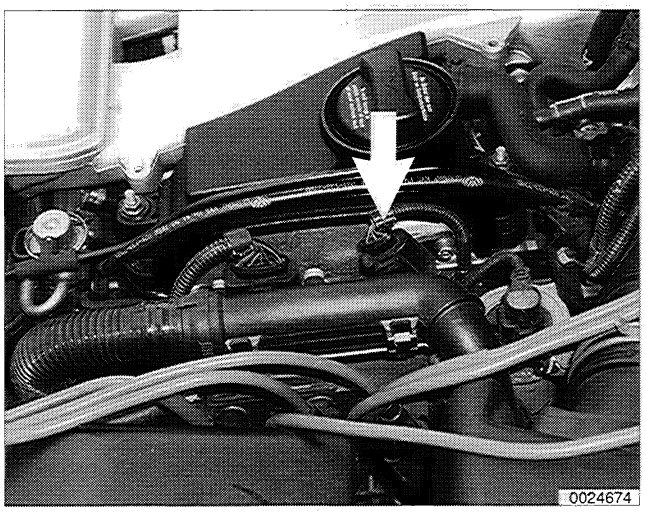
– Remove thermostat housing.

– Remove ignition coil pack and ground strap, see **28 Ignition System**.



➤ Use a socket wrench on crankshaft vibration damper center bolt to rotate engine clockwise by hand. Align timing mark on vibration damper with mark on front engine cover (**arrow**) to set #1 cylinder to Top Dead Center (TDC).

– Remove auxiliary coolant pump from mounting bracket with hoses remaining attached.

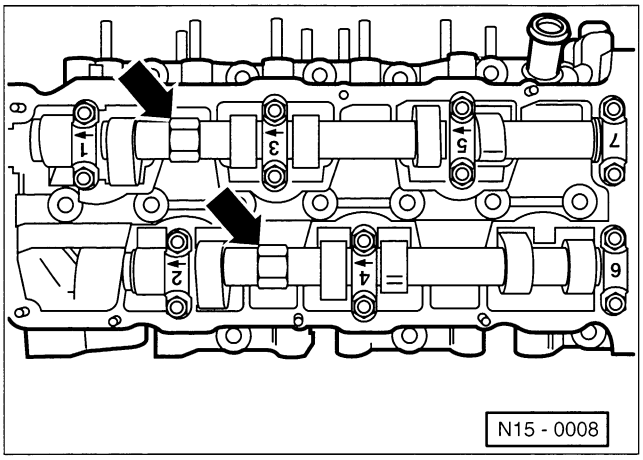


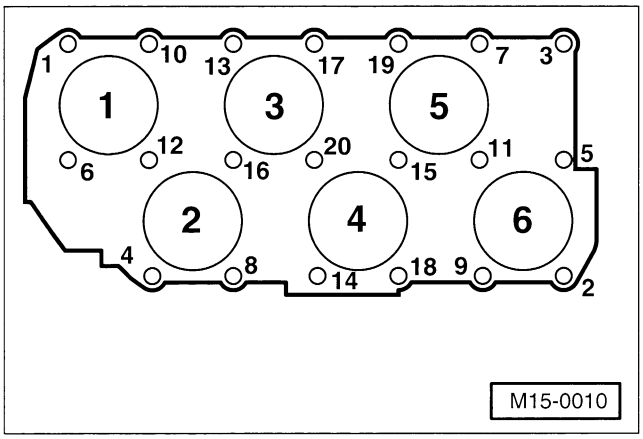
➤ Disconnect 3-pin camshaft position sensor harness connector (**arrow**), but leave sensor installed.

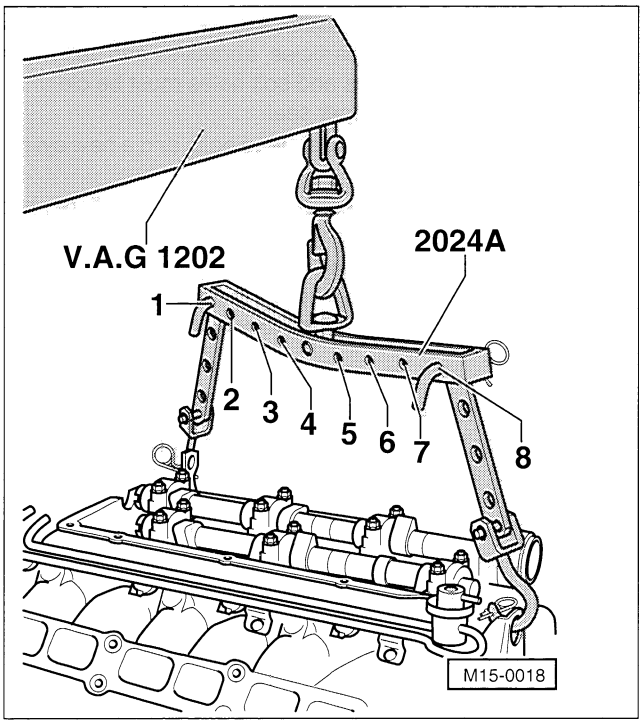
– Remove upper drive chain tensioner from camshaft sprocket cover.

– Remove camshaft sprocket cover together with camshaft position sensor.

> ***NOTE —***
> *When removing the cover, note the two M8 socket-head bolts threaded up through the lower cover and the small O-ring on the rear of the cover.*







➤ Loosen camshaft sprocket bolts:

- Hold camshaft only with 24 mm open end wrench on flat area (**arrows**) cast between camshaft lobes.
- Camshaft alignment ruler 3268 will break if in place on end of camshaft while loosening sprocket bolts.
- End of camshaft can be broken if metal holder is used to loosen sprocket bolts.

– Tie the double camshaft chain up using stiff wire.

– Remove sprockets from camshafts along with camshaft position sensor shutter wheel on exhaust side camshaft.

– Remove both upper double camshaft drive chain guide rail bolts and slide guide rail up off of fitted bolt.

– Disconnect exhaust pipes from exhaust manifolds, see **26 Exhaust System and Emission Controls**.

➤ Gradually and evenly loosen the 20 cylinder head bolts, following loosening sequence at left. Do not reuse head bolts.

NOTE —
Two of the old head bolts, with the hex heads removed, can be used as alignment dowels during cylinder head installation.

– Carefully lift off cylinder head and place in a clean area. Check to make sure no hoses or wires are interfering with removal. If head is stuck, use a soft-faced mallet or pry gently with a wooden stick.

CAUTION —
Some of the valves will be open. Use extra care when removing and handling to avoid damage. Place the cylinder head on the bench or table so that the weight of the cylinder head will not rest on the valves.

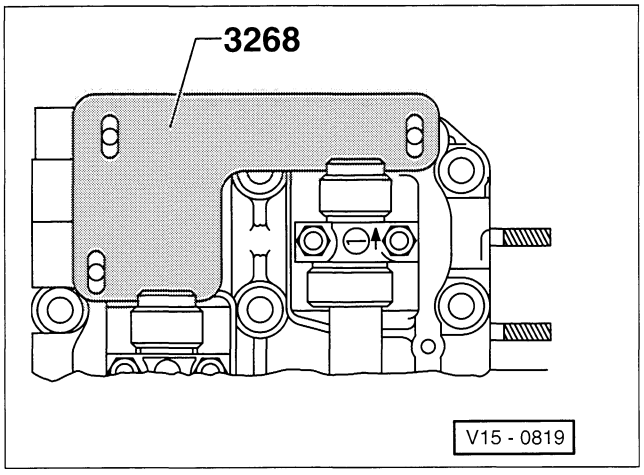
NOTE —
Cylinder head assembly is heavy. Use of a lifting device is strongly suggested to avoid personal injury and/or damage to cylinder head and vehicle.

➤ Cylinder head being lifted from engine using Volkswagen special tools.

Cylinder head, installing

Before proceeding with installation of cylinder head, whether an original or a new unit, observe the following important points:

- Check cylinder head and block for distortion and warpage, see **Cylinder Head Components**, given later in this section.
- Carefully clean cylinder block and cylinder head sealing surfaces being sure to avoid scratching them during cleaning process. Do not use metal scrapers or wire brushes.
- When using abrasive paper do not use any grades coarser than 100 grit (such as 80 grit). Lower numbers are coarser.
- If cylinder head will not be reinstalled immediately, take precautions to prevent rust from forming on cylinder block walls and gasket sealing surfaces.
- When cleaning old gasket material off of cylinder block, take precautions to keep old gasket material and abrasive particles and dirt out of the cooling and oiling system passages. Place a clean shop cloth over cylinders to prevent contamination from getting between cylinder wall and piston.
- Do not take new cylinder head gasket out of packaging until ready to use. Handle new gasket with extreme care as any damage will lead to leaks.
- There MUST NOT BE any oil or coolant in the head bolt holes in the cylinder block. Any fluids in the holes creates the danger of hydrolock while torquing which could lead to structural damage of cylinder block. Use thread chasers to remove foreign material as required. Be sure that all 20 bolt holes are clean and dry.
- When all traces of the old gasket material have been removed from cylinder block and head, carefully remove all traces of metal particles, abrasives and lint. All gasket sealing surfaces and bolt holes must be clean and dry to ensure a proper seal.
- Always use new cylinder head bolts and a new cylinder head gasket.
- Do not use any gasket sealer on the new cylinder head gasket except where specifically advised to do so.
- If installing a Volkswagen supplied replacement cylinder head, be sure to inspect for and remove any plastic packaging materials used to protect the head and open valves.



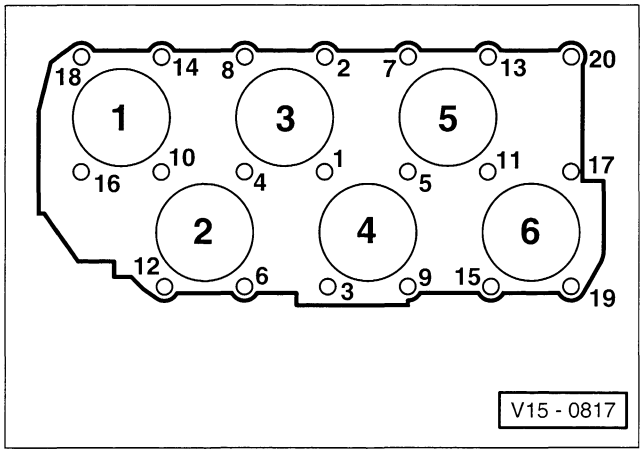
– Using a socket wrench on crankshaft vibration damper center bolt, rotate engine clockwise by hand to set the #1 cylinder at Top Dead Center (TDC) as shown earlier.

➤ Position camshafts so that Volkswagen special tool 3268, camshaft alignment ruler, fits into slots in the end of the camshafts. Install 3268 fully into the cutouts.

– Seal 3mm holes in head gasket with sealant, AMV 188 001 02.

– Install new cylinder head gasket onto block over the alignment dowels with numbers and letters facing up. Alignment dowels can be temporarily installed into bolt holes #12 and #20 during installation to help align head.

– Carefully install cylinder head onto block over the alignment dowels and screw in new head bolts. Tighten the bolts hand-tight only. Be sure that none of the wiring or any vacuum hoses are caught between cylinder head and block.



➤ Tighten the 20 cylinder head bolts in three stages following the tightening sequence shown at left.

CAUTION —
Always replace the cylinder head mounting bolts. They are stretch bolts designed to be used only once.

Tightening torque

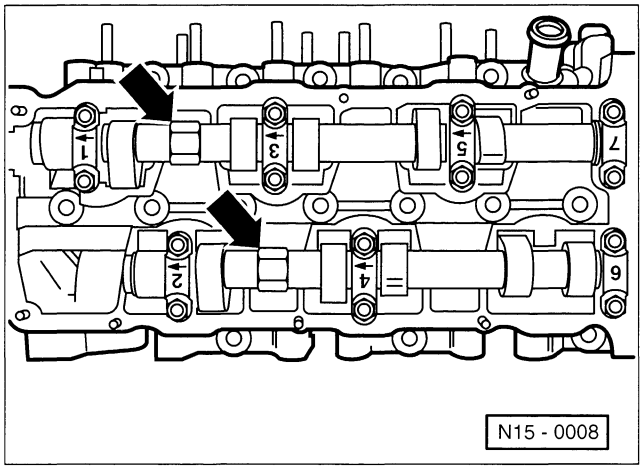
- Cylinder head to cylinder block, 2.8L engine (stretch bolts – always replace)
  stage I . . . . . 50 Nm (37 ft-lb)
  stage II . . . . . additional ¼ turn (90°)
  stage III . . . . . additional ¼ turn (90°)

– Install upper double camshaft drive chain guide rail.

– Mount camshaft sprocket to the shorter camshaft (cylinders 2, 4, and 6). Install mounting bolt hand-tight. Install chain to sprocket so that there is no slack between intermediate shaft sprocket and cam sprocket.

– Install remaining sprocket into chain and onto camshaft so that all chain slack is at tensioner side of chain. Install mounting bolt together with camshaft position sensor shutter wheel. Hand tighten the bolt.

CAUTION —
The mating surfaces between camshaft position sensor wheel and camshaft sprocket must be dry and free of oil before tightening center bolt.



➤ Remove camshaft alignment ruler 3268 from rear of camshafts. Counterhold camshafts with 24mm open end wrench at points for this purpose (**arrows**). Tighten camshaft sprocket mounting bolts to specification.

CAUTION —
Do not tighten the camshaft bolts with the plastic alignment tool installed. It is easily broken.

Tightening torque

- Camshaft sprockets to camshaft (with bolt contact surface oiled) . . . . 100 Nm (74 ft-lb)

– Apply sealant to camshaft sprocket cover.

– Install new O-ring into camshaft sprocket cover insuring proper seating and install cover.

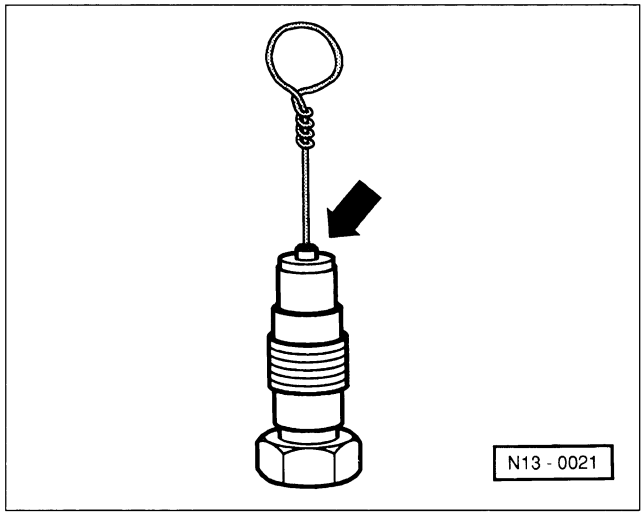
> ***CAUTION —***
> *Be sure to install a new O-ring to the rear of the cover. Lightly oil the O-ring and install it into cover before installation.*

– Install all camshaft sprocket cover bolts hand tight. Torque M8 bolts to specification first, torque M6 bolts last.

Tightening torques

- Camshaft sprocket cover to cylinder head or lower drive chain cover
  - M6 . . . . . 10 Nm (89 in-lb)
  - M8 . . . . . 25 Nm (18 ft-lb)
- Upper camshaft chain tensioner to camshaft sprocket cover . . . . . 30 Nm (22 ft-lb)

– Install upper chain tensioner using a new seal.



If the tensioner was taken apart, or if the piston has expanded out, it must be bled down. Use a thin wire (approximately 0.80 mm) through the opening (**arrow**) in tensioner piston. Push wire into piston while applying light pressure. When piston check valve opens, tensioner will move into tensioner body.

– Turn engine over by hand in normal engine rotation direction two full revolutions and realign timing marks on vibration damper and front engine cover as shown earlier, see **Valve timing, checking**.

– Install camshaft alignment ruler 3268 to end of camshafts. If cam timing is setup correctly, the tool will slide smoothly into camshaft cutouts.

– Install cylinder head (valve) cover.

– Remainder of installation is reverse of removal noting the following additional points:

- Use new gaskets where appropriate.
- Tighten upper intake manifold to lower intake manifold before tightening upper intake manifold support bolts.
- Refill coolant as required.
- Ensure that fuel line couplers are securely attached.

– Quality check your repair work, see **Quality Review** at the end of this repair group.

Tightening torques

- Cylinder head cover to cylinder head. 10 Nm (7 ft-lb)
- Ignition coil to camshaft sprocket cover. 10 Nm (7 ft-lb)
- Ribbed V-belt tensioner to cylinder block . . . . . 25 Nm (18 ft-lb)
- Cylinder head to cylinder block, 2.8L engine (stretch bolt - always replace)
  - stage I . . . . . 50 Nm (37 ft-lb)
  - stage II . . . . . additional ¼ turn (90°)
  - stage III . . . . . additional ¼ turn (90°)
- Front exhaust pipe/catalytic converter to exhaust manifold . . . . . 40 Nm (30 ft-lb)
- Coolant outlet flange to cylinder head . . . . . 10 Nm (7 ft-lb)
- Secondary air pump bracket to cylinder block. . . . . 25 Nm (18 ft-lb)
- Secondary air pump to support bracket . . . . . 10 Nm (7 ft-lb)
- Camshaft sprocket cover to cylinder head or lower drive chain cover
  - M6 . . . . . 10 Nm (89 in-lb)
  - M8 . . . . . 25 Nm (18 ft-lb)
- Upper camshaft chain tensioner to camshaft sprocket cover. . . . . 30 Nm (22 ft-lb)

CYLINDER HEAD COMPONENTS (AFP ENGINE)

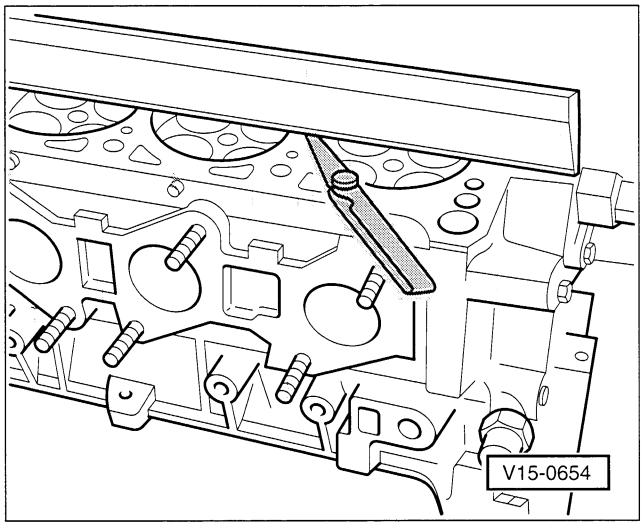
Cylinder head and camshafts

Cylinder heads with small, fine cracks between valve seats and plug threads are usable provided the cracks are not more than 0.5 mm (0.02 in.) wide, and do not extend into more than the first few spark plug threads. They will not reduce service life of the cylinder head.

If camshafts were removed or if installing a new or remanufactured cylinder head, lubricate the contact surfaces between cam lobes and hydraulic lifters prior to start-up.

When removing and installing the camshafts, follow the procedure given under **Camshafts, removing** and **Camshafts, installing.** Special procedures and special tools are required for camshaft removal and installation. Incorrect camshaft removal and/or installation will usually result in damaged camshafts, cylinder head or pistons. Always lubricate contact surfaces between cam lobes and hydraulic cam followers prior to start-up.

When replacing cylinder head or cylinder head gasket, always flush out all the old coolant and replace with new coolant. The will help ensure that any metal shavings and contaminants are removed from engine and cooling system. See **19 Engine–Cooling System** for draining and flushing procedures.



Check cylinder head for warpage and distortion with an accurate straight edge and feeler gauge.

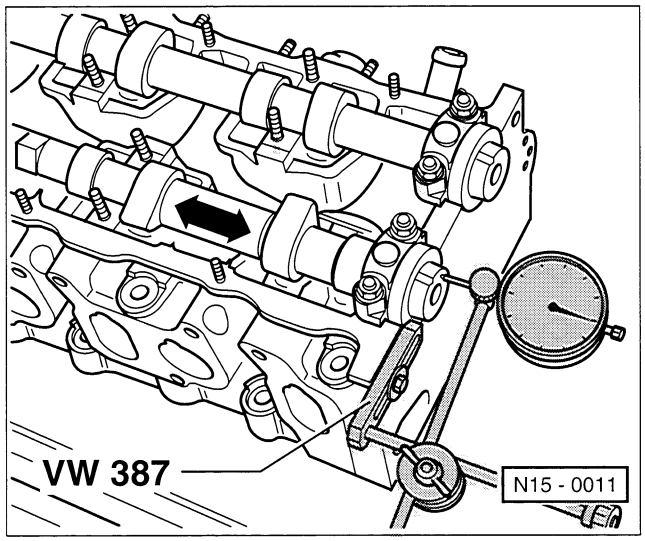
Specification

- Maximum cylinder head distortion/warpage . . . . . 0.1 mm (0.004 in.)
- Minimum cylinder dimension (valve cover gasket surface to head gasket surface) . . . . . 139.5 mm (5.49 in.)

The cylinder head can be resurfaced as long as the distance from cylinder head (valve) cover seating surface to the head gasket surface is never less than specified. Machining too much material off of the cylinder head surface will change the compression ratio and will affect engine emissions.

Camshafts and cam followers

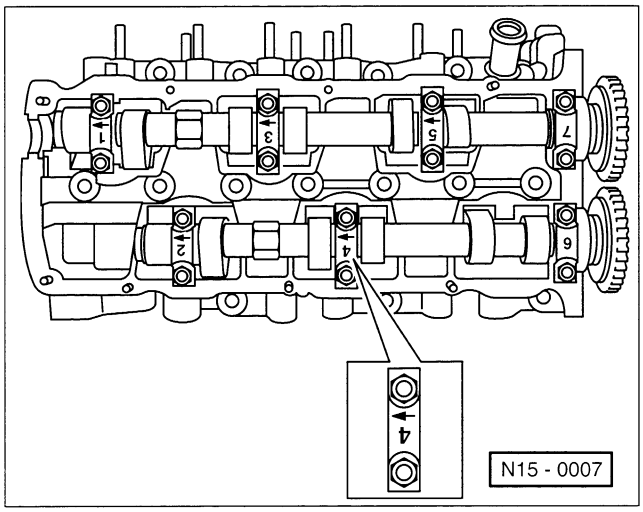
The in and out movement of the camshaft is known as axial play and is measured with the cam followers and drive chain removed and only the first and last bearing caps installed.



Use a dial gauge on the sprocket end of camshaft to check axial play by moving camshaft as far as it can go in each direction (**arrow**).

Specification

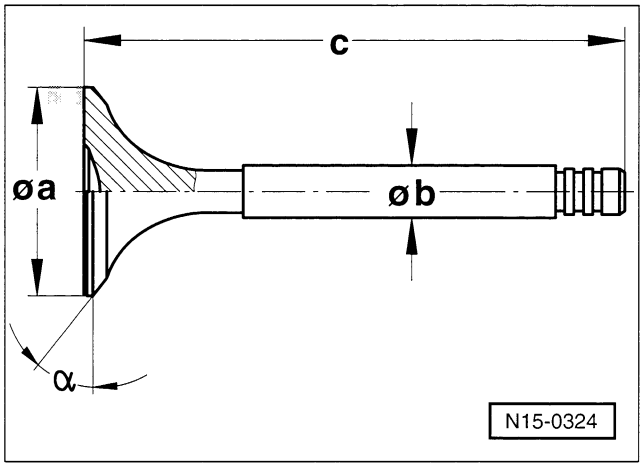
- Camshaft axial play . . . . . 0.15 mm(0.006 in.) max.



Do not interchange camshaft bearing caps or cam followers.

- **Arrows** on bearing caps face drive belt end of engine.
- Numbers should be readable from exhaust side of engine.

> ***CAUTION —***
> *After installing new cam followers, the engine should not be started for at least 30 minutes. New cam followers are at full height and must be allowed to bleed down to their proper height. Failure to do this may cause valve or piston damage.*



Valves

Exhaust valves in the 2.8L engine are sodium-filled. Intake and exhaust valves must be hand-lapped only. Valve and valve spring specifications are given in **Table a**. When using the table refer to illustration at left.

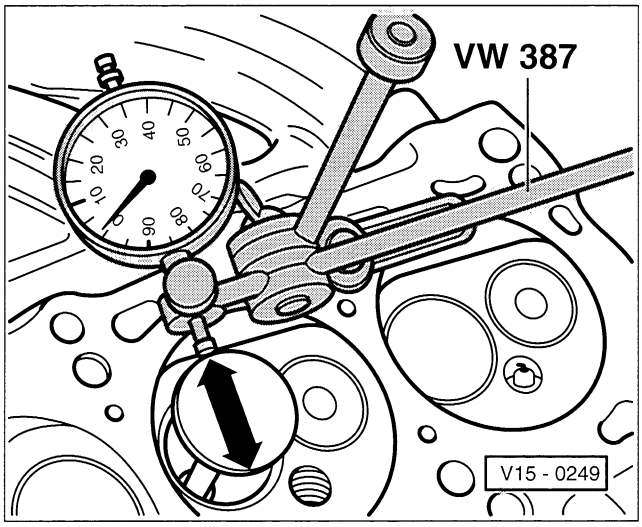
> ***WARNING —***
> *Sodium filled valves, when discarded, must be disposed of properly to avoid personal injury. Always wear protective goggles or glasses. By hand, cut off the valve stem near the head of each valve. Use only a hack saw. Do not use a power saw. Sodium reacts violently with water. Do not let water contact valve while cutting. Throw valve parts (no more than 10 valves at a time) into a bucket of water and stand clear. Discard valves when reaction has ceased.*

Table a. Valve Dimensions (AFP Engine)

Valve	Dimension
Valve head diameter (**a**)	
intake	39.00 mm (1.5354 in.)
exhaust	34.20 mm (1.3465 in.)
Valve stem diameter (**b**)	
intake	6.97 mm (0.2744 in.)
exhaust	6.95 mm (0.2736 in.)
Valve length (**c**)	
intake	105.95 mm (4.1713 in.)
exhaust	106.95 mm (4.2106 in.)
Valve face angle (α)	
intake	45°
exhaust	45°

Valve guides

Special tools and a press are required to replace valve guides. Inspect valve seats to ensure that cylinder head can be reconditioned before installing new valve guides.

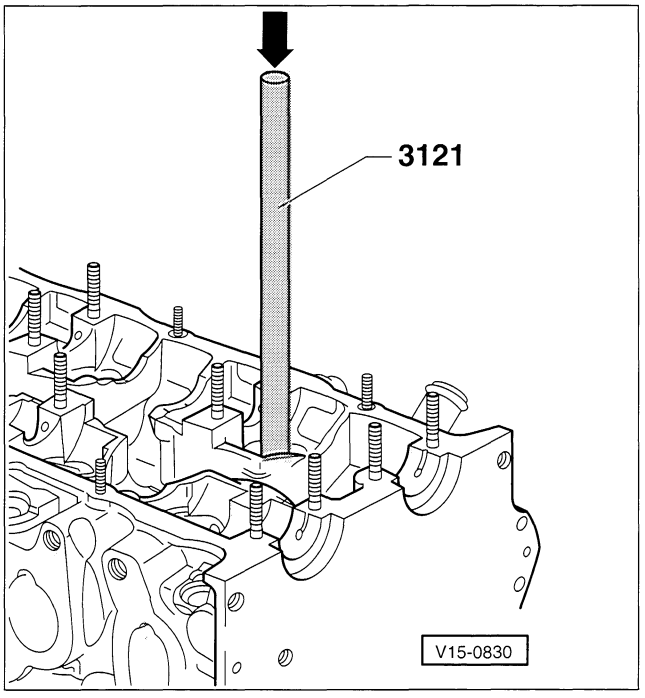


Check valve guide wear using new valve. Rock valve back and forth (**arrow**) to check total travel and compare to specification. Replace valve guides as necessary.

Specification

- Valve guide wear (with new valve)
  intake . . . . . 1.0 mm (0.039 in.)
  exhaust. . . . . 1.3 mm (0.051 in.)

> ***CAUTION —***
> *When checking valves guides, be sure to use an exhaust valve on the exhaust side and an intake valve on the intake side. Exhaust and intake valve stem diameters are slightly different. See **Table b**.*



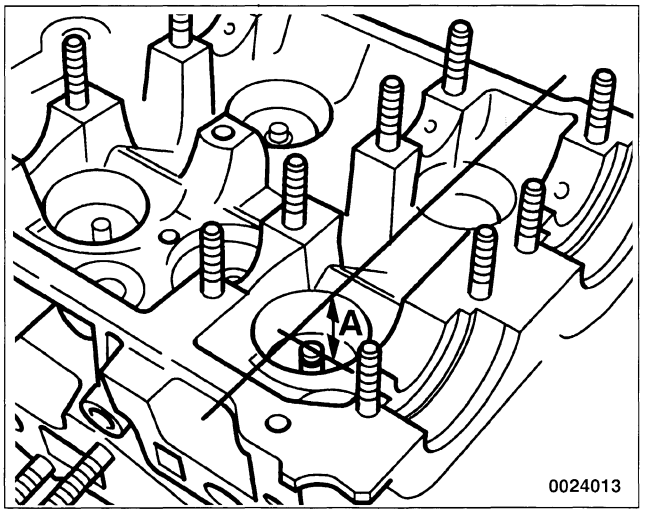
Original valve guides (without shoulders) are pressed out from the camshaft side of cylinder head. Cylinder heads with replacement valve guides (with shoulders) are considered unsuitable for further valve guide replacement.

➢ Lubricate new valve guides with oil and press them in from the camshaft side until the shoulder is fully seated.

- Press old valve guides out using Volkswagen special tool 3121. Use of other press tools may damage the cylinder head or valve guide.
- Cylinder head must be positioned flat during pressing operations.
- Do not seat shouldered valve guides with more than 1 ton of pressure. Shoulder can break off.
- Hand ream new valve guides using Volkswagen special tool 3120 and suitable reaming oil.

Valve seats

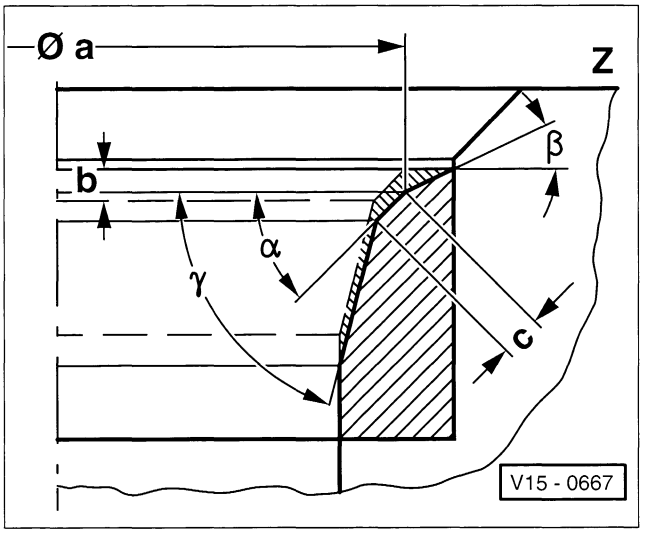
When resurfacing valve seats, there is a limit to the amount of material that can be removed. If too much material is removed, the final assembly will leave too little space for hydraulic cam follower to function correctly. The maximum refacing dimension, that is, the maximum amount of material that can be removed from the valve seat, is calculated as described below.



➢ Measure distance between top of valve stem and gasket surface of cylinder head (dimension **A**), and subtract minimum dimension, as given in **Table b**. The difference is the maximum amount of material that can be removed from valve seat.

Table b. Minimum Dimensions for Calculating Valve Seat Refacing Dimensions

Engine	Intake	Exhaust
2.8L (code: AFP)	33.9 (1.335 in.)	34.1 mm (1.343 in.)



Valve seat dimensions from illustration at left are given in table **Table c**.

Table c. Valve Seat Dimensions (AFP Engine)

	Intake	Exhaust
Seat diameter (**a**)	38.3 mm (1.508 in.)	33.5 mm (1.319 in.)
Maximum refacing dimension (**b**)	Calculated see above	Calculated see above
Seat width (**c**)	1.4-2.0 mm (0.055-0.079 in.)	2.0-2.5 mm (0.079-0.098 in.)
Valve seat angle (α)	45°	45°
Correction angle, upper (β)	30°	30°
Correction angle, lower (γ)	60°	73°

NOTE —

Z *in above graphic represents lower edge of cylinder head.*

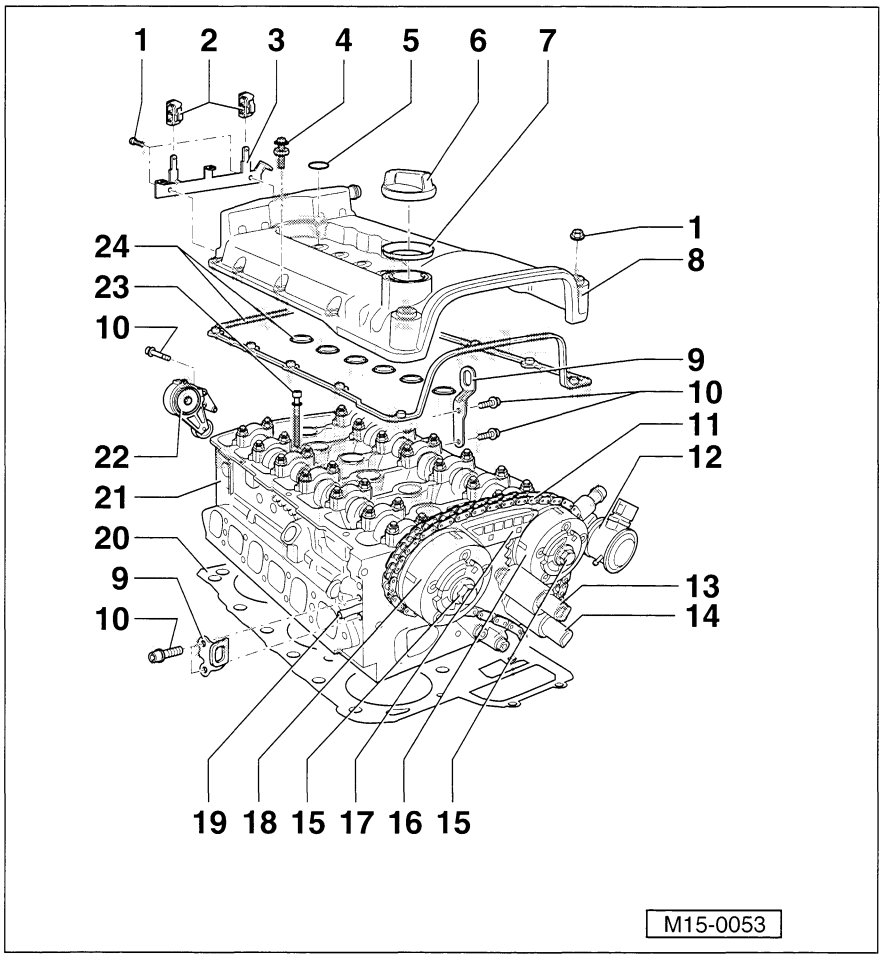
CYLINDER HEAD SERVICE (BDF ENGINE)

Many cylinder head repairs can be accomplished without removing the cylinder head from the engine. The cylinder head cover (valve cover) gasket, camshaft, camshaft oil seal, valve guide oil seals, valve springs and cam followers are all accessible with the cylinder head installed. This section describes repairs that can be done with cylinder head installed.

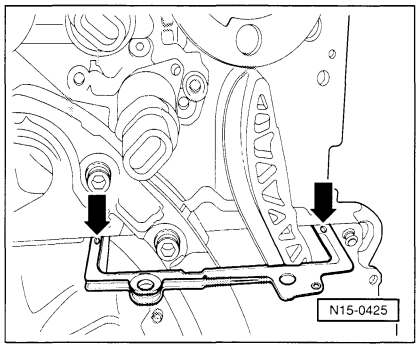
NOTE —

- *If replacing cylinder head, all contact surfaces between bearing elements, roller rocker fingers and cam running surfaces must be oiled.*
- *The plastic protectors installed in a new head to protect valves must only be removed immediately before installing cylinder head.*
- *When replacing cylinder head the entire quantity of coolant must be replaced.*
- *Replace all rubber seals, gaskets and O-rings that are damaged.*
- *Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See* **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*

External cylinder head assembly



1. **Bolt**
   - Tighten to 8 Nm (71 in-lb)
2. **Fuel line bracket**
3. **Supporting frame**
4. **Bolt**
   - Tighten to 8 Nm (71 in-lb)
   - With spacer sleeve and sealing ring (replace ring if damaged)
5. **O-ring**
   - Replace if damaged
   - Lubricate before installing
   - For ignition coils
6. **Oil fill cap**
7. **Boot**
8. **Cylinder head (valve) cover**
9. **Lifting eye**
10. **Bolts**
    - Tighten to 23 Nm (17 ft-lb)
11. **Camshaft roller chain**
    - Mark direction of rotation before removing
12. **Combi-valve**
    - For secondary air injection
    - See **26 Exhaust System and Emission Controls**
13. **Intake camshaft adjustment valve (N205)**
    - Mark connector and component before removing
    - Mounted in control housing
14. **Exhaust camshaft adjustment valve (N318)**
    - Mark connector and component before removing
    - Mounted in control housing
15. **Bolt**
    - Tighten to 60 Nm (44 ft-lb) + ¼ turn (90°) further
    - Contact surface of sensor wheel on bolt head must be dry for assembly
16. **Exhaust camshaft timing adjuster**
    - Marking: 32A
17. **Slide rail (chain guide)**
    - For camshaft roller chain
    - Clipped into control housing
18. **Intake camshaft timing adjuster**
    - Marking: 24E
19. **Fitting**
    - For air shrouded injectors
20. **Cylinder head gasket**
    - Metal
    - Always replace
    - See **Cylinder head gasket, preparing for installation**
21. **Cylinder head**
22. **Tensioner for ribbed belt**
23. **Cylinder head bolt**
    - Always replace
    - Qty. 20, 2 different lengths
24. **Cylinder head (valve) cover gasket**

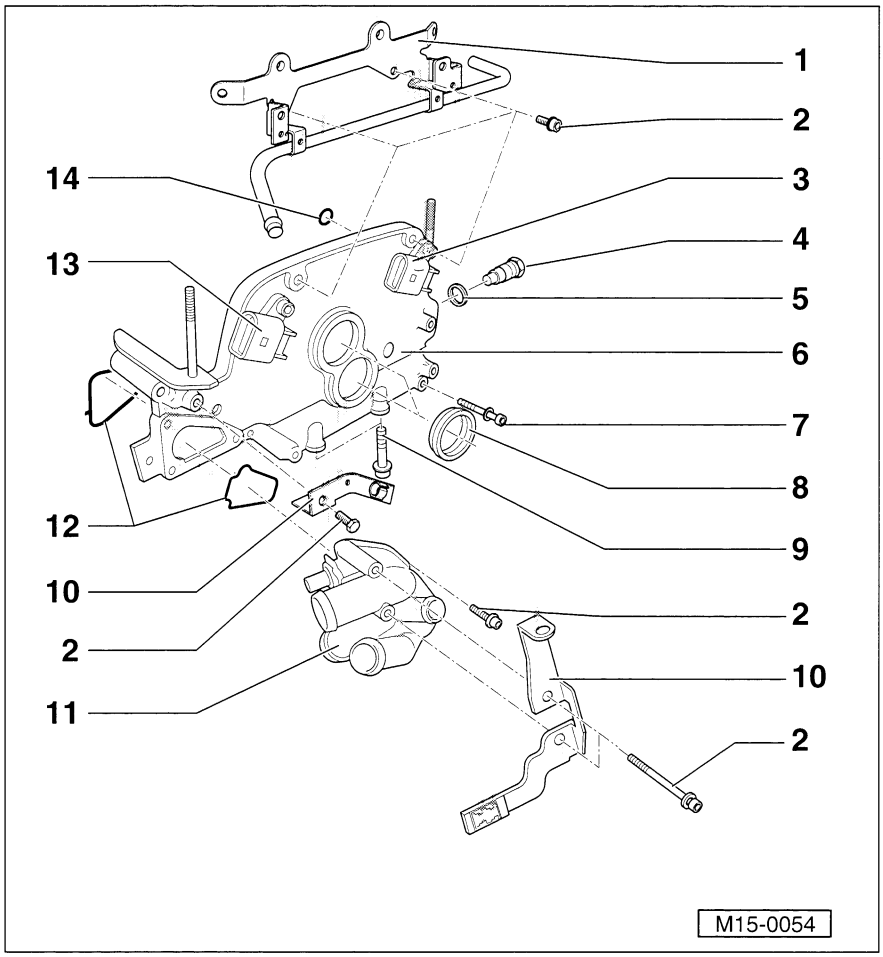


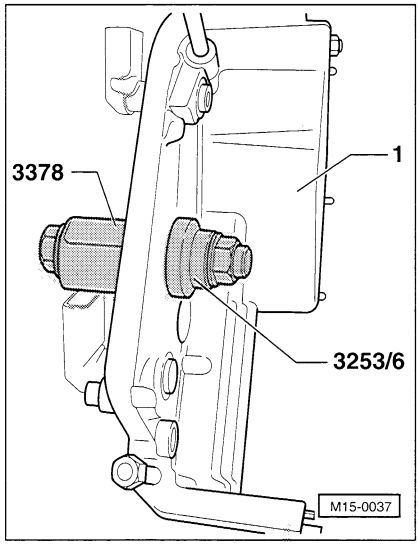
Cylinder head gasket, preparing for installation

- Fill 3 mm holes (**arrows**) in cylinder head gasket with sealing compound AMV 174 004 01. Holes will only be partially visible
- Coat sealing surfaces on cover and seal flywheel/driveplate flange with sealing compound AMV 188 001 02.
- Install cover immediately.

Camshaft sprocket cover, assembly

1. **Cable guide**
   - For coolant hoses and wiring harness
2. **Bolt**
   - Tighten to 8 Nm (71 in-lb)
3. **Camshaft position sensor 2 (G163)**
   - For exhaust camshaft
   - Mark connector and component before removal
4. **Chain tensioner**
   - Tighten to 40 Nm (30 ft-lb)
5. **Seal**
   - Replace if damaged or leaking as described below
6. **Cover**
   - Can be removed/installed with cylinder head installed
   - Coat sealing surfaces with AMV 188 001 02 sealing compound
   - With O-ring for sealing oil passage
   - If only cover is removed, clean old sealing compound from gasket and inside 3mm holes. Install new sealing compound as described previously, see **Cylinder head gasket, preparing for installation**
7. **Bolt**
   - Tighten to 8 Nm (71 in-lb)
   - Tighten securing bolts (item 9) first
8. **Seal**
   - Replace if damaged or leaking
9. **Bolt**
   - Tighten to 23 Nm (17 ft-lb)
10. **Wiring harness bracket**
11. **Thermostat housing**
12. **Seal**
    - Always replace
13. **Camshaft position sensor (G40)**
    - For intake camshaft
    - Mark connector and component before removal
14. **O-ring**
    - For oil channel seal
    - Always replace
    - Lubricate before installing



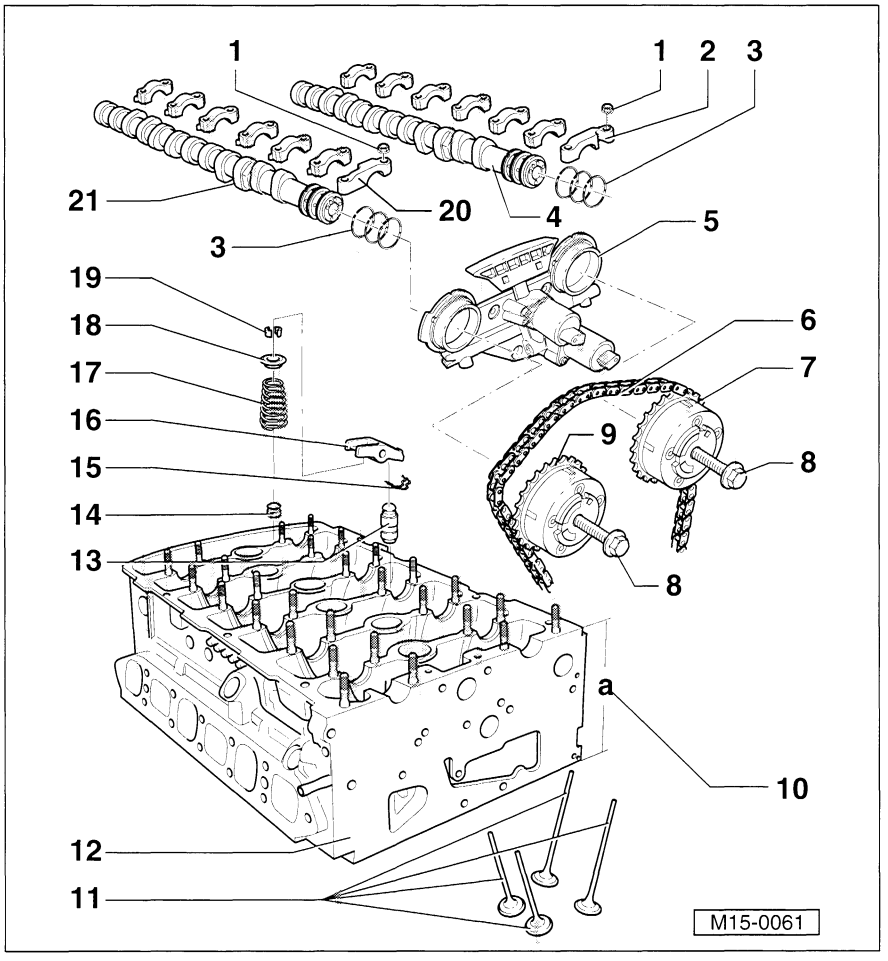


Camshaft sprocket cover seals, installing

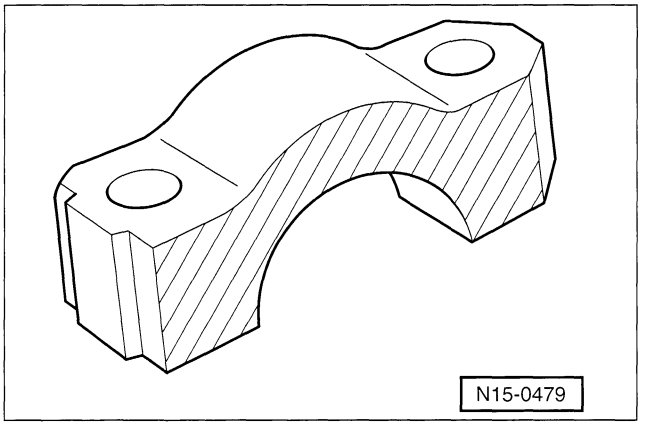
- Position seal in cover (**1**) using puller sleeve 3378 and pull in flush using puller sleeve 3253/6 from fitting device 3253
- Do not lubricate (oil) seal before installing

Internal cylinder head assembly

NOTE —
Special camshaft alignment tool T10068 is required for most BDF cylinder head work. This tool accurately sets camshafts at TDC and should be used any time camshaft drive chains are removed.

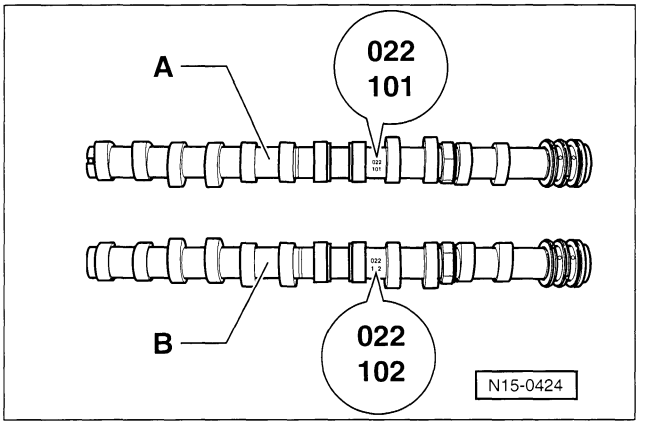


1. **Nut**
   - Tighten to 5 Nm (44 in-lb) + 1/8 turn (45°) further
2. **Bearing cap**
   - Before installing bearing cap 8, lightly grease contact surfaces
   - Note installation position and sequence, see **Camshafts, removing and installing**
3. **Seal**
   - Replace if leaking
   - Lightly oil contact surfaces when installing
   - Spread/stretch seal as little as possible when installing
   - Offset gaps by 120°
4. **Exhaust camshaft**
   - Radial clearance checked with Plastigage®
     wear limit: 0.10 mm (0.004 in)
   - Run out: maximum 0.01 mm (0.0004 in)
   - See **Camshaft identification**
5. **Control housing**
   - See **Control housing assembly** and **Control housing screen, cleaning**
6. **Camshaft roller chain**
   - Mark direction of rotation before removing
7. **Exhaust camshaft sprocket and timing adjuster**
   - Marking: 32A
8. **Bolt**
   - Tighten to 60 Nm (44 ft-lb) + ¼ turn (90°) further
   - Always replace
   - Contact surface of sensor wheel on bolt head must be dry for assembly
9. **Intake camshaft sprocket and timing adjuster**
   - Marking: 24E
10. **Cylinder head height**
    - Dimension a: minimum 139.9 mm (5.508 in)
11. **Valves**
    - Do not rework! Only lapping is permitted
12. **Cylinder head**
13. **Support element**
    - Check camshaft axial clearance before installation
    - Do not interchange
    - With hydraulic valve clearance compensation
14. **Valve stem seal**
15. **Retaining clip**
16. **Roller rocker finger**
    - Check camshaft axial clearance before installation
    - Do not interchange
    - Check roller bearing for easy movement
    - Oil running contact surfaces
    - Use retaining clip to attach onto support element when installing
17. **Valve spring**
18. **Valve spring retainer**
19. **Valve keepers (cotters)**
20. **Camshaft bearing cap**
    - Before installing bearing cap 7, lightly grease contact surfaces
    - Note installation position and sequence, see **Camshafts, removing and installing**
21. **Intake camshaft**
    - Radial clearance checked with Plastigage®
      wear limit: 0.10 mm (0.004 in)
    - Run out: maximum 0.01 mm (0.0004 in)
    - See **Camshaft identification**



Grease bearing caps #7 and #8

- Before installing, lightly grease contact surfaces on both sides (shaded area) with G 052 723 A2 grease.



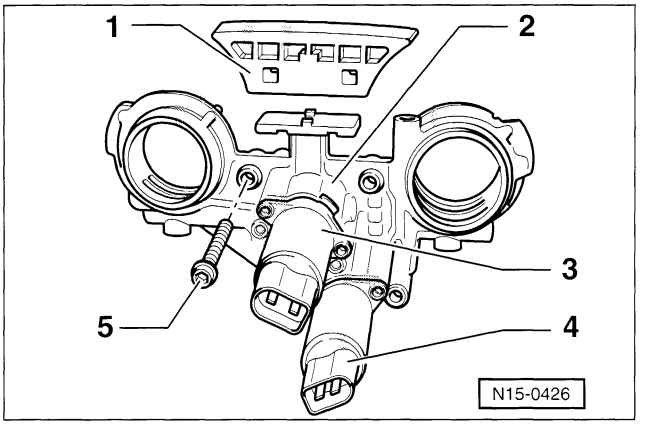
Camshaft identification, valve timing

- Identification marks are between No. 4 and No. 5 cylinder cam pair.
- Exhaust camshaft (A): 022, 101 index
- Intake camshaft (B): 022, 102 index

Table d lists valve timing at 1mm valve lift.

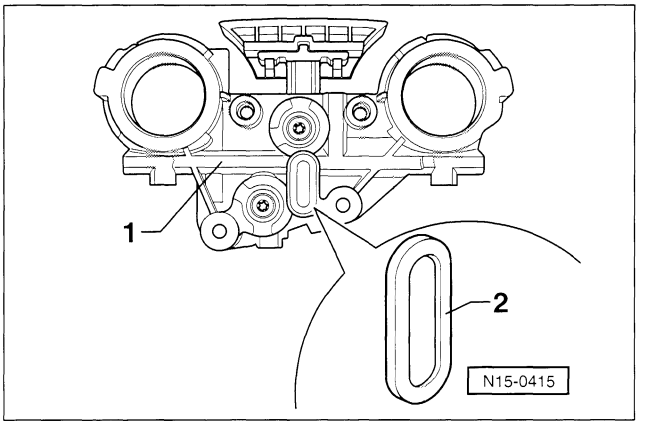
Table d. Valve timing (BDF engine)

Valve	Intake valve	Exhaust valve
Opens BTDC	-	211.5°
Closes BTDC	-	6.5°
Opens ATDC	18.5°	-
Closes ATDC	223.5°	-



Control housing assembly

1. **Guide rail**
   - Clipped onto control housing
2. **Control housing**
   - Replace as complete unit with N205 and N318
3. **Intake camshaft adjustment valve (N205)**
4. **Exhaust camshaft adjustment valve (N318)**
5. **Bolt**
   - Tighten to 8 Nm (71 in-lb)
   - Always replace



Control housing screen, cleaning

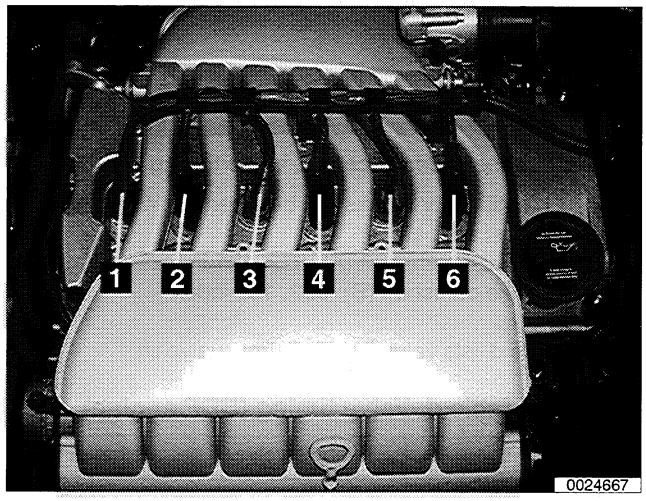
- Unclip screen (**2**) from rear side of control housing (**1**) and clean as needed.

Cylinder head (valve) cover, removing and installing

– With ignition off, disconnect battery ground strap.

NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.

– Remove engine cover, see **0 Maintenance**.



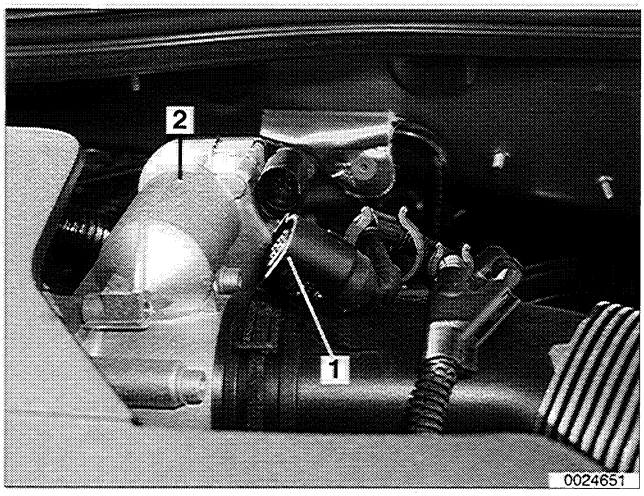
➢ Mark ignition coil connectors and coils. Disconnect connectors from ignition coils.

– Unclip ignition coil wires from guides.

– Unclip ignition coils using Volkswagen special tool T10095 or equivalent.

– Pull off crankcase breather hose from cylinder head cover.

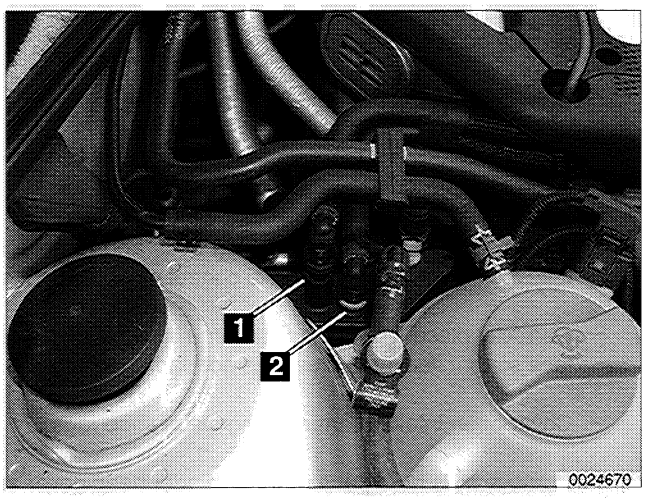
– Remove intake hose between Mass Air Flow (MAF) sensor and throttle valve control module.



➢ Disconnect the 6-pin harness connector (**1**) from the throttle valve control module (**2**).

– Loosen coolant expansion tank cap to release pressure and re-tighten.

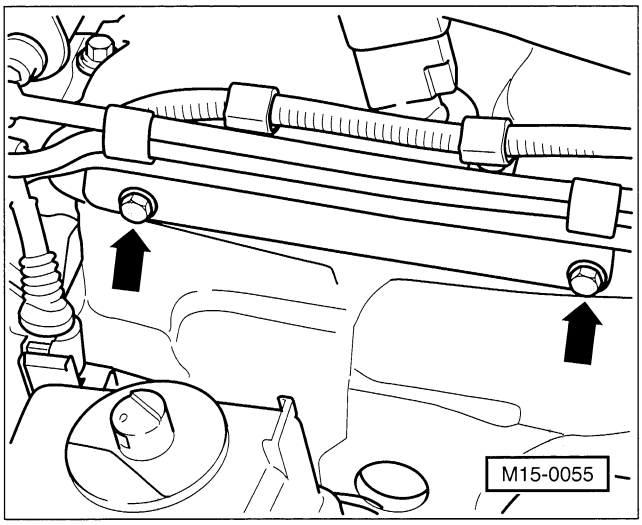
– Pull coolant hoses off throttle valve control module and seal hose ends.



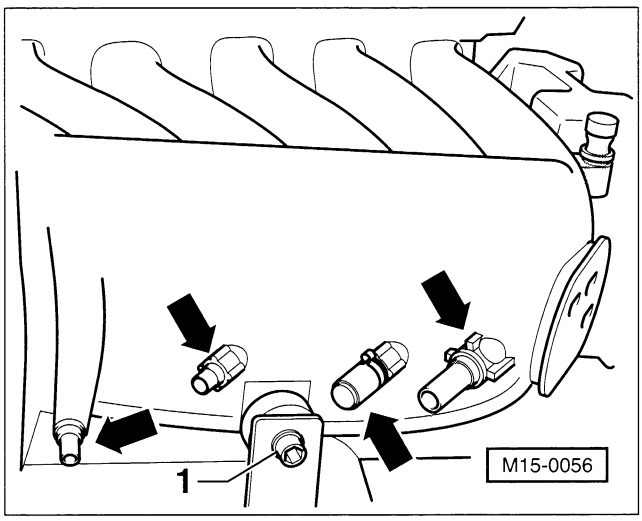
- Disconnect fuel supply line, marked white (**1**) and fuel return line, marked blue (**2**) at fuel rail. Press coupling tabs together to disconnect.

> ***WARNING —***
> *Fuel will be expelled when disconnecting fuel hoses. Wrap a cloth around the fuel line fittings before disconnecting them. Do not smoke or work near heaters or other fire hazards. Have a fire extinguisher handy.*

- Seal off disconnected fuel and vacuum hoses lines to prevent contamination.



- Remove mounting bolts (**arrows**) and retaining frame on cylinder head that holds fuel lines and wiring harness.



- Label and disconnect vacuum connections (**arrows**) on intake manifold. Remove intake manifold support bolt (**1**).
- Unclip secondary air pump inlet hose and remaining lines from retainers of intake manifold and cylinder head cover.
- Remove cable guide on camshaft sprocket cover.
- Remove ground connection at combi-valve flange.
- Disconnect vacuum hose from variable intake manifold change-over vacuum actuator.
- Remove two lateral intake manifold support bolts.
- Remove lower sound absorber panels (belly pan).
- Disconnect connectors from thermal switch and radiator fan.

- Remove front bumper cover and move lock carrier to service position, see **50 Body–Front.**

- Unbolt dipstick guide tube from intake manifold.

- Label and disconnect vacuum connections on rotary valve actuator.

- Remove intake manifold securing bolts and remove intake manifold with throttle valve control module attached.

- Carefully place intake manifold on a suitable clean surface so that vacuum actuator is not damaged.

- Cover open intake runners using clean shop rags.

- Remove nuts from perimeter of cylinder head cover and lift off cylinder head cover and gasket.

- Installation is reverse of removal noting the following additional points:
  - Use new gaskets where appropriate.
  - First bolt intake manifold to cylinder head then tighten both bolts of manifold support.
  - Refill coolant as required.
  - Ensure that fuel line couplers are securely attached.

- Use a VAG 1551/1552 or equivalent aftermarket diagnostic scan tool to:
  - Check DTC memory
  - Adapt engine control module to throttle valve
  - Generate readiness code

- Perform work sequence "Procedure after interruption of voltage supply", see **27 Engine Electrical**.

- Quality check your repair work, see **Quality Review** at the end of this repair group.

Tightening Torques

- Cylinder head cover to cylinder head 8 Nm (71 in-lb)
- Intake manifold to cylinder head. . . . 13 Nm (10 ft-lb)
- Intake manifold to support . . . . . 23 Nm (17 ft-lb)
- Dipstick guide tube to intake manifold . . . . . 8 Nm (71 in-lb)

Camshafts, removing

The camshafts can be removed with cylinder head installed. Removing camshafts allows access to hydraulic cam followers, valve springs, and valve stem oil seals.

NOTE —
Volkswagen special tool T10068, camshaft alignment bar, is specified for setting valve timing during camshaft installation. The tool is relatively inexpensive and highly recommended.

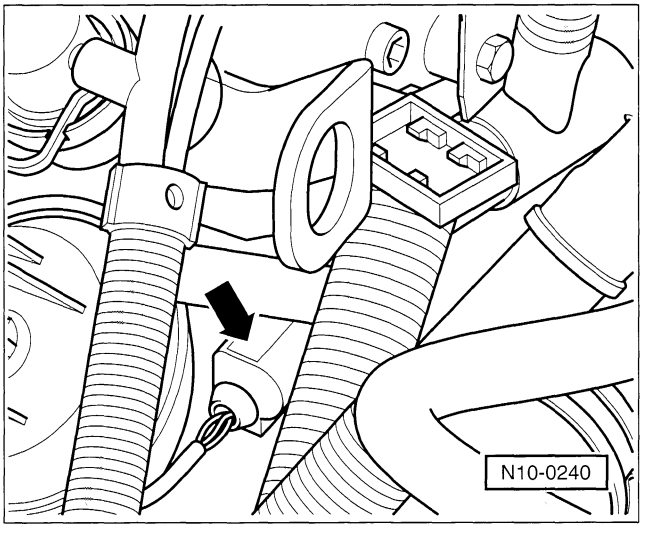
– With ignition off, disconnect battery ground strap.

NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.

– Remove engine cover, see **0 Maintenance**.

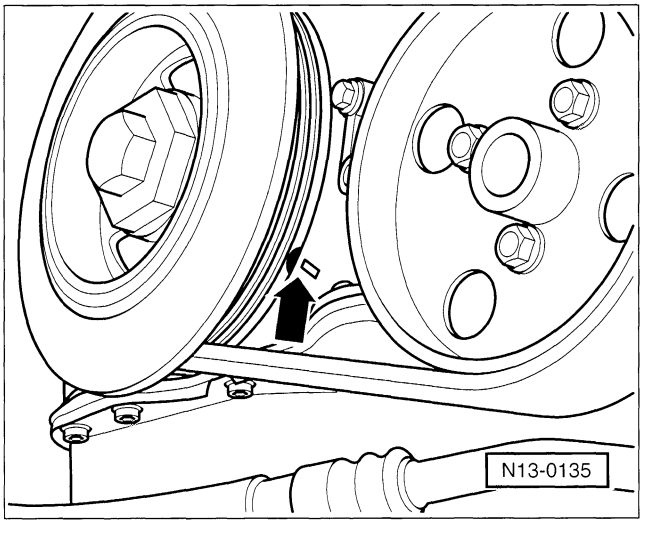
– Remove ignition coils as described previously.

– Remove intake manifold as described previously, see **Cylinder head (valve) cover, removing and installing**.



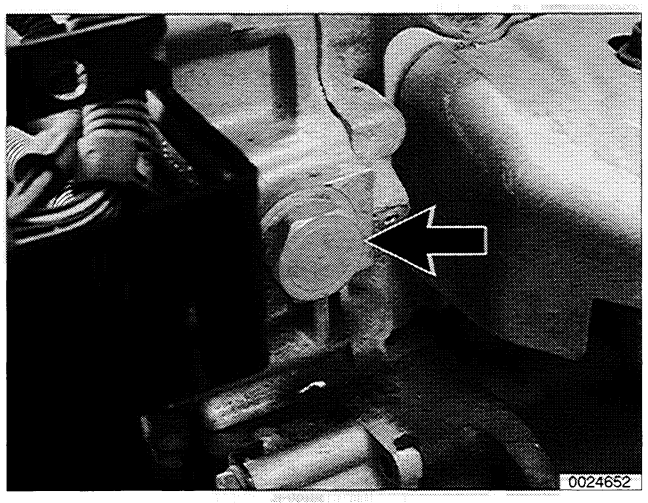
➤ Pull 4-pin connector (**arrow**) of ECT sensor.

– Drain coolant and remove thermostat housing, see **19 Cooling System**.

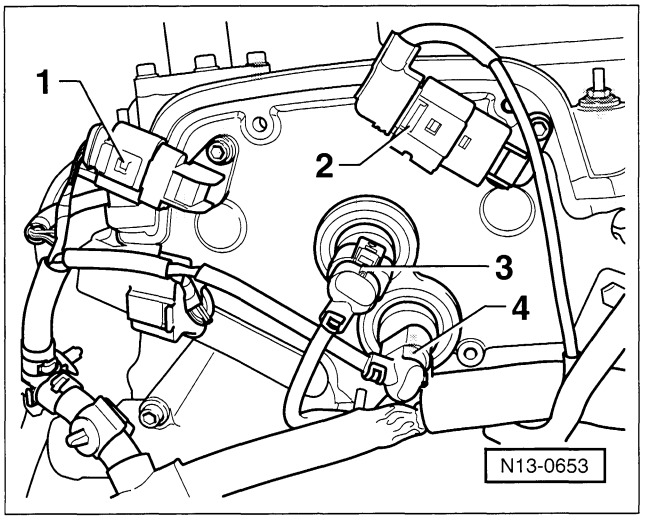


➤ Using a socket wrench on crankshaft vibration damper center bolt, rotate engine clockwise by hand to set #1 cylinder at Top Dead Center (TDC).

- Timing mark on crankshaft vibration damper aligned (**arrow**) with marker on front engine cover.



➤ Remove camshaft roller chain tensioner (**arrow**).



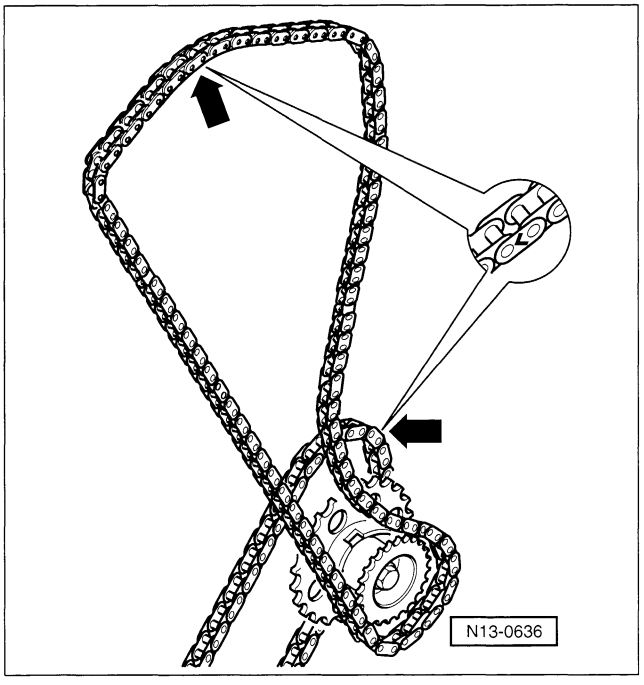
➤ Disconnect harness connectors on camshaft sprocket cover.

1. Camshaft position sensor (G40)
2. Camshaft position sensor 2 (G163)
3. Intake camshaft adjustment valve (N205)
4. Exhaust camshaft adjustment valve (N318)

NOTE —
Mark connector and components before removal.

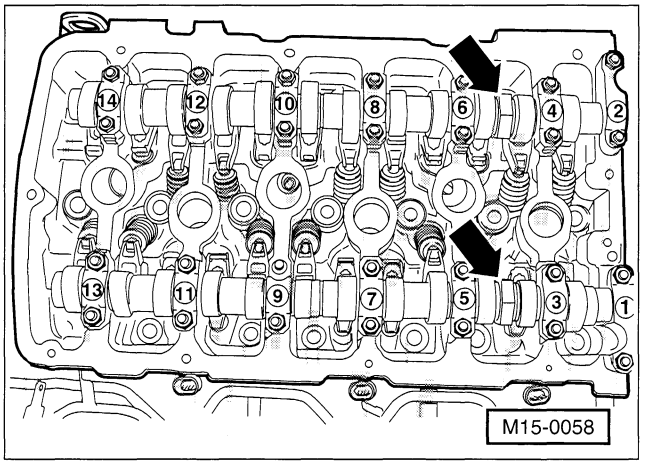
– Unclip wiring harness from camshaft sprocket cover.

– Remove camshaft sprocket cover.



➤ Mark (**arrows**) direction of rotation on timing chains with paint.

NOTE —
Do not mark chain with a punched mark or notch!



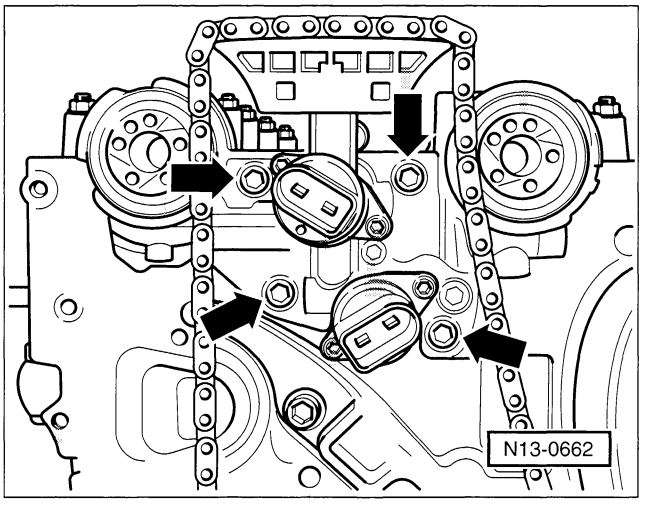
➢ Loosen camshaft sprocket/timing adjuster bolts:

- Hold camshaft with 32 mm open end wrench on flat area (**arrow**) cast between camshaft lobes.
- Camshaft ruler T10068 will break if in place on end of camshaft.
- End of camshaft can be broken if metal holder is used while loosening sprocket bolts.

> ***CAUTION —***
> *Do not rotate the engine once the camshafts chains are removed from the camshafts. The pistons may contact the open valves.*

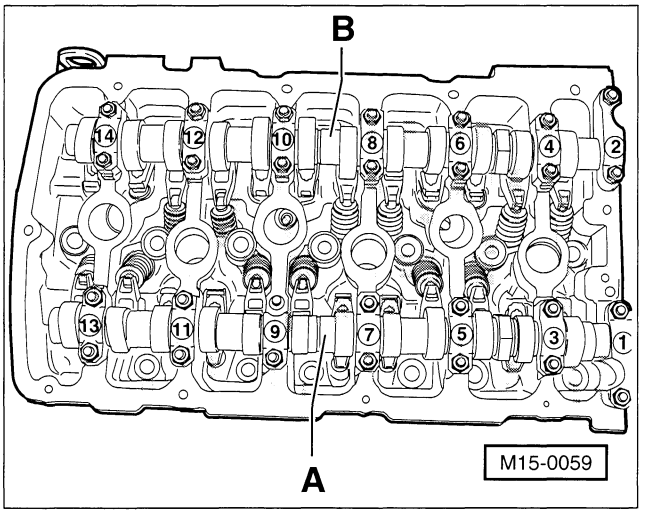
– Remove sprockets/timing adjusters from camshafts.

– Tie camshaft chain up using stiff wire or set aside.



➢ Remove mounting bolts (**arrows**) for control housing.

– Pull control housing carefully off camshaft seals.



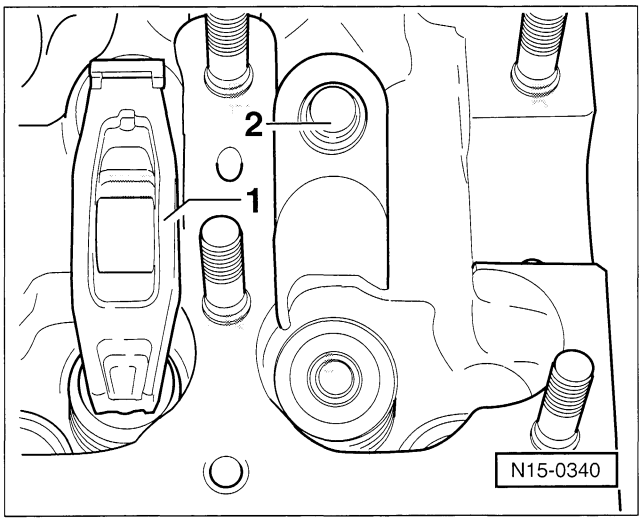
➢ Remove the intake (**A**) camshaft:

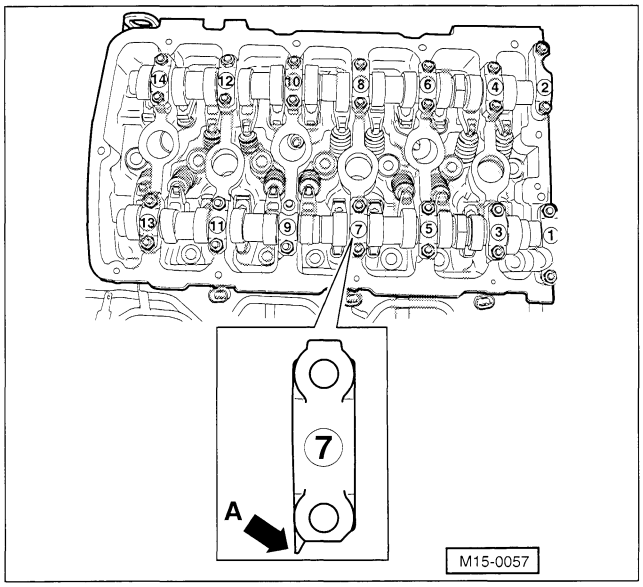
- Remove bearing caps 1 and 13.
- Remove bearing caps 3 and 11.
- Remove bearing cap 7.
- Loosen nuts on caps 5 and 9 alternately and evenly to relieve valve spring tension.
- When all tension is relieved, remove caps.
- Lift out camshaft and lay aside.

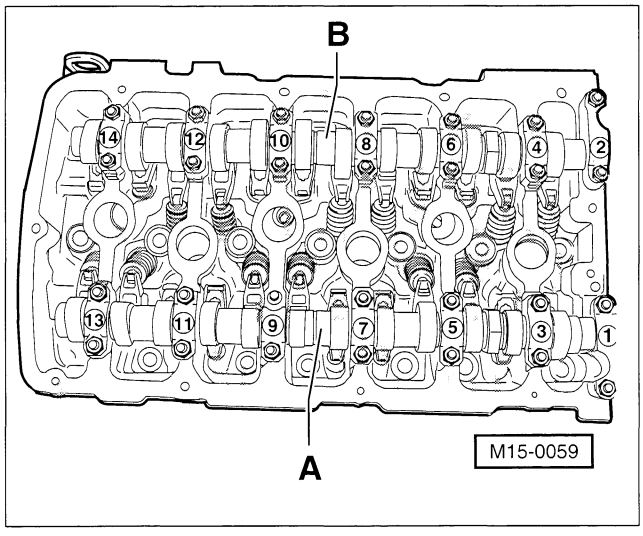
– Remove the exhaust (**B**) camshaft:

- Remove bearing caps 2 and 14.
- Remove bearing caps 4 and 12.
- Remove bearing cap 8.
- Loosen nuts on caps 6 and 10 alternately and evenly to relieve valve spring tension.
- When all tension is relieved, remove caps.
- Lift out camshaft and lay aside.
- Remove roller rocker finger and support elements and place on a clean surface.

> ***NOTE —***
> *Do not interchange roller rocker fingers and support elements.*







NOTE —

Once removed, camshafts should be checked for wear and other visible damage as described later under **Cylinder Head Components.**

Camshafts, installing

– When camshafts are installed, lobes for cylinder number 1 point upwards.

➢ Ensure that all roller rocker fingers (**1**) are properly installed onto valve stem ends and are clipped onto support elements (**2**).

– Oil running surfaces of camshafts

– Place intake and exhaust camshafts in proper position in cylinder head. Observe markings on camshafts as described earlier, see **Camshaft identification, valve timing.**

➢ Note installation position of bearing caps:

- Points of bearing caps (**arrow A**) on intake and exhaust camshafts point downward toward intake manifold.
- Numbers on caps must be readable from intake camshaft side.

NOTE —

- *To avoid uneven and accelerated wear, bearing caps must be reinstalled in their exact original positions.*
- *Grease the contact surfaces (sides) of bearing caps 7 and 8 lightly with G 052 723 A2 grease before installing.*
- *Tighten nuts on bearing caps alternately and evenly, so that valve spring is tensioned evenly and camshaft is drawn down fully into bearing saddle.*

➢ Install bearing caps onto intake camshaft (**A**) and torque evenly to specification. Install caps in the following order:

- Install bearing caps 5 and 9.
- Install bearing caps 1 and 13.
- Install bearing cap 7 with sides lubricated.
- Install bearing caps 3 and 11.

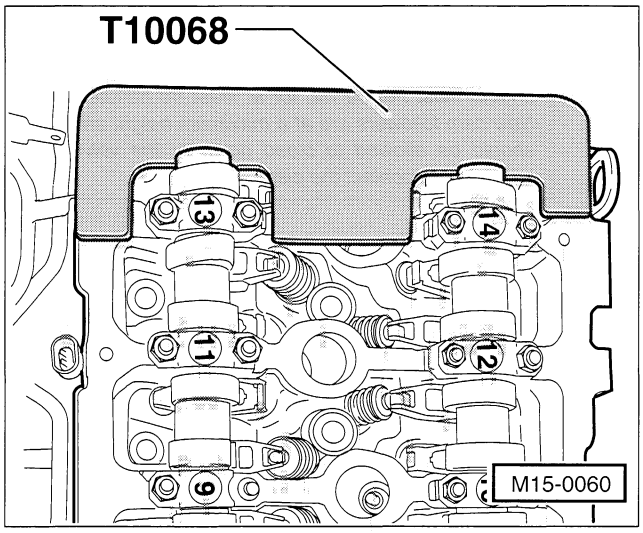
– Install bearing caps onto exhaust camshaft (**B**) and torque evenly to specification. Install caps in the following order:

- Install bearing caps 6 and 10.
- Install bearing caps 2 and 14.
- Install bearing cap 8 with sides lubricated.
- Install bearing caps 4 and 12.

Tightening torque

- Camshaft bearing caps to cylinder head . . . . . 5 Nm (44 in-lb) ¼ turn (45°)

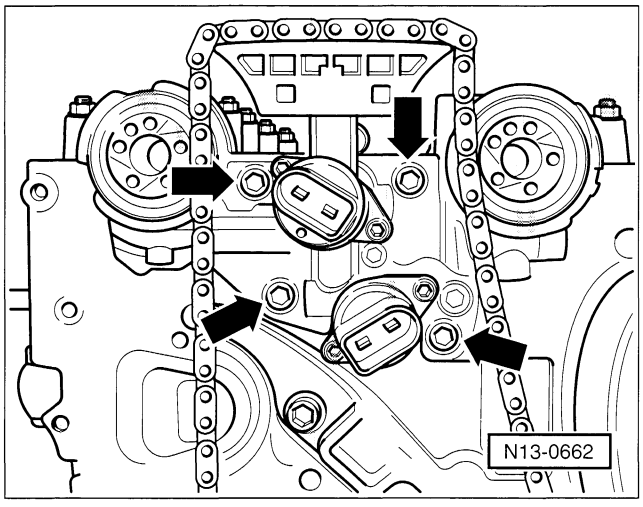
– Check that cylinder #1 is at Top Dead Center (TDC) as shown earlier.



Camshaft alignment tool T10068 must engage in both grooves on end of camshaft. If alignment tool does not properly engage, turn camshafts in direction of rotation past TDC and then back to TDC for the No. 1 cylinder.

– Install control housing, see **Control housing, assembly** given earlier.

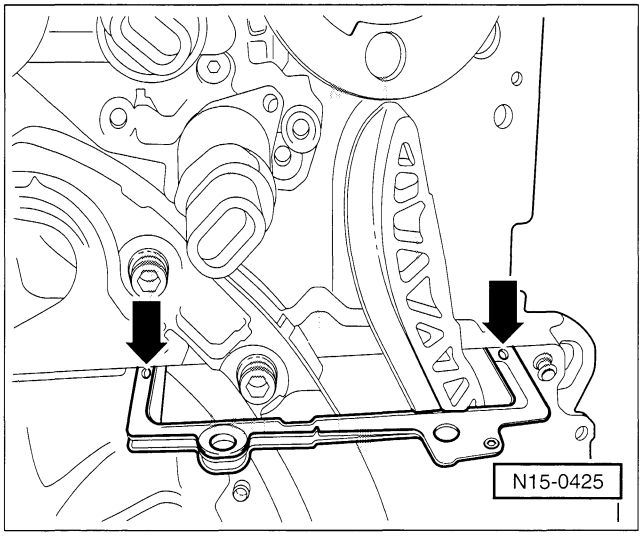
- Clean control housing screen as necessary
- Lightly lubricate contact surfaces in control housing for camshaft seals.
- Carefully push control housing over camshaft seals.



Install control housing and mounting bolts (**arrows**).

Tightening Torque

- Control housing to head . . . . . 8 Nm (71 in-lb)



Clean sealant from 3 mm bores in cylinder head gasket and fill holes (**arrows**) in cylinder head gasket with sealing compound AMV 174 004 01. Coat sealing surfaces on cover and seal flywheel/driveplate flange with sealing compound AMV 188 001 02. Install cover immediately.

– Remaining assembly is the reverse of removal.

CAUTION —
Be sure to install a new O-ring in the rear of the camshaft sprocket cover. Lightly oil O-ring and install it into cover before installation.

– Adjust valve timing, see **Valve timing, adjusting**. Check camshaft adjustment function using a VAG 1551/1552 scan tool or equivalent, see **Camshaft timing adjustment, checking** given later.

– Quality check your repair work, see **Quality Review** at the end of this repair group.

> ***CAUTION —***
> *If new hydraulic cam followers were installed, the engine must not be run for at least 30 minutes. New cam followers are at a maximum height and should be allowed to bleed down or the valve heads could contact the pistons on start up.*

Valve stem oil seals, replacing

The sign of faulty valve stem seals is excessive oil consumption and oil smoke from the exhaust. This is usually most noticeable during periods of high manifold vacuum such as deceleration. If compression and leak-down testing confirm the integrity of the piston rings, but the engine consumes oil, it is possible that faulty valve stem seals are present. It should also be noted that worn valve stem seals could be due to worn valve guides and that worn valve guides are a major cause of oil consumption. See **Cylinder Head Components** given later for more information on checking valve guides.

Replacing valve stem oil seals requires removal of camshaft, cam followers, and valve springs. This can be done with cylinder head installed or removed. In either case, numerous Volkswagen special tools are required to compress the valve springs and remove and install seals.

Working with cylinder head installed:

– Remove cylinder head (valve) cover, camshafts, as described earlier.

– Remove roller rocker fingers and support elements (valve lifters) and place on clean surface.

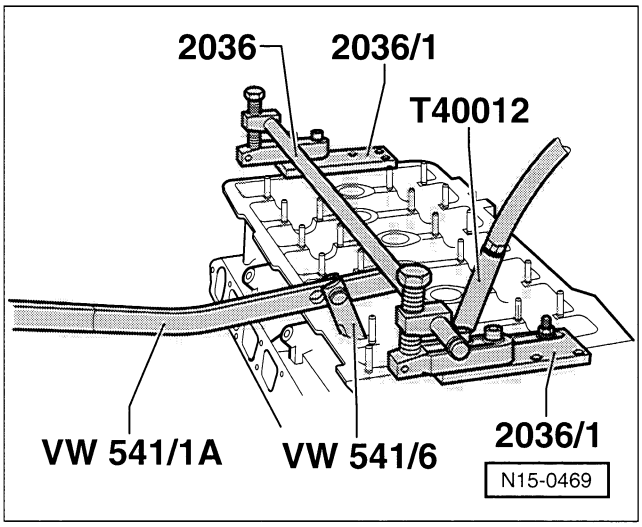
> ***NOTE —***
> *Ensure that roller rockers fingers and support elements are not interchanged.*

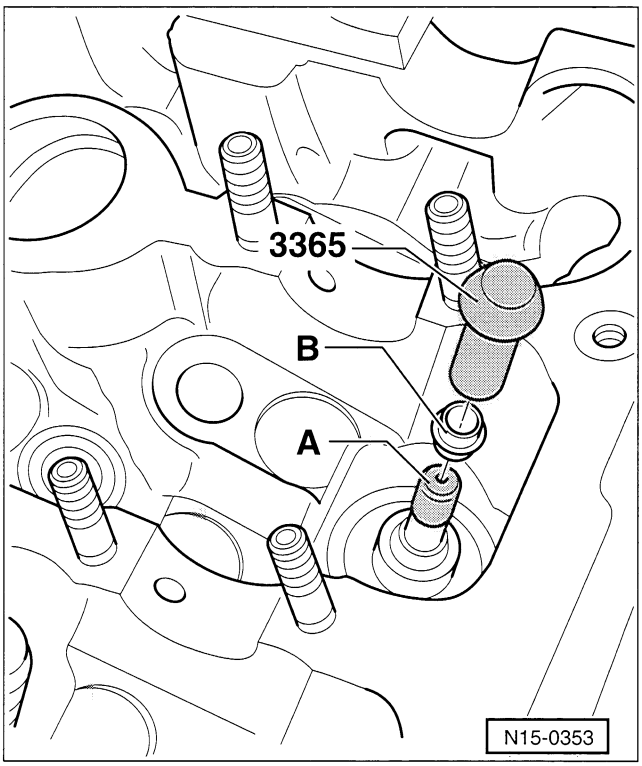
– Remove spark plugs with wrench 3122B or equivalent.

– Set engine to bottom dead center (BDC) for cylinder 1 by turning crankshaft.

– Apply a continuous supply of compressed air with a minimum of 6 bar (87 psi) into first spark plug hole with an adapter (VW special tool T40012 shown below). This will hold valves in place while springs are removed.

> ***CAUTION —***
> *Compressed air supply must be able to maintain at least 6 bar (87 psi) during this repair. If air supply is interrupted while valve spring is removed, valve will fall into cylinder and may require cylinder head removal to retrieve.*





Working with cylinder head removed:

– Secure cylinder head to workbench. Use care to avoid damage to head gasket surfaces.

– Remove camshaft and hydraulic cam followers as described earlier.

Working with cylinder head removed or installed:

➢ Install appropriate valve spring compressor tools. Compress the spring for the first cylinder and remove spring retainer, both keepers, and valve spring. If spring will not compress, lightly tap tool to release stuck keepers. Use a small magnet to retrieve keepers.

NOTE —
Tight keepers can be loosened by tapping lightly on the lever with a hammer.

– Remove valve stem seals with Volkswagen special slide hammer tool 3364.

➢ Begin installation of new seal by temporarily fitting a protective plastic fitting sleeve (**A**) over the valve stem. This sleeve is usually included with new seal set and will prevent damage to the seal due to the sharp edges of the keeper grooves. Lubricate new valve seal (**B**) with clean engine oil and fit it to installation tool (**3365**).

– Push the installation tool (with new seal) down over valve stem until seal is fully seated on the guide. Remove tool and protective plastic fitting sleeve.

– Reinstall valve spring, retainer and keepers.

– Repeat for the second valve on the cylinder.

– When all valve seals have been replaced on the first cylinder, transfer compressed air adapter (if working with cylinder head installed) to the next cylinder and repeat the process until all valve seals have been replaced.

– Remaining installation is the reverse of removal.

CAUTION —
To prevent cylinder head or camshaft damage, be sure to follow camshaft installation procedure exactly when tightening the camshaft bearing caps. See **Camshaft, removing and installing**.

Tightening torque

• Spark plug to cylinder head . . . . . 25 Nm (18 ft-lb)

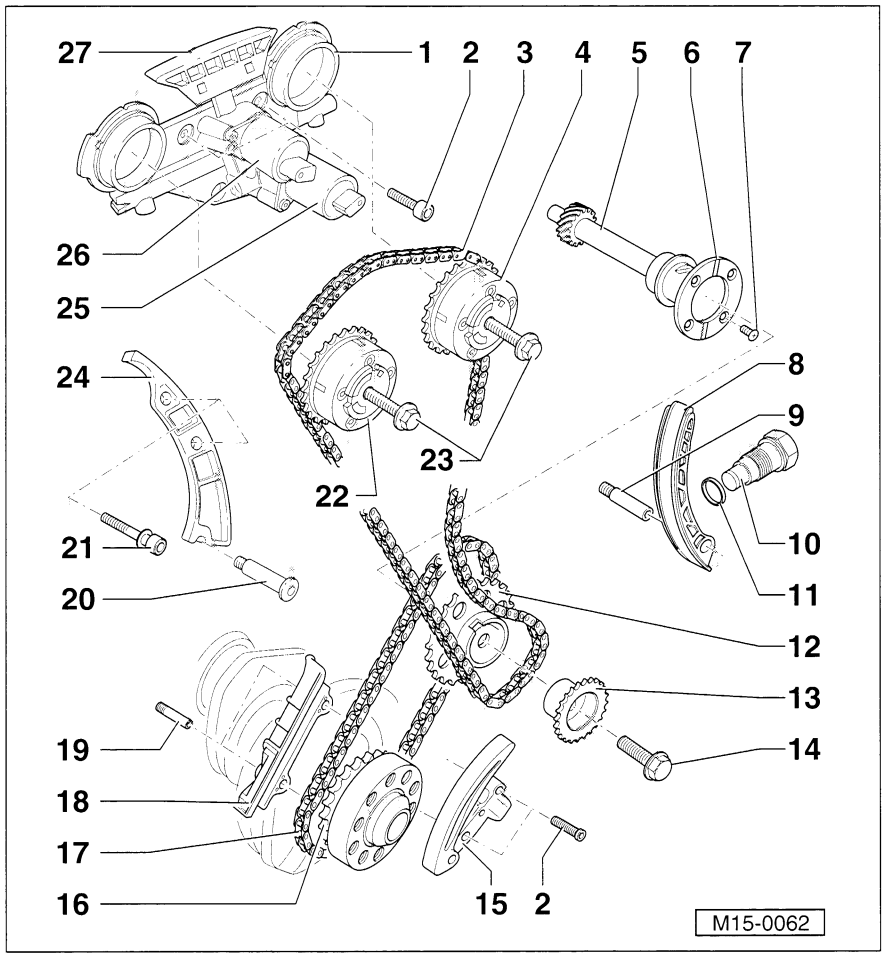
– Be sure to quality check your work, see **Quality Review** at the end of this repair group.

CAMSHAFT DRIVE CHAINS (BDF ENGINE)

NOTE —

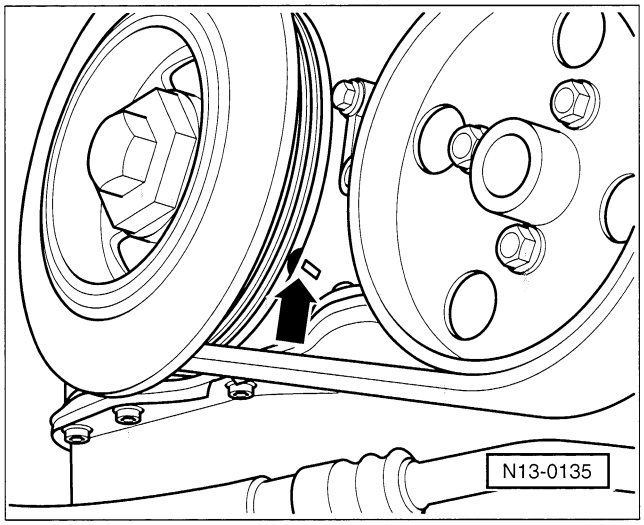
- *Removal and installation of camshaft drive chains requires that the transaxle be separated from the engine.*
- *Replace all seals and gaskets that are damaged or leaking.*

Camshaft drive chains, assembly



1. **Control housing**
   - See **Control housing, assembly** given earlier.
   - Clean screen as necessary.
   - Lubricate contact surfaces of oil seal when installing
2. **Bolt**
   - Tighten to 8 Nm (71 in-lb)
3. **Camshaft drive chain, upper**
   - Mark rotation direction before removal
4. **Exhaust camshaft sprocket and timing adjuster**
   - Marking: 32A
   - Turn engine over only when timing adjuster is installed
5. **Intermediate shaft**
   - Drives engine oil pump shaft
6. **Thrust washer**
7. **Bolt**
   - Tighten to 8 Nm (71 in-lb)
   - Install with locking compound
8. **Guide rail, upper chain**
9. **Tensioner guide pivot pin**
   - Tighten to 10 Nm (7 ft-lb)
10. **Chain tensioner, upper**
    - Tighten to 40 Nm (30 ft-lb)
    - Turn engine over only when tensioner is installed
11. **Seal**
    - Replace if damaged or leaking
12. **Intermediate shaft sprocket, inner (lower chain)**
13. **Intermediate shaft sprocket, outer (upper chain)**
14. **Bolt**
    - Always replace
    - Tighten to 60 Nm (44 ft-lb) + ¼ turn (90°)
    - Counterhold with T10069 to loosen and tighten
15. **Chain tensioner assembly, lower**
    - Turn engine over only when tensioner is installed
    - Compress and lock ratchet mechanism with small screwdriver in locking hole before installing
    - After installing release the locking device in the chain tensioner and press the tensioning bar against the chain tensioner
16. **Crankshaft with integral chain sprocket**
    - Beveled (ground) tooth used as TDC timing mark when aligned with bearing cap joint
17. **Camshaft drive chain, lower**
    - Mark rotation direction before removal
18. **Guide rail, lower chain**
    - Remove and install together with lower roller chain
19. **Locating pin, guide rail (w/o collar)**
    - Tighten to 10 Nm (7 ft-lb)
20. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
21. **Bolt**
    - Tighten to 23 Nm (17 ft-lb)
22. **Intake camshaft sprocket and timing adjuster**
    - Marking: 24E
    - Turn engine over only when timing adjuster is installed
23. **Bolt**
    - Always replace
    - Contact surface of sensor wheel on bolt head must be dry when installing
    - Tighten to 60 Nm (44 ft-lb) + ¼ turn (90°)
    - Use 32mm open-end wrench on camshaft flats to counter hold when removing or installing
24. **Guide rail, upper chain**
25. **Exhaust camshaft adjustment valve (N318)**
26. **Intake camshaft adjustment valve (N205)**
27. **Guide rail**
    - Clipped into control housing

Valve timing, checking



– Remove lower sound absorber panels (belly pan).

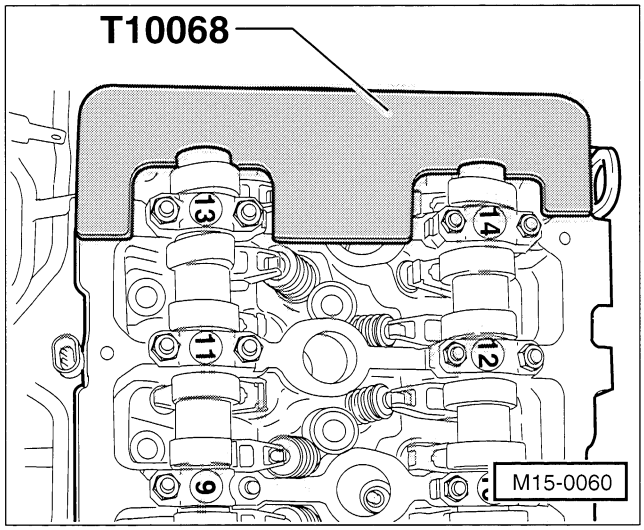
– Remove intake manifold and cylinder head (valve) cover as given earlier.

➤ Using a socket wrench on crankshaft vibration damper center bolt, rotate engine clockwise by hand to set the #1 cylinder at Top Dead Center (TDC).

- Align timing mark on crankshaft vibration damper with marker on front engine cover (**arrow**).

– Remove upper drive chain tensioner from camshaft sprocket cover.

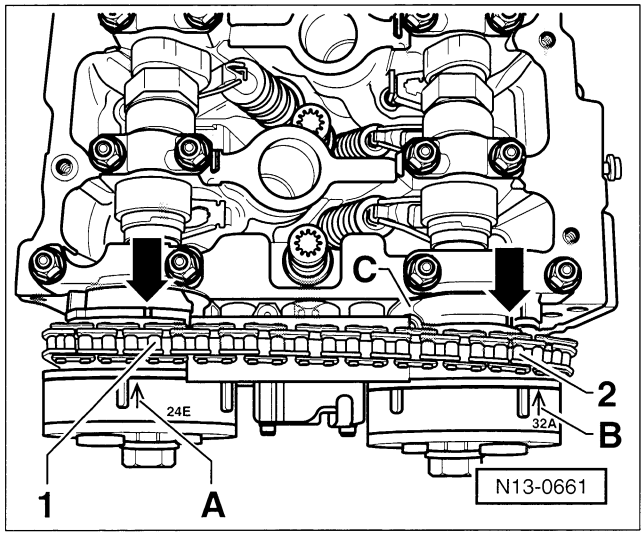
– Remove camshaft sprocket cover together with camshaft position sensor.



➤ Camshaft alignment tool T10068 must engage in both grooves on end of camshaft. If alignment tool does not properly engage, turn crankshaft one full turn further in direction of engine rotation.

NOTE —

If camshaft bar will still not fit, turn crankshaft in engine direction of rotation approximately 5mm past the TDC setting for No.1 cylinder (dependent on drive chain tolerances).



➤ Check setting marks of camshaft timing adjusters with marks on control housing:

- Marks (**A** and **B**) on camshaft timing adjusters must align with notches (**arrows**) on control housing (**C**).
- Distance between tooth **1** and tooth **2** must be exactly 16 rollers of camshaft chain.

– If the marks do not align, adjust valve timing as described below, see **Camshaft drive chains, installing**.

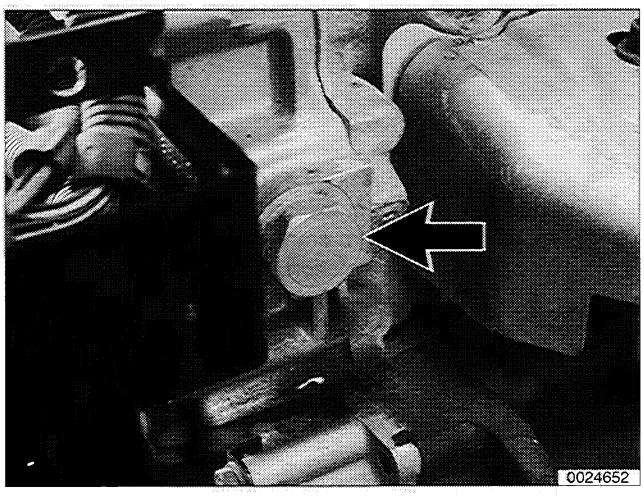
– If the marks do align, install cylinder head cover and intake manifold.

Camshaft drive chains, removing

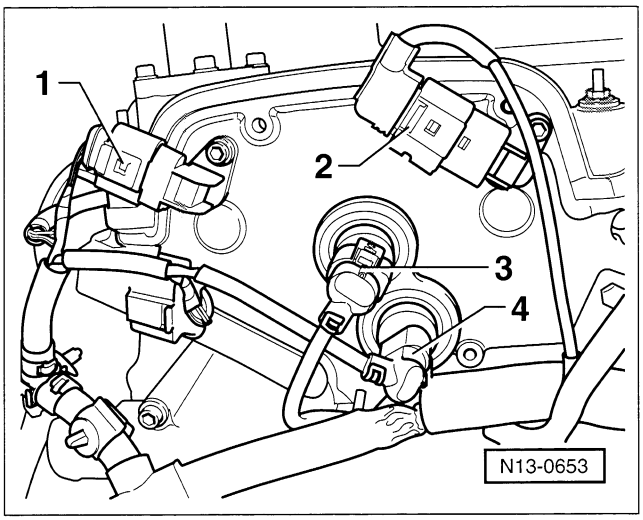
– Depending on the nature of the repair work to be done, proceed with one of the following:
  - Remove engine and transaxle from vehicle and separate transaxle from engine. See **10 Engine, Removing and Installing**.
  - Remove transaxle from engine. With this method, engine remains in vehicle. See **34 Manual Transmission,** or **37 Automatic Transmission** for transmission removal and installation.

– Using a socket wrench on crankshaft vibration damper center bolt, rotate engine clockwise by hand to set the #1 cylinder at Top Dead Center (TDC) as shown earlier.

– Remove cylinder head (valve) cover as given earlier.



➢ Remove camshaft roller chain tensioner (**arrow**).



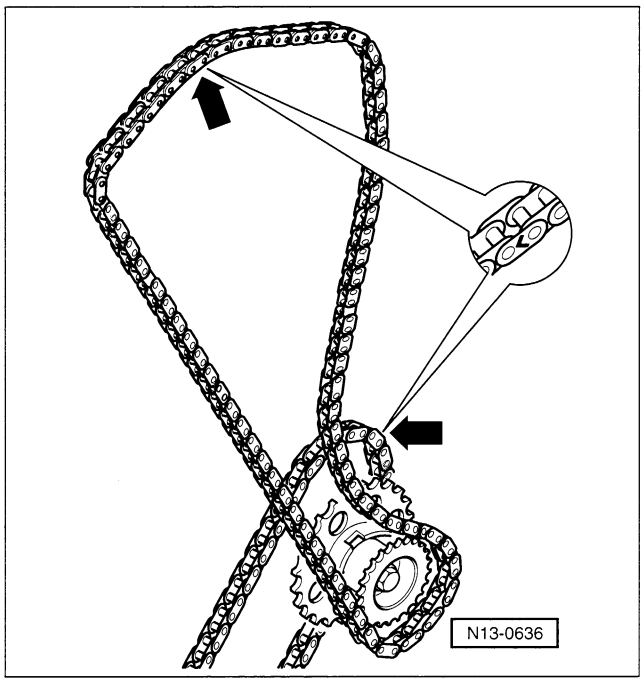
➢ Disconnect harness connectors on camshaft sprocket cover.

1. Camshaft position sensor (G40)
2. Camshaft position sensor 2 (G163)
3. Intake camshaft adjustment valve (N205)
4. Exhaust camshaft adjustment valve (N318)

NOTE —
Mark connector and components before removal.

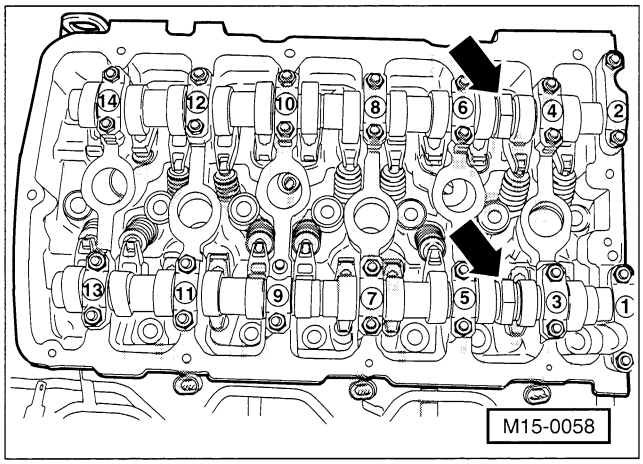
– Unclip wiring harness from camshaft sprocket cover.

– Remove camshaft sprocket cover.



➢ Mark (**arrows**) direction of rotation on timing chains with paint.

NOTE —
Do not mark chain with a punched mark or notch!

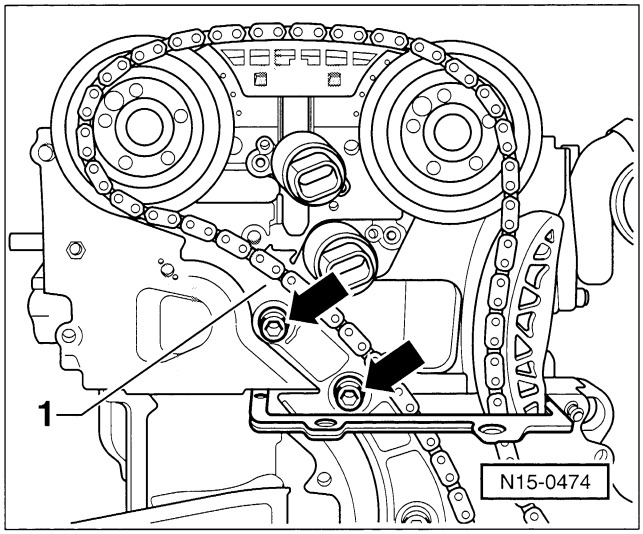


➢ Loosen camshaft sprocket/timing adjuster bolts:

- Hold camshaft with 32 mm open end wrench on flat area (**arrow**) cast between camshaft lobes.
- Camshaft ruler T10068 can break if in place on end of camshaft.
- End of camshaft can be broken if metal holder is used while loosening sprocket bolts.

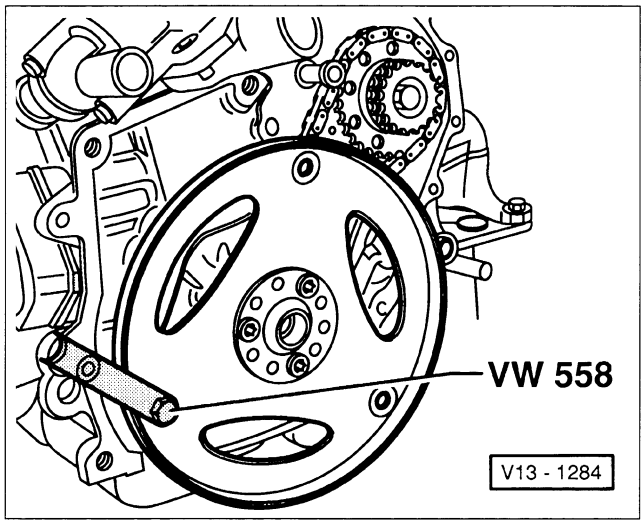
CAUTION —
Do not rotate the engine once the camshafts chains are removed from the camshafts. The pistons may contact the open valves.

– Remove sprockets/timing adjusters from camshafts.



➢ Remove guide rail mounting bolts (**arrows**) and guide rail (**1**).

– Remove upper camshaft timing chain.

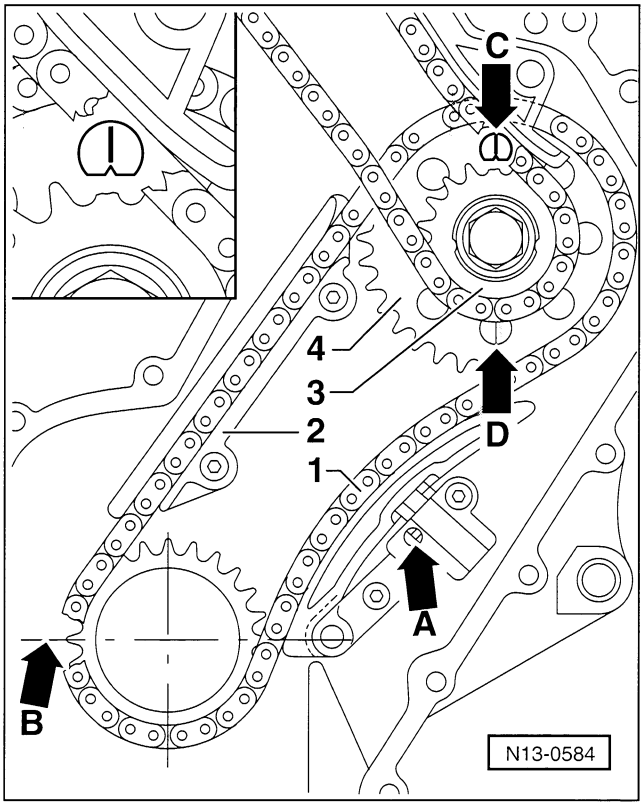


➤ Temporarily install flywheel or driveplate using three old mounting bolts. Lock flywheel or driveplate using a holding tool (**VW 558** shown).

NOTE —
Special tool 3406 can also be used on the vibration damper to lock crankshaft.

- With crankshaft locked, remove intermediate shaft sprocket mounting bolt.
- Remove lower drive chain tensioner.
- Remove intermediate shaft sprockets together with lower drive chain and lower guide rail.
- Remove flywheel or driveplate.
- Inspect tensioner assemblies and chain guides for wear or damage. Replace any worn or damaged parts.

Camshaft drive chains, installing



➤ Adjust position of crankshaft relative to intermediate shaft. To position: Align ground-down tooth of drive chain sprocket (**B**) with mounting joint (TDC cylinder #1).

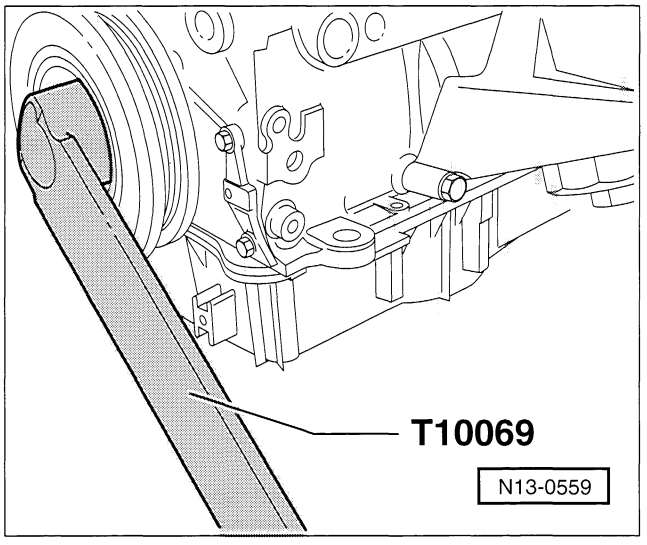
1. Camshaft drive chain, lower (single row)
2. Guide rail, lower
3. Intermediate shaft sprocket, outer
4. Intermediate shaft sprocket, inner

- Install both bolts without collar for guide rail (**2**) and tighten to 10 Nm (7 ft-lb).
- Install guide rail (**2**) with roller chain (**1**) and both chain sprockets (**3**) and (**4**).
- Marking on sprocket (**4**) for roller chain must align with notch (**C**) or (**D**) on thrust washer of intermediate shaft.
- During installation make sure that the roller chain runs completely straight in the guide plate from the crankshaft to the intermediate shaft.
- Tighten chain sprockets (**3**) and (**4**) on the intermediate shaft by hand.

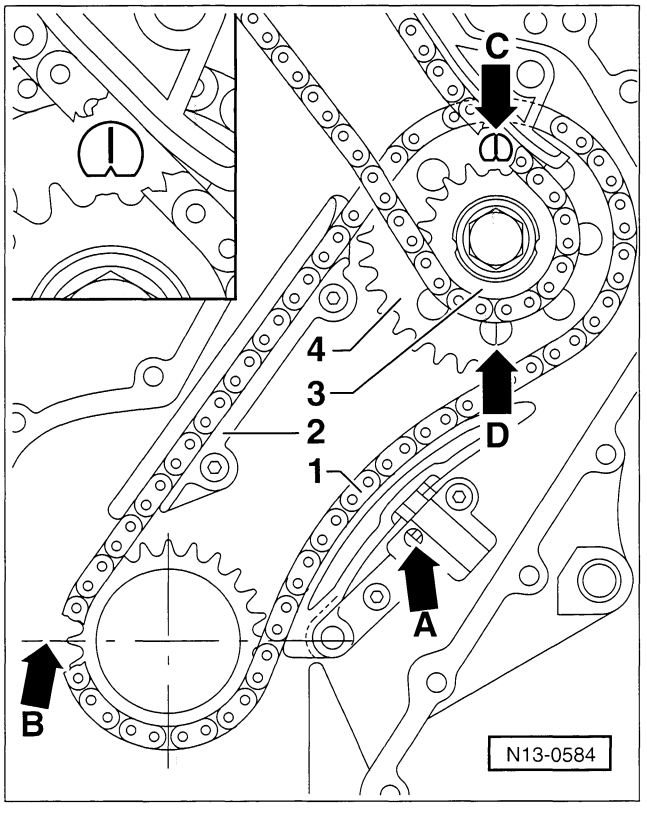
NOTE —
All chain sprocket securing screws/bolts must be replaced after removal.

- Install chain tensioner on opposite side.
- Release locking splines of chain tensioner (**A**) with a small screwdriver and tensioning plate pressed against chain tensioner.

– Install chain tensioner in this position and tighten to 8 Nm (71 in-lb).



➢ Lock vibration damper with counter support T10069.



➢ Tighten new securing bolts of chain sprocket (**3**) and (**4**) for intermediate shaft to 60 Nm + 90° (¼ turn).

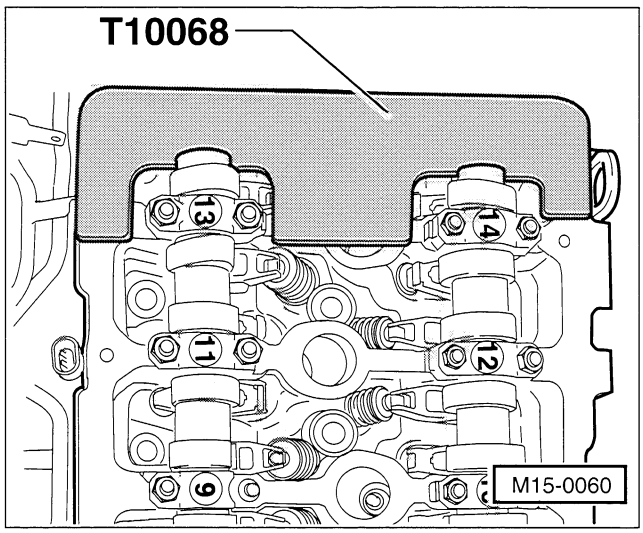
– Remove counter support T10069 from vibration damper.

– Check position of crankshaft (**B**) to intermediate shaft (**C**) or (**D**) once again.

– Set engine (crankshaft) again to TDC cylinder #1.

– Install roller chain for camshaft drive

– Position camshafts to TDC for cylinder #1.
  - If necessary, use 32mm wrench on camshaft flats to set camshaft position to TDC.
  - Camshaft alignment bar T10068 must not be installed when rotating camshafts.

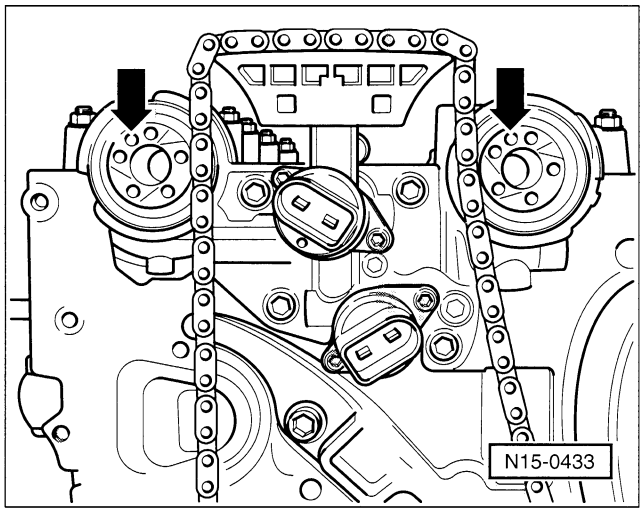


➢ Install camshaft alignment tool T10068 in both grooves on end of camshaft to ensure that camshafts are at TDC for cylinder #1.

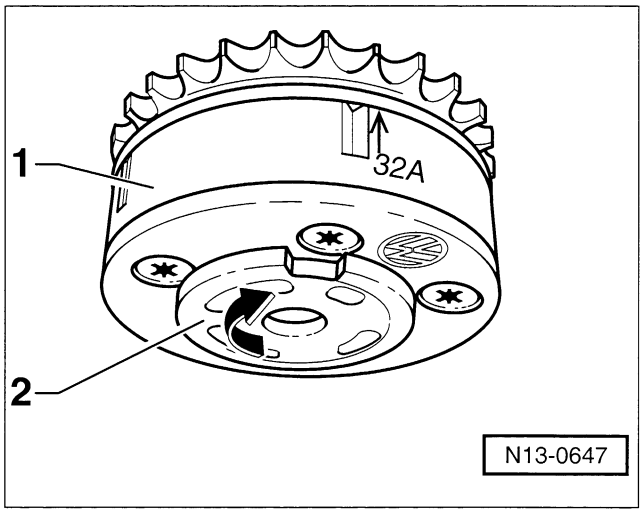
– Place upper camshaft timing chain on intermediate shaft chain sprocket.

– Guide chain between tensioning rail and guide rail toward control housing.

– First install intake camshaft sprocket/timing adjuster along with upper camshaft timing chain.

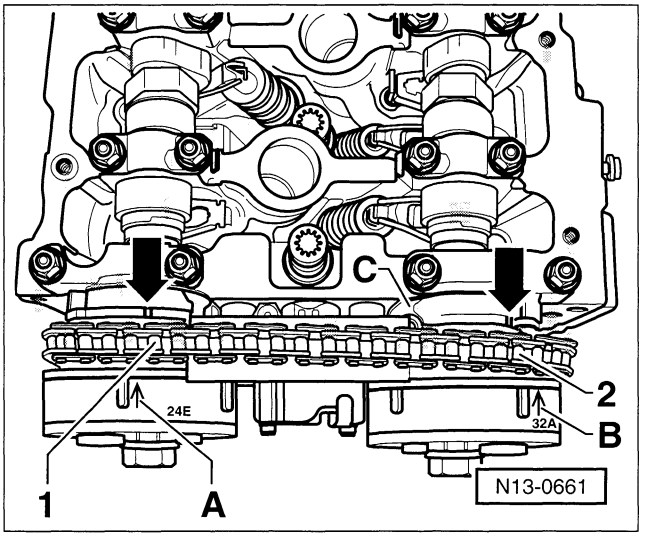


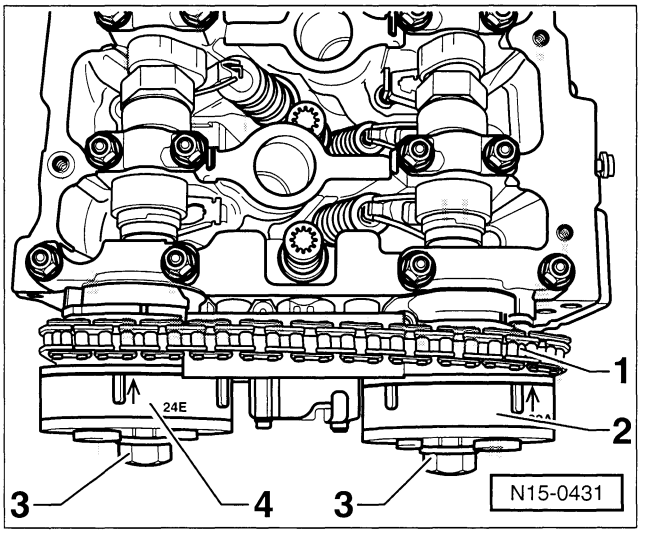
➢ Position both camshaft timing adjusters on the camshaft mountings (**arrows**).

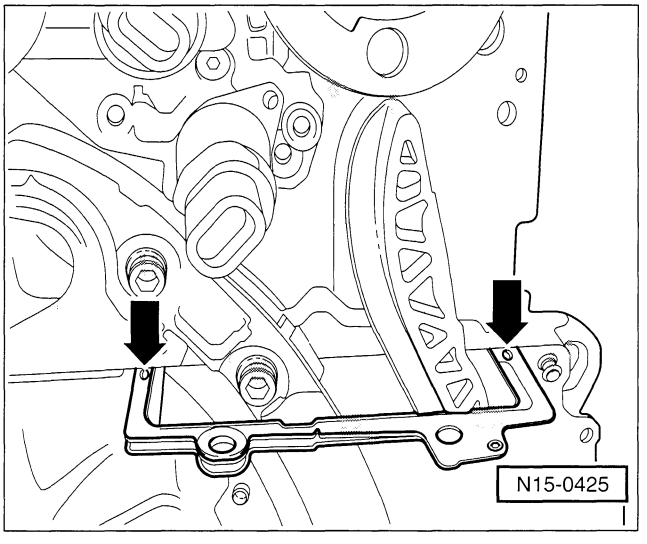


➢ The exhaust camshaft sprocket/timing adjuster (**1**) can be turned in two directions. When installing, ensure that the sensor wheel (**2**) for the CMP sensor is turned onto limit stop in direction of (**arrow**). The distance between the two ground-down teeth of the intake and exhaust camshaft timing adjusters (markings 24E and 32A, respectively) must be exactly 16 rollers of the camshaft roller chain

– Install exhaust camshaft sprocket/timing adjuster with fitted camshaft roller chain.







Marks (**A**) and (**B**) on camshaft timing adjusters must align with notches (**arrows**) on control housing (**C**).

– Tighten new securing bolts for camshaft timing adjuster hand tight.

– Check distance between tooth (**1**) and tooth (**2**) of camshaft timing adjuster. It must be exactly 16 rollers of camshaft roller chain.

– Remove camshaft bar T10068.

– Turn crankshaft two full turns in engine direction of rotation and check valve timing as described earlier.

NOTE —
When the crankshaft is turned, the tensioning rail must be pressed against the camshaft roller chain by hand instead of with the chain tensioner.

– If marks on camshaft adjusters do no align, repeat timing adjustment. If marks do align, remove camshaft alignment bar T10068.

Install mounting bolts (**3**) for camshaft sprockets/timing adjusters (**4** and **2**). Counter-hold camshaft on flats with 32mm wrench.

Tightening Torque

- Camshaft sprockets/timing adjusters to camshaft . . . . . .60 Nm (44 ft-lb) + ¼ turn (90°)

– Coat sealing surfaces of flywheel/drive plate sealing flange with sealing compound AMV 188 001 02 and install. Tighten securing bolts to 8 Nm.

– Install flywheel/driveplate sealing flange.

Fill 3 mm holes (**arrows**) in cylinder head gasket with sealing compound AMV 174 004 02.

– Coat sealing surface of cover with sealing compound AMV 188 001 02.

– Lubricate O-ring for oil channel seal and insert into cover together with seal ring.

– Install camshaft sprocket cover as described earlier.

– Install chain tensioner for camshaft roller chain and tighten to 40 Nm (30 ft-lb).

– Turn crankshaft two full turns in engine direction of rotation and check valve timing as described earlier.

– Install cylinder head (valve) cover and intake manifold as described earlier.

– Check camshaft adjustment using VAG 1551/1552 diagnostic scan tool or equivalent.

CYLINDER HEAD, REMOVING AND INSTALLING (BDF ENGINE)

The cylinder head can be removed and installed with engine in vehicle. Internal and external cylinder head assembly views given earlier, show views of the 2.8L cylinder head and related components. Note that the cylinder head bolts are stretch type fasteners and should never be reused. In addition, whenever the cylinder head or the cylinder head gasket is replaced, the coolant must also be replaced, see **19 Engine–Cooling System**.

If a failed head gasket or warped head is suspected, a compression test, as described earlier under **Diagnostic Testing,** may aid diagnosis and should be performed before the cylinder head is removed. A failed head gasket may be caused by a warped cylinder head. When replacing a failed head gasket, always check the cylinder head for straightness. See **Cylinder Head Components.**

Cylinder head, removing

> ***WARNING —***
> *Do not start work on a hot engine. Allow to cool sufficiently before proceeding. Engine temperature must be no hotter than warm to the touch. Cylinder head warpage can result due to uneven cooling rates.*

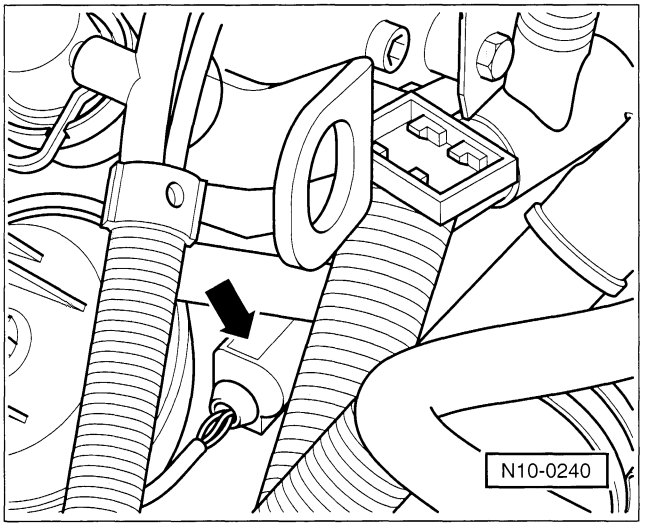
NOTE —

- *Volkswagen special tool T10068, camshaft alignment bar, is specified for setting valve timing during camshaft installation. The tool is relatively inexpensive and highly recommended.*
- *It is advisable to read the entire procedure through before beginning the job.*
- *Disconnecting the battery cables will erase fault codes and basic settings in the engine management and automatic transmission control unit memories. Some driveability problems may be noticeable until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. See* **24b Fuel Injection – Motronic (2.8L engine)** *for additional information. In most instances proper diagnosis will require the use of a scan tool such as the Volkswagen supplied VAG 1551 or 1552. See* **ST Scan Tool** *section at the back of this manual.*
- *Cylinder head will be removed with the exhaust manifold and the lower intake manifold still attached.*

– Remove engine cover.

– With ignition switched off, disconnect battery negative terminal from the battery.

NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.



– Remove the cylinder head (valve) cover and intake manifold as described earlier.

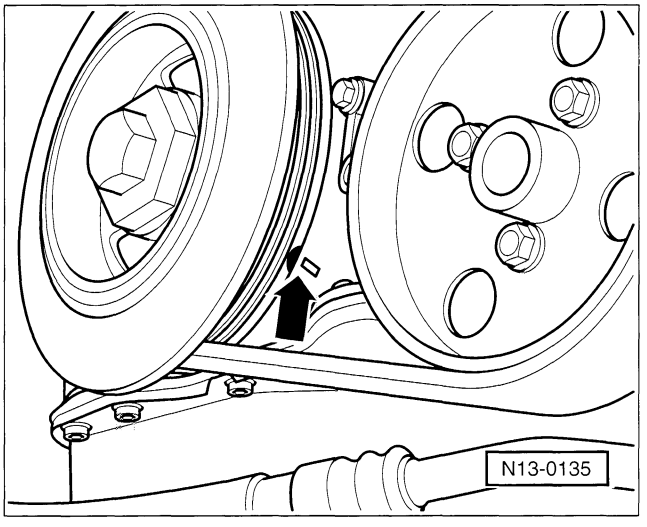
– Remove lower sound absorber panels (belly pan).

◄ Disconnect 4-pin harness connector from Engine Coolant Temperature (ECT) sensor.

– Drain engine coolant, see **19 Engine–Cooling System**.

– Disconnect all coolant hoses from outlets on cylinder head.

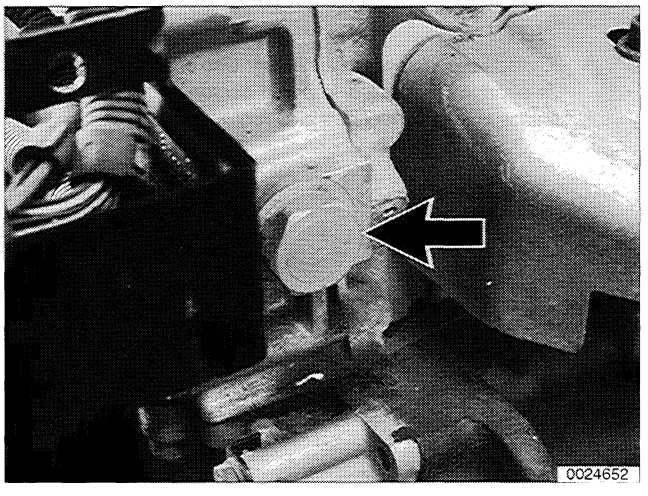
> ***WARNING —***
> *Hot coolant can scald. Drain coolant only with the engine cold.*



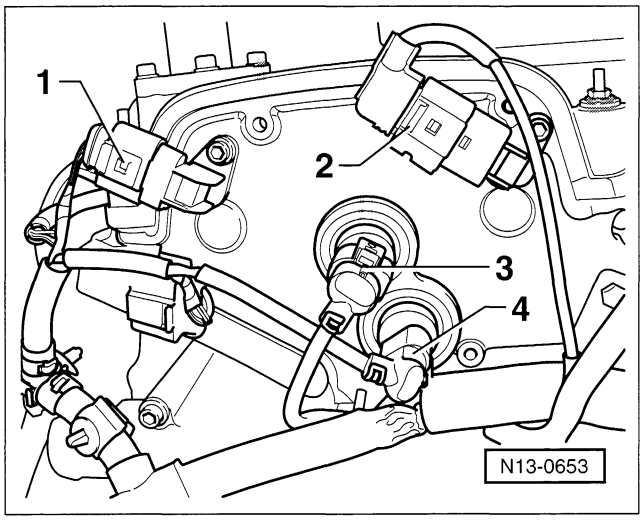
– Remove thermostat housing.

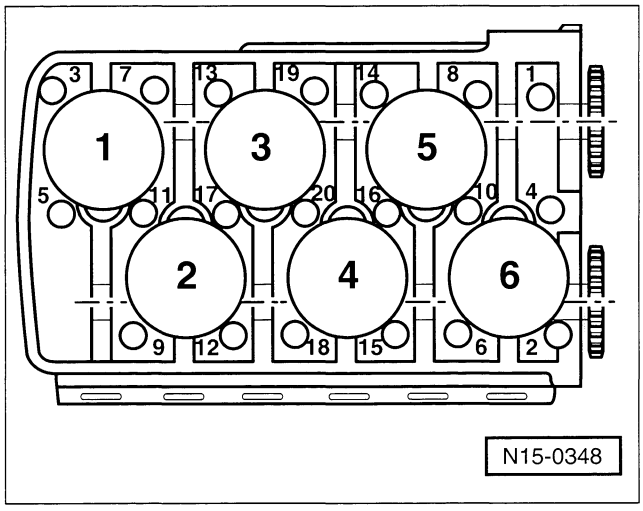
– Remove ignition coil pack and ground strap.

◄ Use a socket wrench on crankshaft vibration damper center bolt to rotate engine clockwise by hand. Align timing mark on vibration damper with mark on front engine cover (**arrow**) to set #1 cylinder to Top Dead Center (TDC).



◄ Remove camshaft timing chain tensioner (**arrow**).





➤ Disconnect connections from following components on camshaft sprocket cover:

1. **Camshaft position sensor (G40)**
2. **Camshaft position sensor 2 (G163)**
3. **Intake camshaft adjustment valve (N205)**
4. **Exhaust camshaft adjustment valve (N318)**

NOTE —
Mark connector and components before removal.

– Unclip wiring harness from camshaft sprocket cover.

– Remove camshaft sprocket cover, see **Camshaft sprocket cover, assembly** given earlier.

– Remove camshaft drive chains as described earlier.

– Disconnect exhaust pipes from exhaust manifolds, see **26 Exhaust System and Emission Controls**.

➤ Gradually and evenly loosen the 20 cylinder head bolts, following loosening sequence at left. Use special tool 3452 for Polydrive cylinder head bolts. Do not reuse head bolts.

NOTE —
Two of the old head bolts, with the hex heads removed, can be used as alignment dowels during cylinder head installation.

– Carefully lift off cylinder head and place in a clean area. Check to make sure no hoses or wires are interfering with removal. If head is stuck, use a soft-faced mallet or pry gently with a wooden stick.

CAUTION —
Some of the valves will be open. Use extra care when removing and handling to avoid damage. Place the cylinder head on the bench or table so that the weight of the cylinder head will not rest on the valves.

NOTE —
Cylinder head assembly is heavy. Use of a lifting device is strongly suggested to avoid personal injury and/or damage to cylinder head and vehicle.

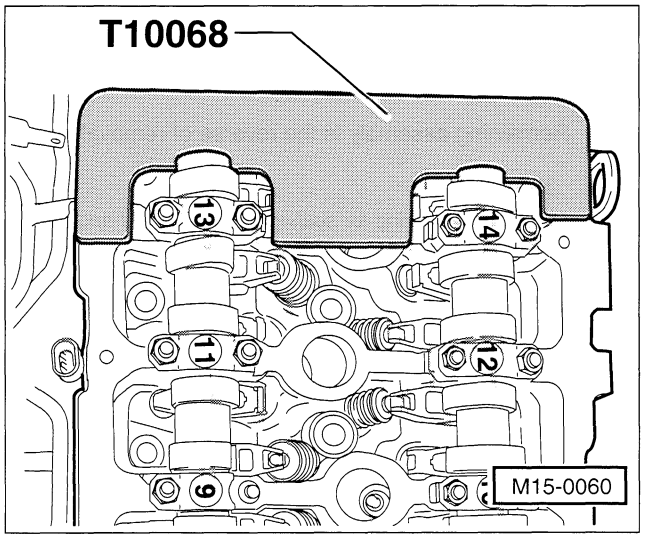
Cylinder head, installing

Before proceeding with installation of cylinder head, whether an original or a new unit, observe the following important points:

- Check cylinder head and block for distortion and warpage, see **Cylinder Head Components**, given later.
- Carefully clean cylinder block and cylinder head sealing surfaces being sure to avoid scratching them during cleaning process. Do not use metal scrapers or wire brushes.
- When using abrasive paper do not use any grades coarser than 100 grit (such as 80 grit). Lower numbers are coarser.
- If cylinder head will not be reinstalled immediately, take precautions to prevent rust from forming on cylinder block walls and gasket sealing surfaces.
- When cleaning old gasket material off of cylinder block, take precautions to keep old gasket material and abrasive particles and dirt out of the cooling and oiling system passages. Place a clean shop cloth over cylinders to prevent contamination from getting between cylinder wall and piston.
- Do not take new cylinder head gasket out of packaging until ready to use. Handle new gasket with extreme care as any damage will lead to leaks.
- There MUST NOT BE any oil or coolant in the head bolt holes in the cylinder block. Any fluids in the holes creates the danger of hydrolock while torquing which could lead to structural damage of cylinder block. Use thread chasers to remove foreign material as required. Be sure that all 20 bolt holes are clean and dry.
- When all traces of the old gasket material have been removed from cylinder block and head, carefully remove all traces of metal particles, abrasives and lint. All gasket sealing surfaces and bolt holes must be clean and dry to ensure a proper seal.
- Always use new cylinder head bolts and a new cylinder head gasket.
- Do not use any gasket sealer on the new cylinder head gasket except where specifically advised to do so.
- If installing a Volkswagen supplied replacement cylinder head, be sure to inspect for and remove any plastic packaging materials used to protect the head and open valves.

– Ensure that engine is still set to TDC for cylinder #1 as shown earlier.

➢ Position camshafts so that Volkswagen special tool T10068, camshaft alignment bar, fits into slots in the end of the camshafts.

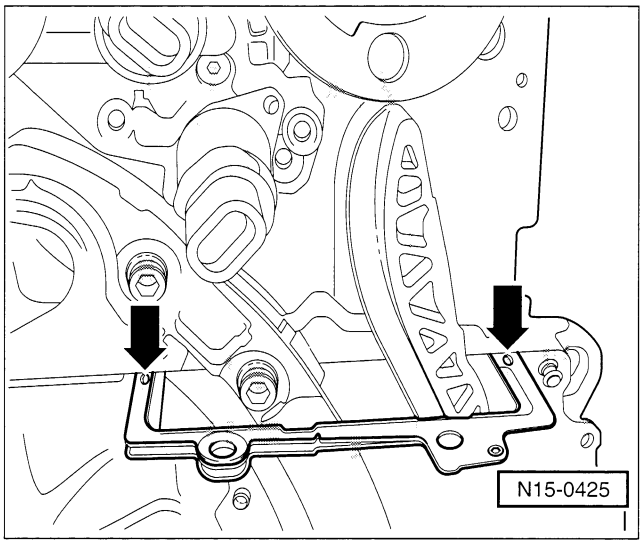


– Install new cylinder head gasket onto block over the alignment dowels with numbers and letters facing up.

NOTE —

- *Remove new cylinder head gasket from packaging only immediately before installation.*
- *Handle gasket with extreme care. Damage will lead to leaks.*

– Install alignment dowels into bolt holes #12 and #20 to help properly locate cylinder head onto head gasket.



➤ Fill 3 mm holes in cylinder head gasket with sealing compound AMV 188 001 02.

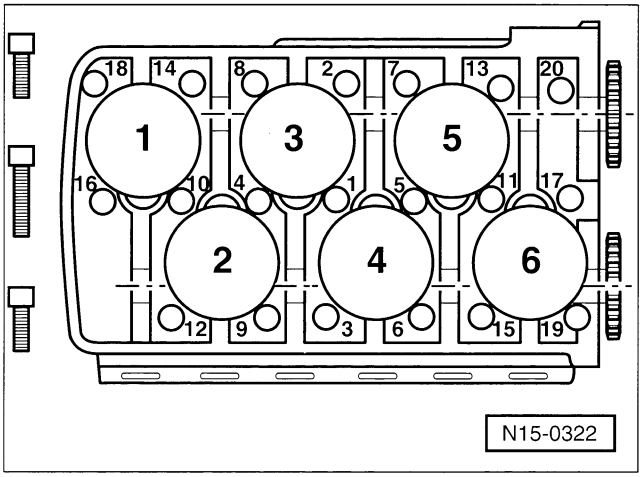
NOTE —

Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.

– Carefully install cylinder head onto block over the alignment dowels and screw in new head bolts. Tighten the bolts hand-tight only.

NOTE —

Be sure that none of the wiring or any vacuum hoses are caught between cylinder head and block.



➤ Tighten the 20 cylinder head bolts in four stages following the tightening sequence shown at left.

CAUTION —

Always replace the cylinder head mounting bolts. They are stretch bolts designed to be used only once.

Tightening torque

- Cylinder head to cylinder block, 2.8L engine (stretch bolts – always replace)

stage I	30 Nm (22 ft-lb)
stage II	50 Nm (37 ft-lb)
stage III	additional ¼ turn (90°)
stage IV	additional ¼ turn (90°)

– Remaining assembly is the reverse of removal.

NOTE —

Ensure that O-ring for sealing the oil channel and the seal in the sprocket cover are installed.

– Install timing chains and adjust valve timing as described earlier.

– Install cylinder head (valve) cover and intake manifold as described earlier.

– Fill cooling system with fresh coolant, see **19 Cooling System**.

– Check camshaft timing adjustments using VAG 1551/1552 or equivalent aftermarket diagnostic scan tool, as described below.

– Be sure to quality check your work, see **Quality Review** at the end of this repair group.

Camshaft timing adjustment, checking

The camshaft timing adjustment is dependent upon load and speed. Oil pressure is directed to the camshaft timing adjuster (mechanical adjustment unit) by the camshaft timing adjustment solenoid valve and the camshaft adjuster then adjusts the camshaft.

Test conditions

- All fuses OK
- Battery voltage at least 11.5 volts
- All electrical consumers, i.e. lights, rear window defrost, air conditioning, etc. must be off.
- Gear selector lever must be in "P" or "N" on vehicles with automatic transmission.
- No Diagnostic Trouble Codes (DTCs) must be stored in memory.

– Connect VAG 1551/1552, or aftermarket equivalent, diagnostic scan tool. For connector location see **ST Scan Tool** section in the back of this manual.

– Switch ignition on (engine not running) and select Motronic Engine Control Module (ECM) by pressing buttons -0- and -1- for address word "Engine electronics" and confirm entry with -Q- button.

– Press buttons -0- and -3- for function "Output Diagnosis Test Mode (DTM)". The following components will be operated in the order listed during DTM:

1. EVAP canister purge regulator valve (N80)
2. Secondary air injection solenoid valve (N112)
3. Secondary air injection pump relay (J299)
4. Intake manifold change-over valve (N156)
5. Intake camshaft adjustment valve (N205)
6. Leak detection pump (V144)
7. Exhaust camshaft adjustment valve (N318)
8. Brake system vacuum pump (V192)
9. Cylinder 1 fuel injector (N30)
10. Cylinder 5 fuel injector (N83)
11. Cylinder 3 fuel injector (N32)
12. Cylinder 6 fuel injector (N84)
13. Cylinder 2 fuel injector (N31)
14. Cylinder 4 fuel injector (N33)

NOTE —

- *During DTM components are checked by hearing them operate or by feel.*
- *Run engine briefly first if there is a requirement to repeat Output Diagnosis Test Mode (DTM).*

NOTE —

Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*

- Ensure that Intake camshaft adjustment valve (N205) and Exhaust camshaft adjustment valve (N318) operated during DTM.
- If activation is OK, continue checking function of camshaft timing adjuster.
- With scan tool connected, start engine and select Motronic Engine Control Module (ECM) by pressing buttons -0- and -1- for address word "Engine electronics" and confirm entry with -Q- button.
- Press buttons -0- and -4- for function "Initiate basic setting" and confirm entry with -Q- button.
- Press buttons -0-, -0- and -1- for function "Display group number 1" and confirm entry with -Q- button.
- Ensure that engine coolant temperature is at least 85°C. This will be indicated on the scan tool in display zone 2.
- Press -C- button to clear entry and continue test.

Intake camshaft timing adjustment, checking

- Press buttons -0-, -9- and -4- for function "Display group number 94" and confirm entry with -Q- button. Scan tool will indicate "System in basic setting 94".
- Depress brake pedal and hold.
- Depress accelerator pedal down to wide open throttle position.
  - Engine speed will be increased by engine control module to approximately 2300 rpm.
- Hold brake pedal and accelerator down until display in display zone 3 jumps from "Test OFF" to "Test ON".
- Continue to hold brake pedal and accelerator down until display zone 3 displays "Syst. OK." This indicates the system is operating properly, continue with **Exhaust camshaft timing adjustment, checking**.
- Release brake and accelerator pedals.

- If "Syst.n.OK" (system not OK) appeared in display zone 3, press arrow (⇒) button.
- Check DTC memory and read readiness code using scan tool. Generate readiness code if DTC memory has been erased or if voltage supply has been disconnected.
- If no DTCs are stored in memory, press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Switch ignition off.
- Check camshaft position sensors (G40) and (G163). The harness connectors may be interchanged.
- Check oil pressure, see **17 Engine–Lubrication System**.
- Check valve timing as described earlier.
- If no faults can be found as described above, replace the intake camshaft timing adjustment valve (N205).
- Repeat test using diagnostic scan tool. If "Sys. OK" appears in display zone 3 then continue with **Exhaust camshaft timing adjustment, checking**.

Exhaust camshaft timing adjustment, checking

- Press buttons -0-, -9- and -6- for function "Display group number 96" and confirm entry with -Q- button. Scan tool will indicate "System in basic setting 94".
- Depress brake pedal and hold.
- Depress accelerator pedal down to wide open throttle position.
  - Engine speed will be increased by engine control module to approximately 2300 rpm.
- Hold brake pedal and accelerator down until display in display zone 3 jumps from "Test OFF" to "Test ON".
- Continue to hold brake pedal and accelerator down until display zone 3 displays "Syst. OK." This indicates the system is operating properly.
- Release brake and accelerator pedals.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.

- If "Syst.n.OK" (system not OK) appeared in display zone 3, press arrow (⇒) button.
- Check DTC memory and read readiness code using scan tool. Generate readiness code if DTC memory has been erased or if voltage supply has been disconnected.
- If no DTCs are stored in memory, press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Switch ignition off.
- Check camshaft position sensors (G40) and (G163). The harness connectors may be interchanged.
- Check oil pressure, see **17 Engine–Lubrication System**.
- Check valve timing as described earlier.
- If no faults can be found as described above, replace the exhaust camshaft timing adjustment valve (N318).
- Repeat test for exhaust camshaft timing adjustment to ensure system is operating properly.

CYLINDER HEAD COMPONENTS (BDF ENGINE)

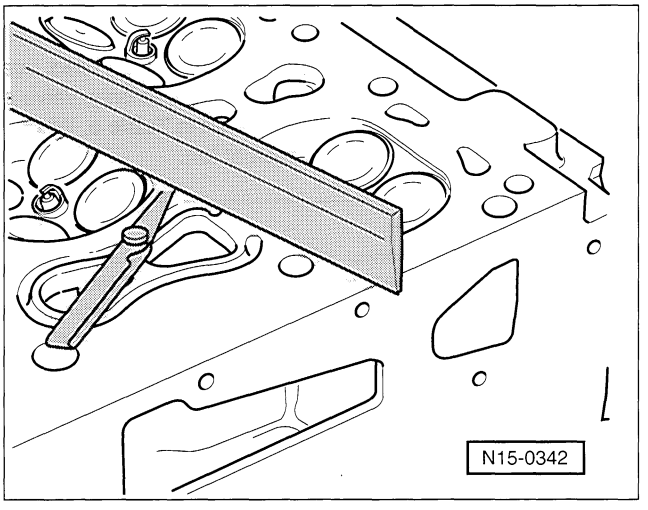
Cylinder head and camshafts

Cylinder heads with small, fine cracks between valve seats and plug threads are usable provided the cracks are not more than 0.5 mm (0.02 in.) wide, and do not extend into more than the first few spark plug threads. They will not reduce service life of the cylinder head.

If camshafts were removed or if installing a new or remanufactured cylinder head, lubricate the contact surfaces between cam lobes and hydraulic cam followers prior to start-up.

When removing and installing the camshafts, follow the procedure given under **Camshafts, removing** and **Camshafts, installing.** Special procedures and special tools are required for camshaft removal and installation. Incorrect camshaft removal and/or installation will usually result in damaged camshafts, cylinder head or pistons. Always lubricate contact surfaces between cam lobes and hydraulic cam followers prior to start-up.

When replacing cylinder head or cylinder head gasket, always flush out all the old coolant and replace with new coolant. The will help ensure that any metal shavings and contaminants are removed from engine and cooling system. See **19 Engine–Cooling System** for draining and flushing procedures.

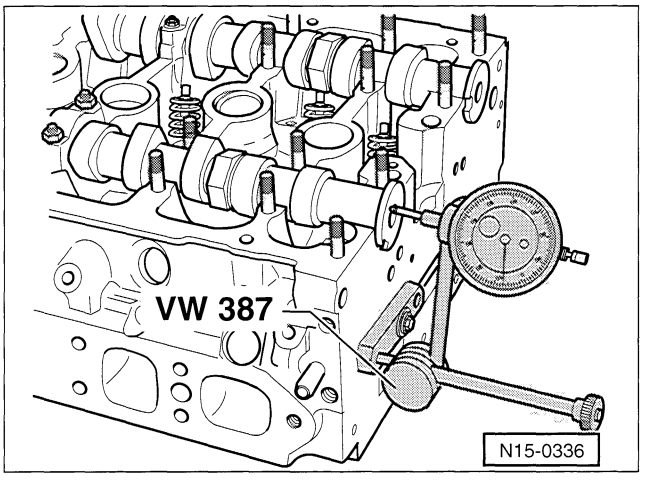


Check cylinder head for warpage and distortion with an accurate straight edge and feeler gauge.

Specification

- Maximum cylinder head distortion/warpage . . . . . 0.05 mm (0.002 in.)
- Minimum cylinder dimension (valve cover gasket surface to head gasket surface) . . . . . 139.9 mm (5.508 in.)

The cylinder head can be resurfaced as long as the distance from cylinder head (valve) cover seating surface to the head gasket surface is never less than specified. Machining too much material off of the cylinder head surface will change the compression ratio and will affect engine emissions.



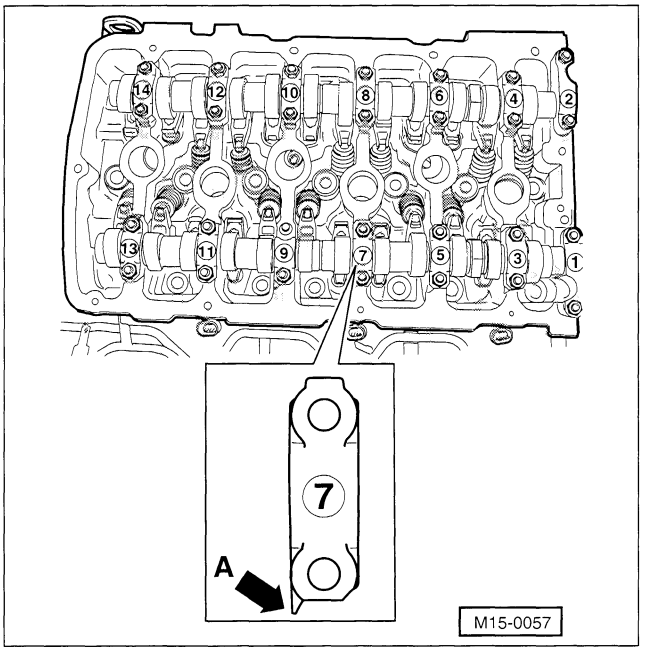
Camshafts and cam followers

The in and out movement of the camshaft is known as axial play and is measured with the cam followers and drive chain removed and only the first and last bearing caps installed.

Use a dial gauge on the sprocket end of camshaft to check axial play by moving camshaft as far as it can go in each direction (**arrow**).

Specification

- Camshaft axial play . . . . . 0.10 mm (0.004 in.) max.



Do not interchange camshaft bearing caps or cam followers.

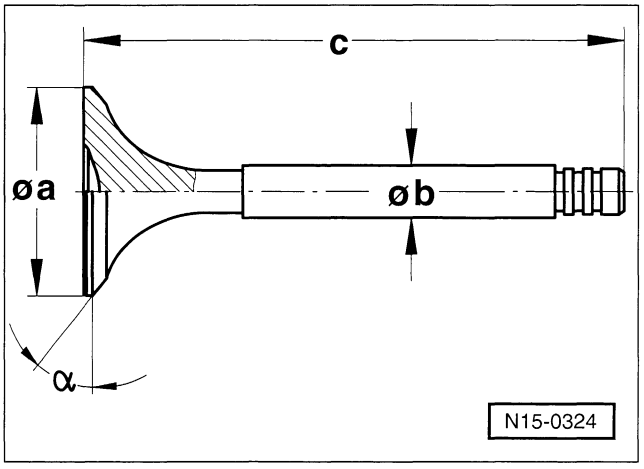
- Points of bearing caps (**arrow A**) on intake and exhaust camshafts point downward toward intake manifold.
- Numbers on caps must be readable from intake camshaft side.

NOTE —

- *To avoid uneven and accelerated wear, bearing caps must be reinstalled in their exact original positions.*
- *Grease contact surfaces (sides) of bearing caps 7 and 8 lightly with G 052 723 A2 grease before installing.*
- *Tighten nuts on bearing caps alternately and evenly, so that valve spring is tensioned evenly and camshaft is drawn down fully into bearing saddle.*

CAUTION —

After installing new cam followers, the engine should not be started for at least 30 minutes. New cam followers are at full height and must be allowed to bleed down to their proper height. Failure to do this may cause valve or piston damage.



Valves

Exhaust valves in the 2.8L engine are sodium-filled. Intake and exhaust valves must be hand-lapped only. Valve and valve spring specifications are given in **Table e**. When using the table refer to illustration at left.

> ***WARNING —***
> *Sodium filled valves, when discarded, must be disposed of properly to avoid personal injury. Always wear protective goggles or glasses. By hand, cut off the valve stem near the head of each valve. Use only a hack saw. Do not use a power saw. Sodium reacts violently with water. Do not let water contact valve while cutting. Throw valve parts (no more than 10 valves at a time) into a bucket of water and stand clear. Discard valves when reaction has ceased.*

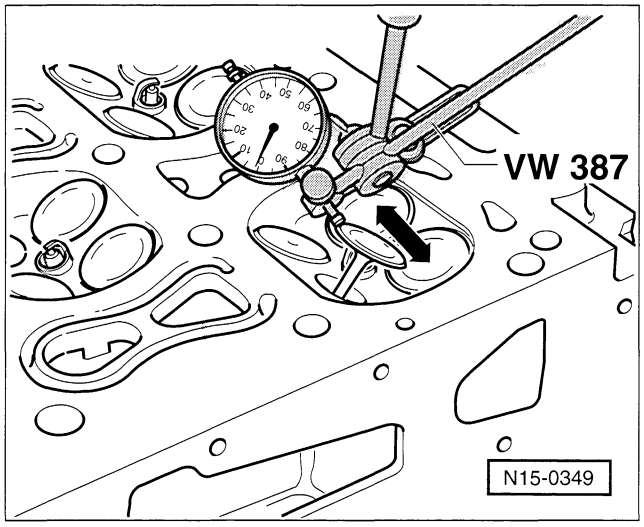
Table e. Valve Dimensions (BDF Engine)

Valve	Dimension
Valve head diameter (**a**)	
intake	
short	31.00 mm (1.2204 in.)
long	31.00 mm (1.2204 in.)
exhaust	
short	27.00 mm (1.0629 in.)
long	27.00 mm (1.0629 in.)
Valve stem diameter (**b**)	
intake	
short	5.96 mm (0.2346 in.)
long	5.96 mm (0.2346 in.)
exhaust	
short	5.94 mm (0.2338 in.)
long	5.94 mm (0.2338 in.)
Valve length (**c**)	
intake	
short	102.2 mm (4.024 in.)
long	136.1 mm (5.358 in.)
exhaust	
short	102.5 mm (4.035 in.)
long	136.4 mm (5.370 in.)
Valve face angle (α)	
intake- all	45°
exhaust -all	45°

Valve guides

Special tools and a press are required to replace valve guides. Inspect valve seats to ensure that cylinder head can be reconditioned before installing new valve guides.

NOTE —
Replacement valve guides for the 2.8L 24V engines are not available through the Volkswagen/Audi parts system. In cases where the wear limits are exceeded, Volkswagen recommends cylinder head replacement.



➤ Check valve guide wear using new valve. Rock valve back and forth (**arrow**) to check total travel.

Specification

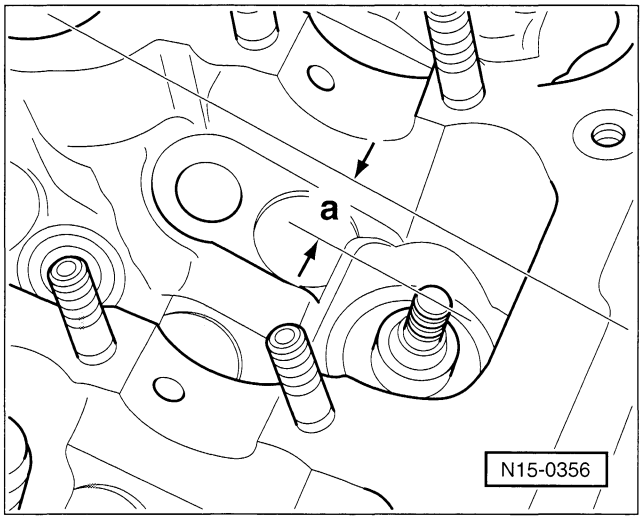
- Valve guide wear (with new valve)
  intake and exhaust . . . . . 0.8 mm (0.031 in.)

CAUTION —
*When checking valves guides, be sure to use an exhaust valve on the exhaust side and an intake valve on the intake side. Exhaust and intake valve stem diameters are slightly different. See **Table b**.*

– If valve guide specification is exceeded, cylinder head must be replaced.

Valve seats

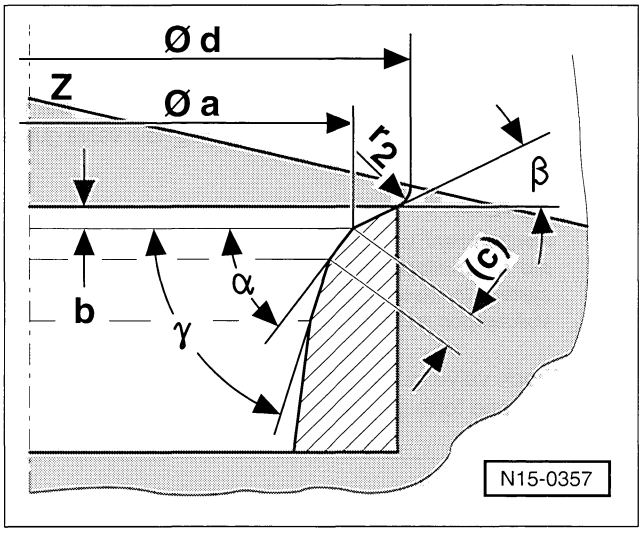
When resurfacing valve seats, there is a limit to the amount of material that can be removed. If too much material is removed, the final assembly will leave too little space for hydraulic cam follower to function correctly. The maximum refacing dimension, that is, the maximum amount of material that can be removed from the valve seat, is calculated as described below.



➤ Measure distance between top of valve stem and gasket surface of cylinder head (dimension **a**), and subtract minimum dimension, as given in **Table f**. The difference is the maximum amount of material that can be removed from valve seat.

Table f. Minimum Dimensions for Calculating Valve Seat Refacing Dimensions (BDF Engine)

Valve	Minimum dimension
Intake short long	 31.8 mm (1.252 in.) 10.2mm (0.402 in.)
Exhaust short long	 31.8 mm (1.252 in.) 10.2mm (0.402 in.)



Valve seat dimensions from illustration at left are given in table **Table g**.

Table g. Valve Seat Dimensions (BDF Engine)

	Intake	Exhaust
Seat diameter (**a**)	30.6 mm (1.205 in.)	26.7 mm (1.051 in.)
Maximum refacing dimension (**b**)	Calculated see above	Calculated see above
Seat width (**c**)	0.9-1.5 mm (0.035-0.059 in.)	1.2-1.7 mm (0.047-0.067 in.)
Max. diameter (**d**)	35.0 mm (1.378 in.)	29.0 mm (1.142 in.)
Radius (**r2**)	2.0 mm (0.079 in.)	2.0 mm (0.079 in.)
Valve seat angle (α)	45°	45°
Correction angle, upper (β)	30°	30°
Correction angle, lower (γ)	60°	73°

NOTE —
Z *in above graphic represents lower edge of cylinder head.*

QUALITY REVIEW

When you have finished working under the hood and around other areas of the vehicle it is advisable to take a moment to quality check or review your work. This helps to ensure that the operation or repair has been completed properly with all affected systems functioning within normal parameters. This may include the following:

- Make sure that the radiator fan cycles properly and that the coolant level and concentration are correct.
- Ensure that all cable ties and hose clamps that were removed as part of the repair are replaced.
- Check and adjust all other applicable fluid levels.
- Make sure that there are no fluid leaks.
- Make sure that there are no air, vacuum or exhaust leaks.
- Make sure that all components involved in the repair are positioned correctly and function properly.
- Male sure all tools, shop cloths, fender covers, and protective tape are removed.
- Clean grease from painted surfaces and steering wheel.
- Unlock the anti-theft radio and reset the clock.

In addition to the above noted points, the ECM and TCM may need to be checked using the Volkswagen supplied VAG 1551 or 1552 scan tools or the VAS 5051 or 5052 diagnostic computer, or equivalent, as mentioned at the start of this repair.

15e Cylinder Head and Valvetrain (1.9L PD Engine)

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Cylinder leakdown test 15e-3

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15e

GENERAL

This section covers most cylinder head and valvetrain service and repair work for the 4-cylinder, 2 valve per cylinder, 1.9 liter PD (Pumpe Düse, or Pump Injection) diesel engine. Substantial differences exists between the this version of the 1.9L engine and the earlier ALH diesel engine, although both are Turbo Direct Injection (TDI) engines. For information on short block engine rebuilding and internal engine specifications, see **13a Crankshaft/Cylinder Block (4-cylinder)**.

Most of the operations described in this repair group require special equipment and experience. If you lack the skills, tools, or a suitable workplace for servicing or repairing the cylinder head, we suggest that you leave these repairs to an authorized Volkswagen dealer or other qualified shop.

Engine Codes

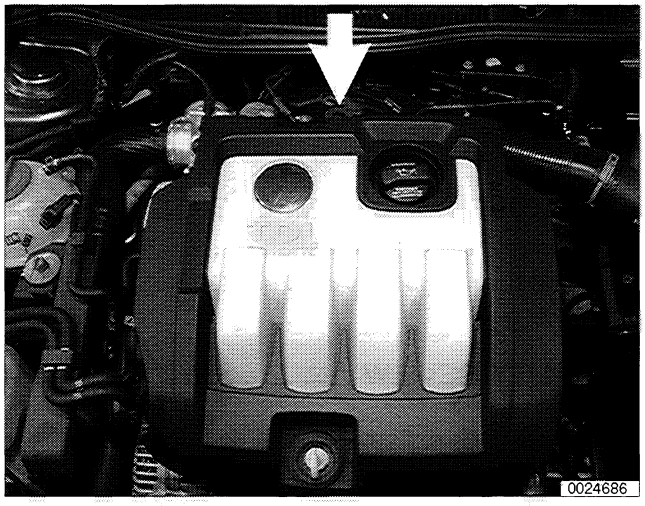
- BEW . . . . . 1.9L 4-cylinder turbo PD diesel

DIAGNOSTIC TESTING

The tests that follow can be used to help isolate engine problems, to better understand a problem before starting expensive and extensive repairs, or to just periodically check engine condition.

Compression Test

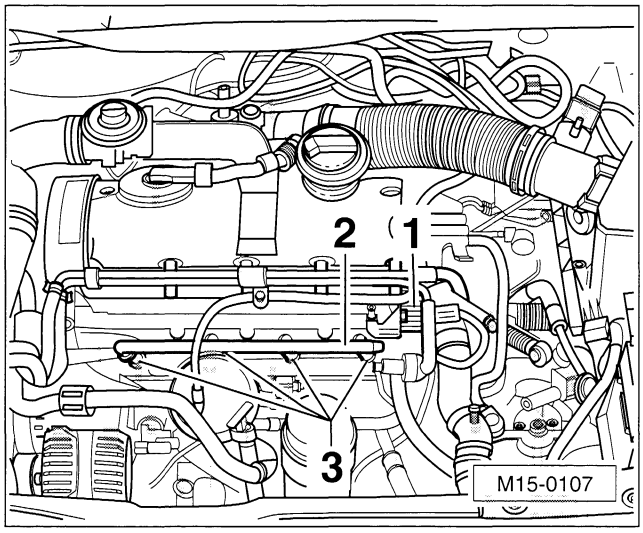
A compression test will tell a lot about the overall condition of the engine without the need for taking it apart. Testing is relatively simple and straightforward.



– Warm-up engine until it is a minimum of 30°C (86°F).

➢ Remove engine cover by pulling forward edge upward and pulling forward out of rear securing clip (**arrow**).

NOTE —
It is not necessary to remove the engine oil dipstick before removing engine cover.

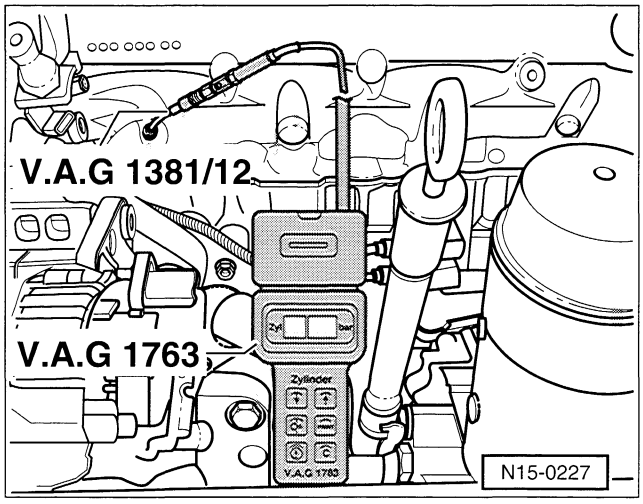


➢ Disconnect central harness connector (**1**) for fuel injectors.

– Disconnect bus connector (**2**) from glow plugs by gently pulling up on it. Lay complete bus connector aside.

– Use compressed air to clear area around glow plugs.

– Using a 10 mm deep socket with swivel or special tool 3220, remove all glow plugs (**3**).



➢ Install compression tester adaptor VAG 1381/12 into glow plug hole and connect compression tester. Volkswagen supplied VAG 1763 shown.

– Have a helper:
- depress clutch pedal fully
- put transmission in neutral or park
- crank engine over with starter motor

– Observe compression tester manufacturers instructions for proper operation.

NOTE —
Cranking engine over with diesel injection system components disconnected may Diagnostic Trouble Codes (DTCs) to be stored in engine management system memory.

– Engine should be cranked a minimum of 4 to 5 revolutions.

– Record readings, release pressure in gauge and repeat procedure for each cylinder.

– Compare readings to specification.

Specification

- Compression pressures (1.9L PD diesel engine)
  new . . . . . 25 to 31 bar (363 - 450 psi)
  wear limit . . . . . 19 bar (276 psi)
  maximum difference
  between cylinders . . . . . 5 bar (73 psi)

– When all cylinders have been checked, reinstall glow plugs and bus connector, connect harness connector for injectors. Install upper engine cover.

Tightening torque

- Glow plug to cylinder head. . . . . 15 Nm (11 ft-lb)

Cylinder leakdown test

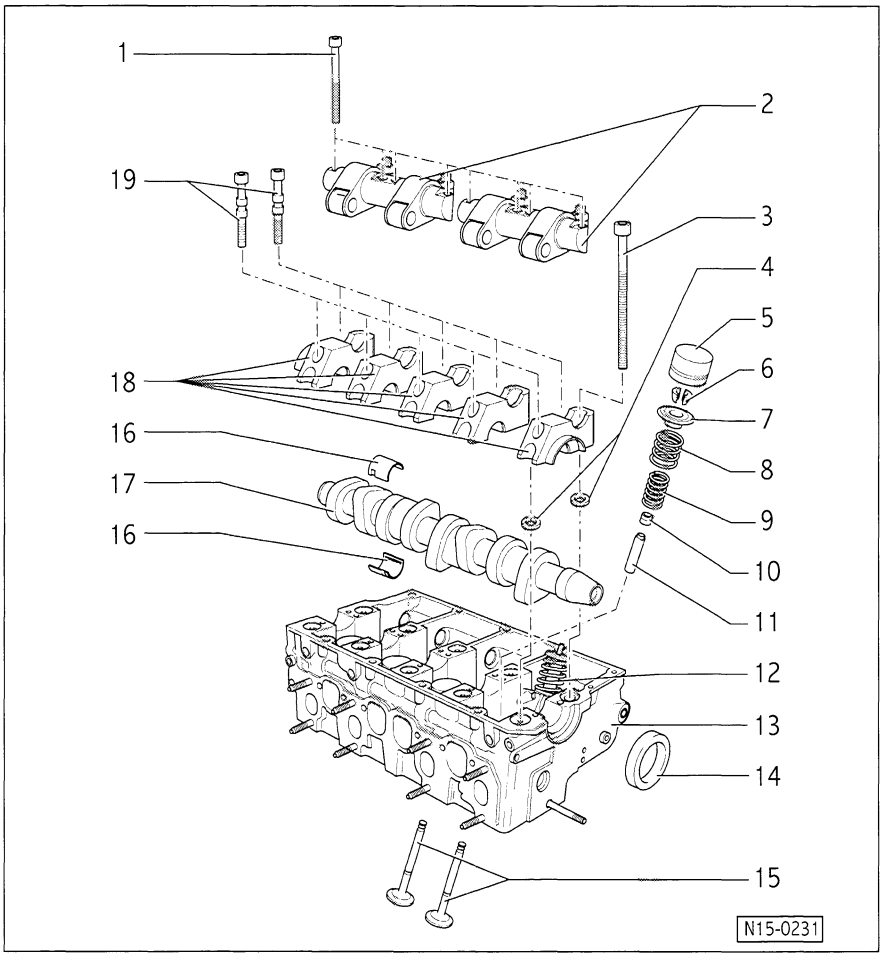
The most conclusive diagnosis of low compression symptoms requires a cylinder leak-down test. Using a special tester and a supply of compressed air, each cylinder is pressurized. The rate at which air leaks out of cylinder, as well as the sound and location of escaping air can more accurately pinpoint the magnitude and source of leakage. Any engine compression diagnosis that will require major disassembly should first be confirmed by a cylinder leak-down test. Because this test requires special equipment and experience, it may be desirable to have it performed by a Volkswagen dealer or other qualified repair shop. Leakdown limit specifications are usually supplied by the equipment manufacturer.

CYLINDER HEAD SERVICE

Many cylinder head repairs can be accomplished without removing cylinder head from engine. The cylinder head cover (valve cover) gasket, camshaft, camshaft oil seal, valve guide oil seals, valve springs, and camshaft followers are all accessible with cylinder head installed. This heading describes those repairs that can be done with cylinder head installed.

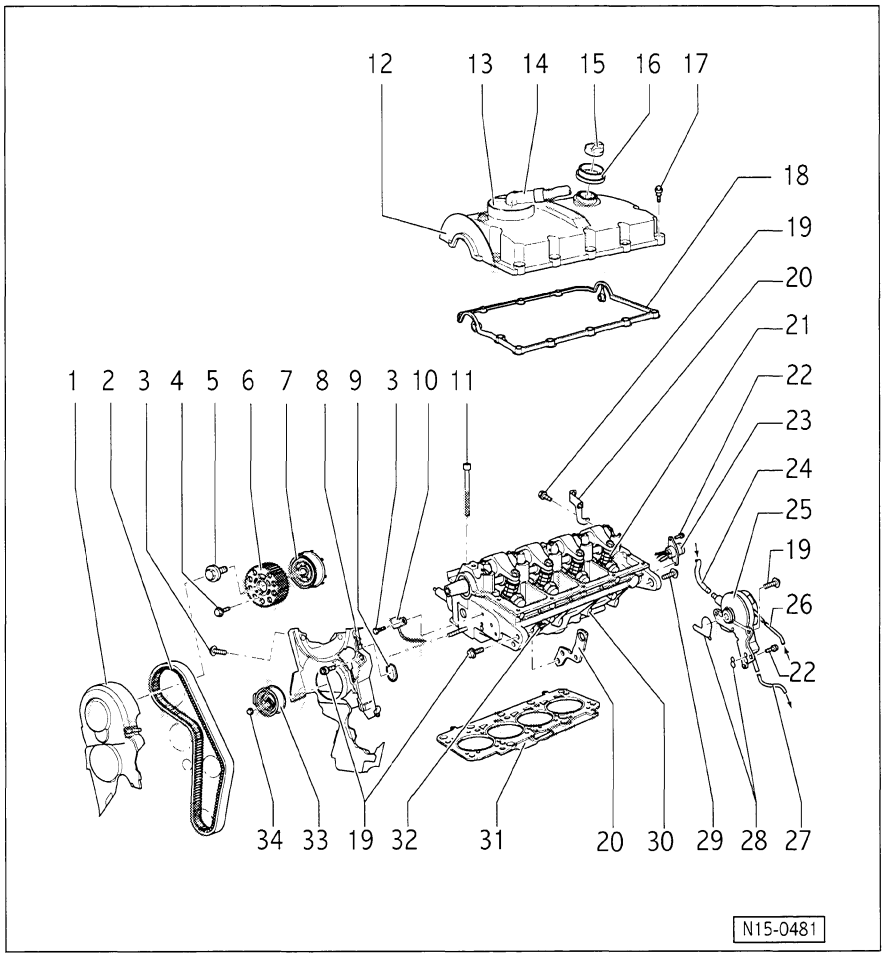
The following two pages contain assembly views of internal and external cylinder head components.

Internal cylinder head assembly



1. **Bolt, rocker arm shaft**
   - Qty. 8
   - Always replace
   - Tighten to 20 Nm (15 ft-lb) + ¼ turn (90°)
   - Note sequence when loosening and tightening, see **Camshaft, removing & installing**
2. **Rocker arm shafts**
   - Qty. 2
   - Do not interchange; mark with permanent marker before removal
   - For pump injectors
3. **Cylinder head bolt**
   - Always replace
   - Note sequence when loosening and tightening, see **Cylinder head, removing & installing**
   - Note washer position in cylinder head
4. **Washer**
   - For cylinder head bolts
   - Position/install in cylinder head before installing bearing caps
5. **Valve lifter, hydraulic**
   - Bearing caps must be removed before lifter can be removed
   - Do not interchange
   - Store with cam contact surface facing downwards
   - Equipped with hydraulic clearance compensation
   - Before installing, check camshaft axial clearance, see **Cylinder Head Components** maximum clearance: 0.15 mm (0.006 in.)
   - Oil contact surfaces
6. **Valve keepers (cotters)**
7. **Valve spring retainer**
8. **Valve spring (outer)**
9. **Valve spring (inner)**
10. **Valve stem seal**
11. **Valve guide**
12. **Pump injector**
    - Removing and installing, see **23 Fuel Injection–Diesel (1.9L Engine)**
13. **Cylinder head**
14. **Seal**
    - Do not additionally oil or grease oil seal sealing lip
    - Before installing, remove oil remains from camshaft journals with a clean cloth
    - To install, tape over (e.g. with cellophane tape) groove in taper of camshaft to protect seal
15. **Valves**
    - Do not rework! Only lapping is permitted
16. **Bearing shell**
    - Do not interchange used bearing shells; mark when removing
    - Ensure proper seating of retaining lugs in bearing caps and cylinder head
17. **Camshaft**
    - Checking radial clearance with plastigage
      wear limit: 0.11 mm (.0043 in.)
    - Run-out: max. 0.01 mm (.0004 in.)
18. **Bearing cap**
    - Note sequence when loosening and tightening, see **Camshaft, removing & installing**
    - When installing, seal joining surfaces of bearing caps 1 and 5 with AMV 174 004 01
19. **Bolt, special**
    - Always replace
    - Tighten to 8 Nm (71 in-lb) + ¼ turn (90°)
    - Note sequence when loosening and tightening, see **Camshaft, removing & installing**

External cylinder head assembly



1. **Timing belt guard, upper outer section**
2. **Timing belt**
   - Mark direction of engine rotation before removing
   - Check for wear
   - Do not kink
3. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
4. **Bolt**
   - Tighten to 25 Nm (18 ft-lb)
5. **Bolt**
   - Tighten to 100 Nm (74 ft-lb)
6. **Camshaft sprocket, outer**
   - Loosen and remove from camshaft/hub with 2-arm puller T40001
7. **Camshaft sprocket, hub**
   - With sender wheel for camshaft position sensor
   - Counterhold with T10051
   - Remove with puller T10052
   - Removing and installing, see **Camshaft, removing & installing**
8. **Timing belt guard, rear**
9. **Sealing grommet**
   - Replace if damaged
10. **Camshaft Position Sensor, G40**
    - Unclip sealing grommet to remove
11. **Cylinder head bolt**
    - Always replace
    - Note sequence when loosening and tightening, see **Cylinder head, removing & installing**
    - Note washer position in cylinder head
12. **Valve cover**
    - Also known as cylinder head cover
    - Thoroughly clean sealing surface before installation
    - Valve cover gasket is integral with the cover itself. If gasket is damaged or leaking, replace the entire cover
    - See: **Valve cover (cylinder head cover) bolts; tightening sequence**
13. **Crankcase ventilation valve**
    - For positive crankcase ventilation and regulation
14. **Fitting/line**
    - To turbocharger
15. **Cap**
    - Replace seal if damaged
16. **Seal**
    - Between valve cover and upper engine sound absorber
    - Replace if damaged
17. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
    - Note sequence when loosening and tightening, see **Valve cover (cylinder head cover) bolts; tightening sequence**
18. **Valve cover gasket**
    - Also known as cylinder head cover gasket
    - When installing, seal corners (transition points) with AMV 174 004 01
    - Although shown separately, valve cover gasket is integral with the cover itself. If gasket is damaged or leaking, replace the entire cover
19. **Bolt**
    - Tighten to 20 Nm (15 ft-lb)
20. **Lifting eye**
21. **Pump injector**
    - Removing and installing, see **23 Fuel Injection–Diesel (1.9L Engine)**
22. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
23. **Central electrical connector**
    - For pump injectors

(continued of following page)

External cylinder head assembly (continued)

24. Fitting/line
- To power brake servo

25. Tandem pump
- For fuel supply
- For vacuum supply
- See **20 Fuel Storage and Supply**

26. Supply line
- From fuel filter
- Marked with white
- Check for proper seating
- Secure with spring clips

27. Return line
- To fuel filter
- Marked with blue
- Check for proper seating
- Secure with spring clips

28. Seals
- Always replace

29. Bolt
- Tighten to 20 Nm (15 ft-lb)

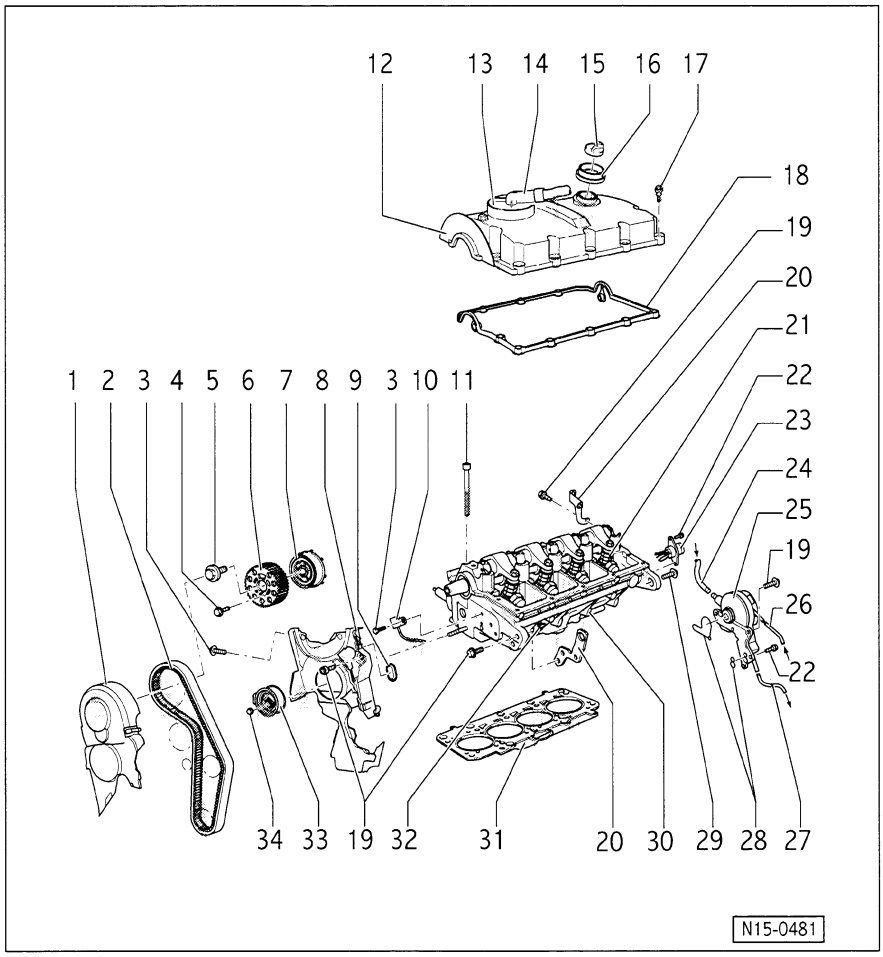
30. Cylinder head
- Replace engine coolant if removing head

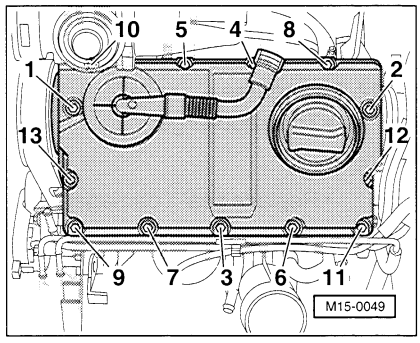
31. Cylinder head gasket
- Always replace
- Always measure piston projection before securing new parts.
- 3 different thicknesses. Thickness determines compression height, see **13a Crankshaft/Cylinder Block (4-cylinder)**
- Replace engine coolant if removing head

32. Glow plug
- Tighten to 15 Nm (11 ft-lb)
- Remove and install with 3220 or 10 mm deep socket with extension and swivel joint

33. Tensioning roller, timing belt

34. Nut
- Tighten to 20 Nm (15 ft-lb) + $^{1}/_{8}$ turn (45°)

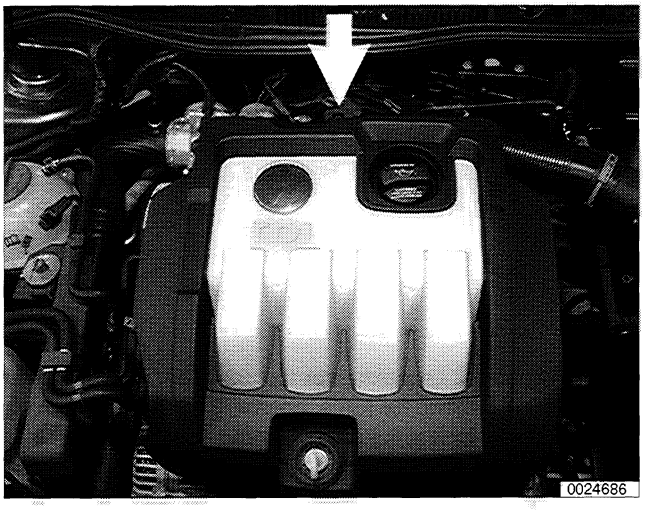




Valve cover bolts, tightening sequence
- Tighten to 10 Nm (7 ft-lb)
- Only tighten bolts in the sequence indicated.

Cylinder head (valve) cover, removing and installing

NOTE —
The valve cover gasket is vulcanized into the rigid aluminum cover and is not available as a separate part.

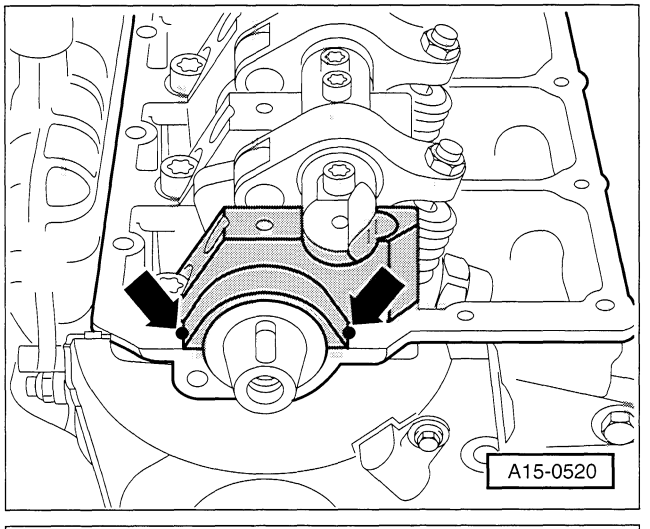


Removing

Remove engine cover by pulling forward edge upward and pulling forward out of rear securing clip (**arrow**).

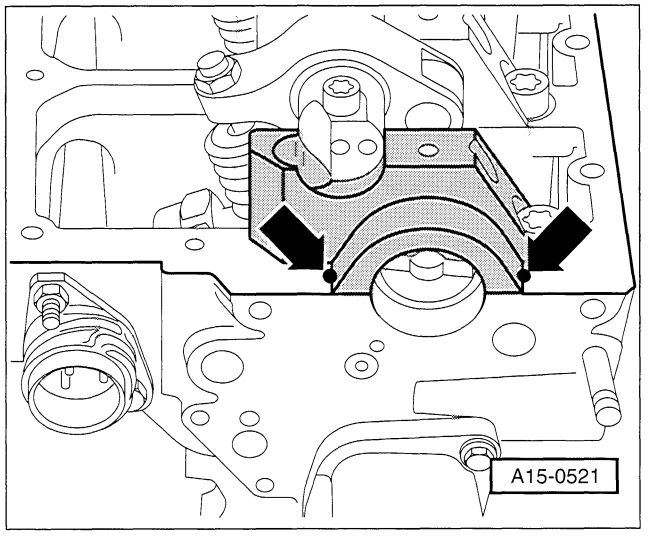
NOTE —
It is not necessary to remove the engine oil dipstick before removing engine cover.

- Remove EGR valve.
- Remove timing belt guard outer upper section.
- Disconnect crankcase breather hose at intercooler connection at rear.
- Remove cylinder head (valve) cover.



Installing

Before installing the cover, apply a drop of sealant AMV 174 004 01 approximately 5 mm in diameter to both side edges of the front bearing cap to cylinder head sealing surface joint as shown (**arrows**). These are identified as "transition points".



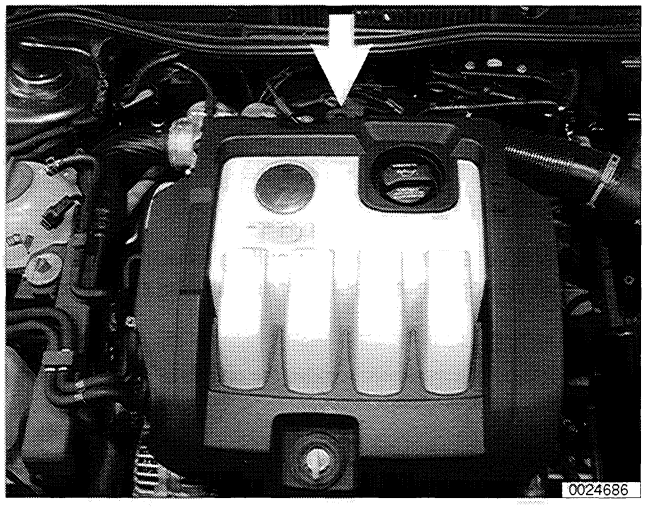
Also apply a drop of sealant AMV 174 004 01 approximately 5 mm in diameter to both side edges of the rear t bearing cap to cylinder head sealing surface joint as shown (**arrows**).

- Install and tighten valve cover (cylinder head cover) bolts in the sequence shown previously for **Valve cover bolts, tightening sequence**.

Tightening torque

- Cylinder head cover to cylinder head (in sequence) . . . . . 10 Nm (7 ft-lb)

- Remainder of installation is the reverse of removal.

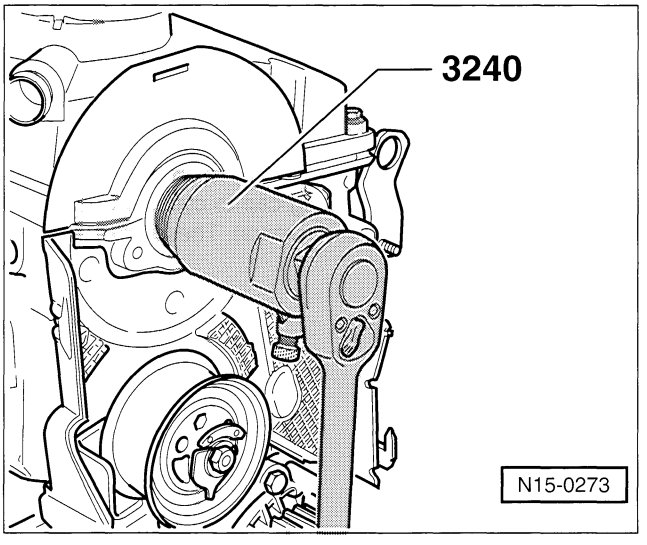


Camshaft oil seal, replacing

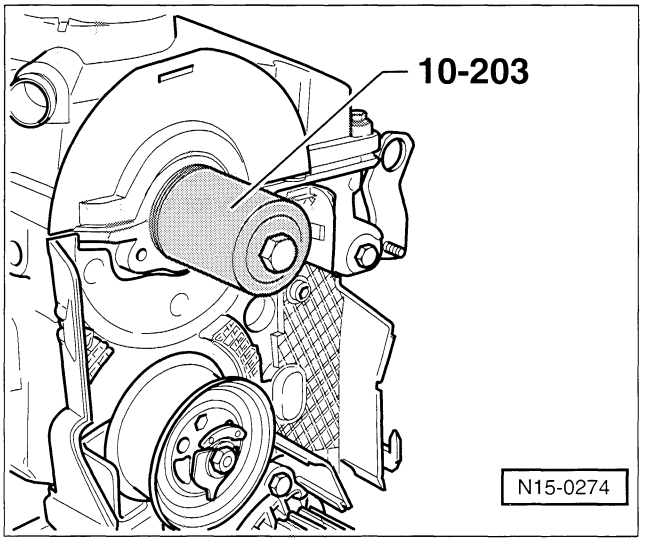
- Remove engine cover by pulling forward edge upward and pulling forward out of rear securing clip (**arrow**).

NOTE —
It is not necessary to remove the engine oil dipstick before removing engine cover.

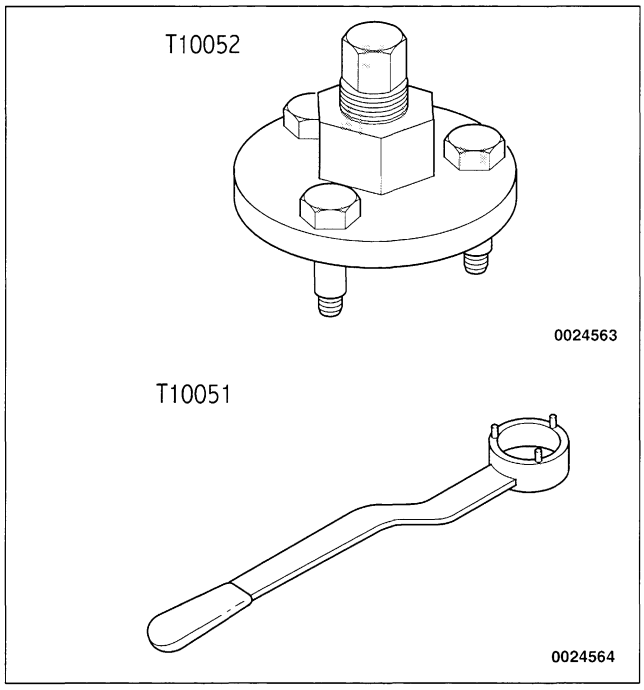
- Remove timing belt.
- Remove camshaft sprocket, outer and hub.
- Prepare oil seal extractor tool 3240 by unscrewing inner part of tool two full turns, approx. 3 mm ($^1/_8$ in) from outer part and lock with knurled screw.



- Lubricate threaded tapered end of oil seal extractor. Place it in position and exerting firm pressure, screw it as far as possible into oil seal.
- Loosen knurled screw and turn inner part against camshaft until oil seal is pulled out.
- When installing new seal, do not additionally oil or grease the inner oil seal sealing lip.
- Before installing, remove oil remains from camshaft journals with a clean cloth
- Tape over (for example, with cellophane tape) the groove in the taper of the camshaft to protect the sealing lip.
- Carefully position seal on camshaft and push against cylinder head.



- Press in oil seal with press piece of puller 10-203 and a bolt (M12 x 65). Continue pressing into bore until completely seated.
- Install timing belt, sprockets and hub as given previously.
- Install valve cover.
- Remainder of installation is the reverse of removal.



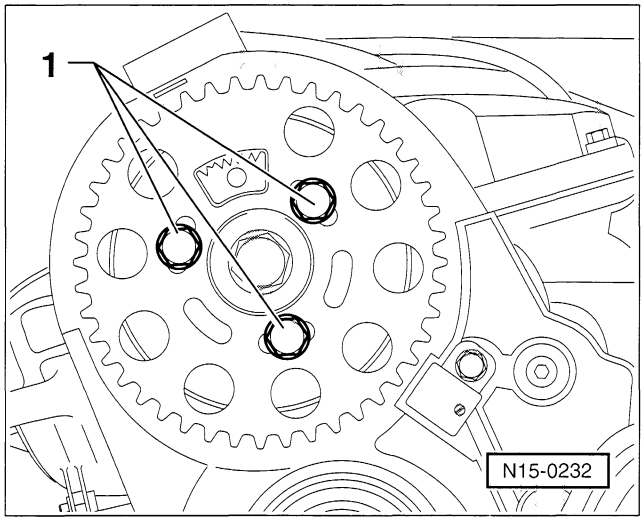
Camshaft, removing and installing

The camshaft can be removed and installed with cylinder head installed. Removing the camshaft allows access to hydraulic cam followers, valve springs and valve stem oil seals.

Removing

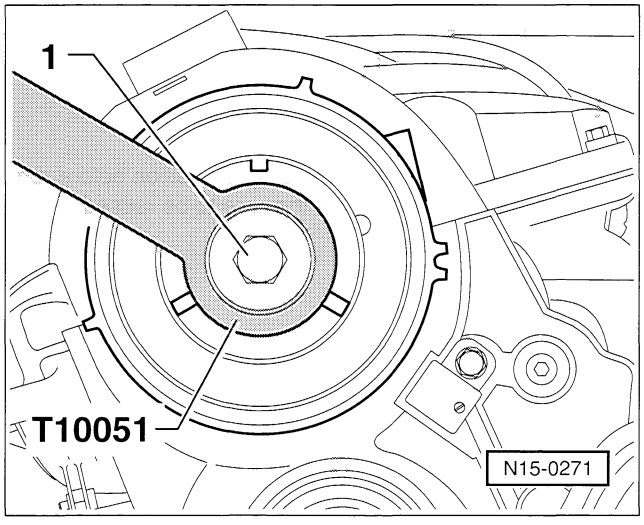
➢ Special tools T10051 spanner and T10052 puller are required to remove and install camshaft outer sprocket and hub from the camshaft.

– Remove timing belt as given later in this section.



➢ Remove the 3 camshaft securing bolts (**1**) holding the outer sprocket to the hub.

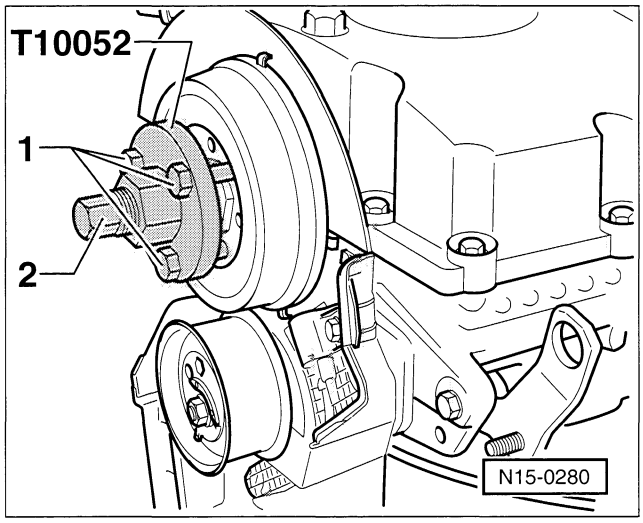
– Pull sprocket off of the hub.



➢ Counterhold hub with T10051 and loosen camshaft hub securing bolt (**1**), but do not remove bolt at this time.

– Once bolt is broken free, loosen a further two complete turns only.

NOTE —
Camshaft hub securing bolt must only be loosened approximately two turns (not removed) to facilitate the use of puller T10052.

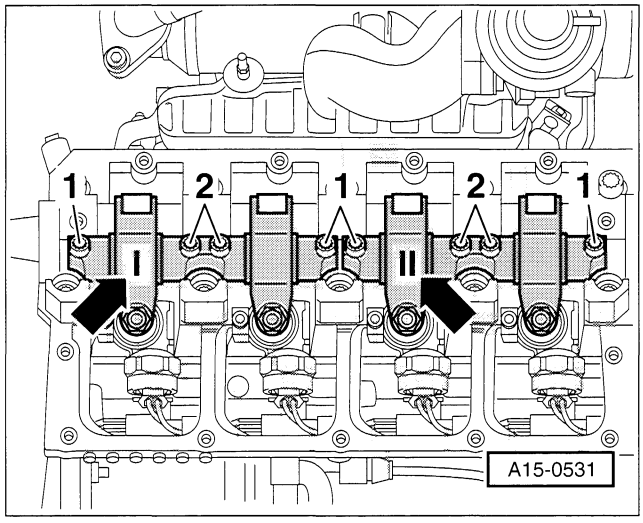


➤ Set up puller T10052 as shown. Align bolts (**1**) with holes in hub and thread into holes.

– Turn spindle (**2**) carefully and evenly until hub separates from taper on camshaft. Counterhold puller with a 30 mm wrench.

– Remove hub from taper of camshaft and remove puller.

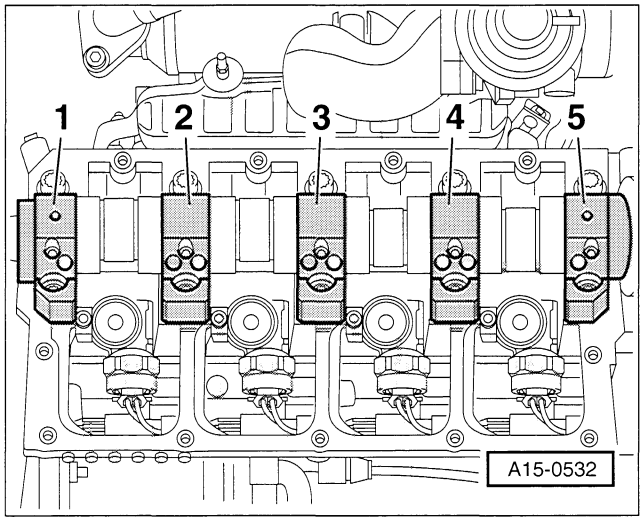
– Remove valve cover as given previously.



➤ Mark both rocker arm shafts (**arrows**) with a permanent felt tip marker to prevent accidental interchanging. This eliminates the need to reset basic settings of pump injectors upon complete of repair.

– Remove rocker shafts by removing each shaft's outer bolts (**1**) first, and then inner bolts (**2**).

– Remove tandem pump from end of cylinder head.



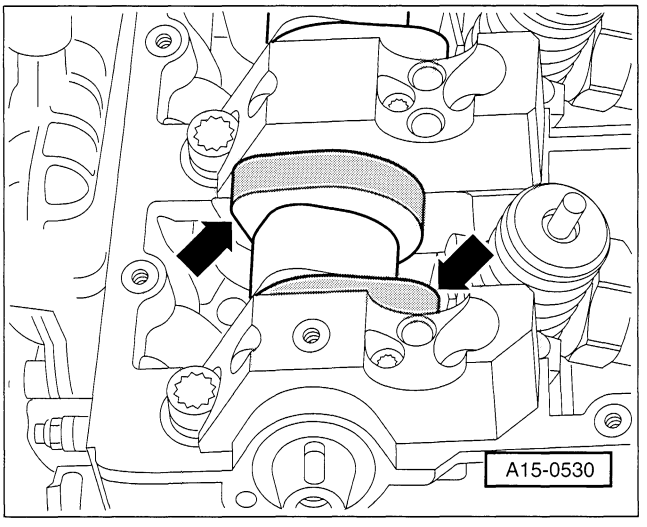
➤ Loosen and remove camshaft bearing caps **5**, **1**, and **3** in that order. Mark bearing shells according to position before removing from caps if they are to be reused.

– Loosen bearing caps **2** and **4** alternately and diagonally. When all tension is released, lift caps off.

– Remove camshaft.

– Mark bearing shells according to position before removing from cylinder head if they are to be reused.

Installing



NOTE —

- *If bearing shells are to be reused, ensure that they are returned to their original positions.*
- *Ensure that bearing shell retaining lugs are properly seated in cylinder head and in bearing caps during installation.*
- *If cylinder head has been removed from cylinder block, ensure that cylinder head bolt washers are installed before installing cylinder head bearing caps.*

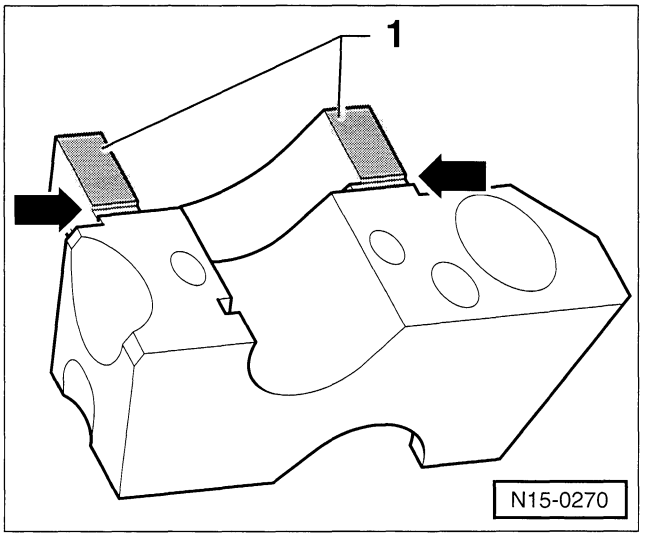
– Install bearing shells in cylinder head and oil the running surfaces.

➢ Install camshaft with lobes for cylinder #1 generally pointing up as shown (**arrows**).

– Install and tighten bearing caps for cylinders #2 and #4 alternately and diagonally.

Tightening torque

- Camshaft bearing caps to cylinder head . . . . . 8 Nm (71 in-lb) + ¼ turn (90°)

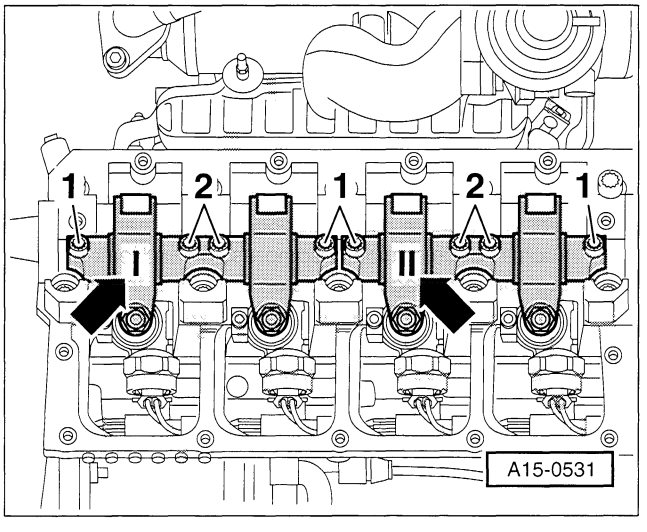


– Seal parting (joining) surfaces of bearing caps #1 and #5 with sealant AMV 174 004 01 before installing.

➢ Apply sealant AMV 174 004 01 thinly and evenly onto surfaces (**1**) as shown. Ensure that no sealant gets into the grooves (**arrows**).

– Install and tighten bearing caps for cylinders #5, #1 and #3 alternately and diagonally. Ensure that bearing cap #5 is aligned flush with outer edge of cylinder head, otherwise leaks can develop at the tandem pump.

– Install camshaft oil seal as previously given.

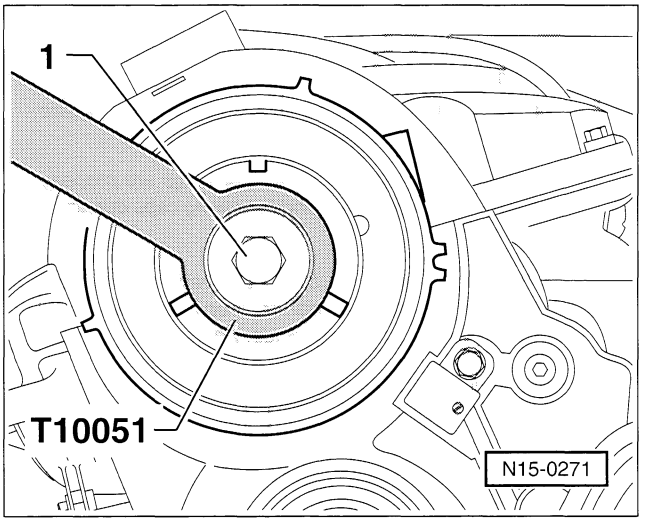


➢ Install rocker shafts and bolts. Tighten each shaft's inner inner bolts (**2**) first and then outer bolts (**1**). Tighten evenly and alternately.

Tightening torque

- Rocker arm shafts to cylinder head . . . . . .20 Nm (15 ft-lb) + ¼ turn (90°)

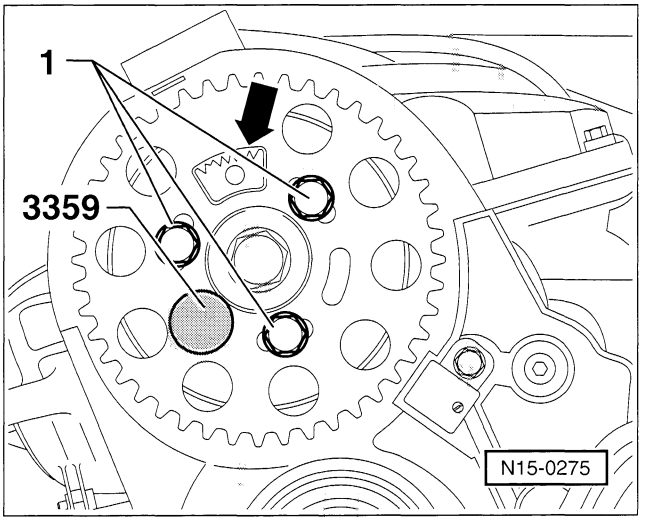
– Position hub on camshaft.



➤ Couterhold camshaft sprocket hub with T10051 and tighten hub securing bolt (**1**).

Tightening torque

- Camshaft sprocket hub to camshaft . . . . . 100 Nm (74 ft-lb)



➤ Push outer camshaft sprocket onto hub with toothed segment of the sprocket aligned as shown (**arrow**).

– Install and hand-tighten bolts (**1**). Position so that bolts are in center of slotted holes in outer sprocket.

– Lock hub with locking pin 3359.

– Install timing belt and tension as given in this section.

– Install tandem pump.

– Remainder of installation is the reverse of disassembly.

NOTE —

After installing new hydraulic lifters the engine must not be started for approximately 30 minutes. The hydraulic compensation elements must settle, otherwise valves will contact pistons.

Valve stem oil seals, replacing

The sign of faulty valve stem seals is excessive oil consumption and oil smoke from exhaust. This is usually most noticeable during periods of high manifold vacuum such as deceleration. If compression and leak-down testing confirm integrity of piston rings, but the engine consumes oil, it is likely that faulty valve stem seals are present. It should also be noted that worn valve stem seals could be due to worn valve guides and that worn valve guides are a major cause of oil consumption. See **Cylinder Head Components** for more information on checking valve guides.

Replacing valve stem oil seals requires removal of camshaft, cam followers, and valve springs. This can be done with cylinder head installed or removed. In either case, several Volkswagen special tools are required to compress valve springs and remove and install seals.

NOTE —
Compressed air is not used as on other engines. When the spring is removed, the valve is properly supported by piston crown at TDC.

Working with cylinder head installed:

- Remove cylinder head (valve) cover, and camshaft as described earlier.
- Remove hydraulic cam followers (lifters) and place them with contact surface downward. Ensure that lifter positions will not be interchanged.
- Turn crankshaft so that cylinder #1 (or appropriate cylinder) is at TDC. Continue under **Working with cylinder head removed or installed**.

NOTE —
Compressed air is not used as on other engines. When the spring is removed, the valve is properly supported by piston crown at TDC.

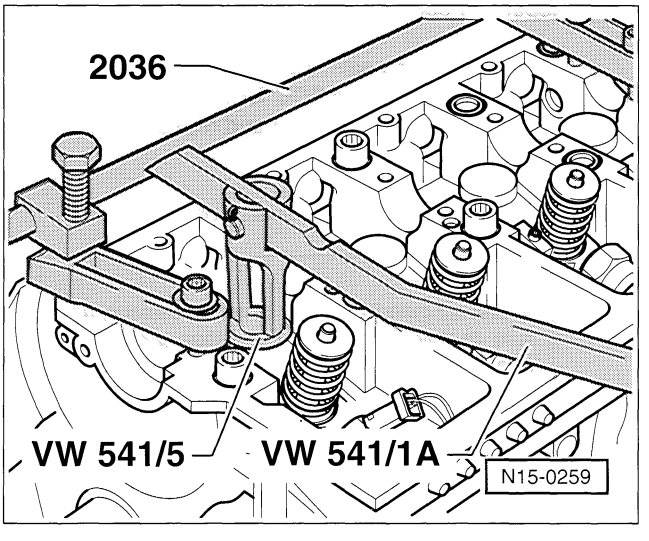
Working with cylinder head removed:

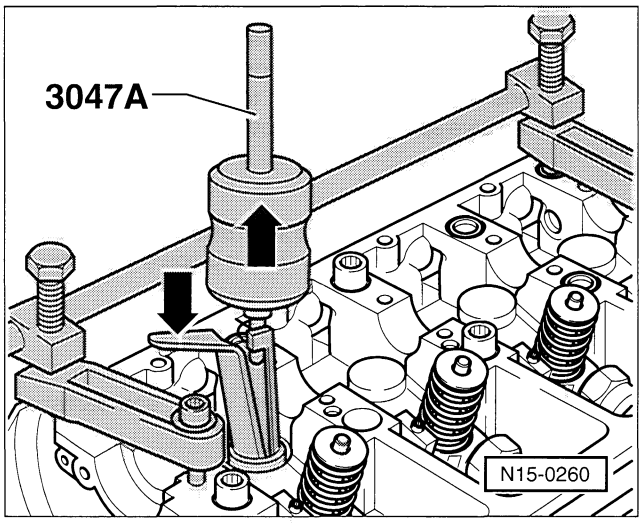
- Secure cylinder head to workbench. Use care to avoid damage to head gasket surfaces and any open valves.
- Remove camshaft and hydraulic cam followers as described earlier. Continue below.

Working with cylinder head removed or installed:

- Install appropriate valve spring compressor tools. Compress spring for first cylinder and remove spring retainer, both keepers, and valve springs. If spring will not compress, lightly tap tool to release stuck keepers. Use a small magnet to retrieve keepers.

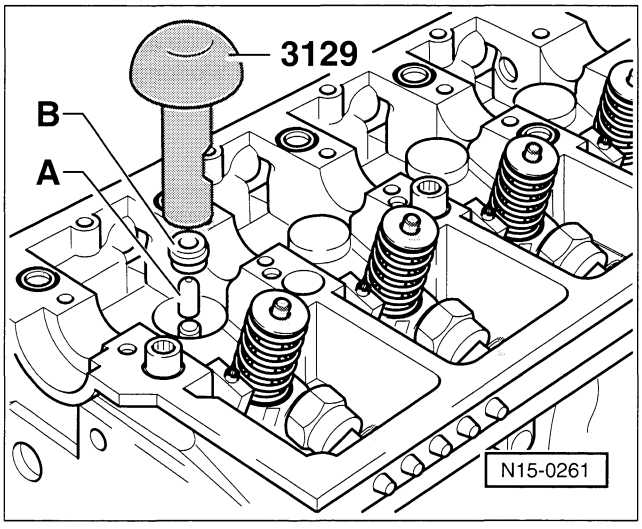
CAUTION —
If it becomes necessary to release stuck valve keepers by tapping the spring compressor tools, use caution and be gentle! Keep in mind that the valves are being supported by the pistons and not by compressed air.





➤ Remove valve stem seals with special slide hammer tools 3047A.

- Valve stem seal removal tool shown in position to remove valve stem seal. Push down on tool (**left arrow**) while sliding hammer up (**right arrow**).



➤ Begin installation of new seal by temporarily fitting a protective plastic fitting sleeve over valve stem. This sleeve is usually included with new seal set and will prevent damage to seal due to sharp edges of keeper grooves. Lubricate new seal with clean engine oil and fit it to installation tool.

- Plastic fitting sleeve (**A**), shown with valve stem seal (**B**) and plastic installation tool 3129.

– Push tool (with seal) down over valve stem until seal is fully seated on guide. Remove tool and protective fitting sleeve.

– Reinstall valve springs, retainer and keepers.

– Repeat for second valve on the cylinder.

– When both valve seals have been replaced on first cylinder, turn crankshaft to TDC for next cylinder (if working with cylinder head installed) and repeat process until all valve seals have been replaced.

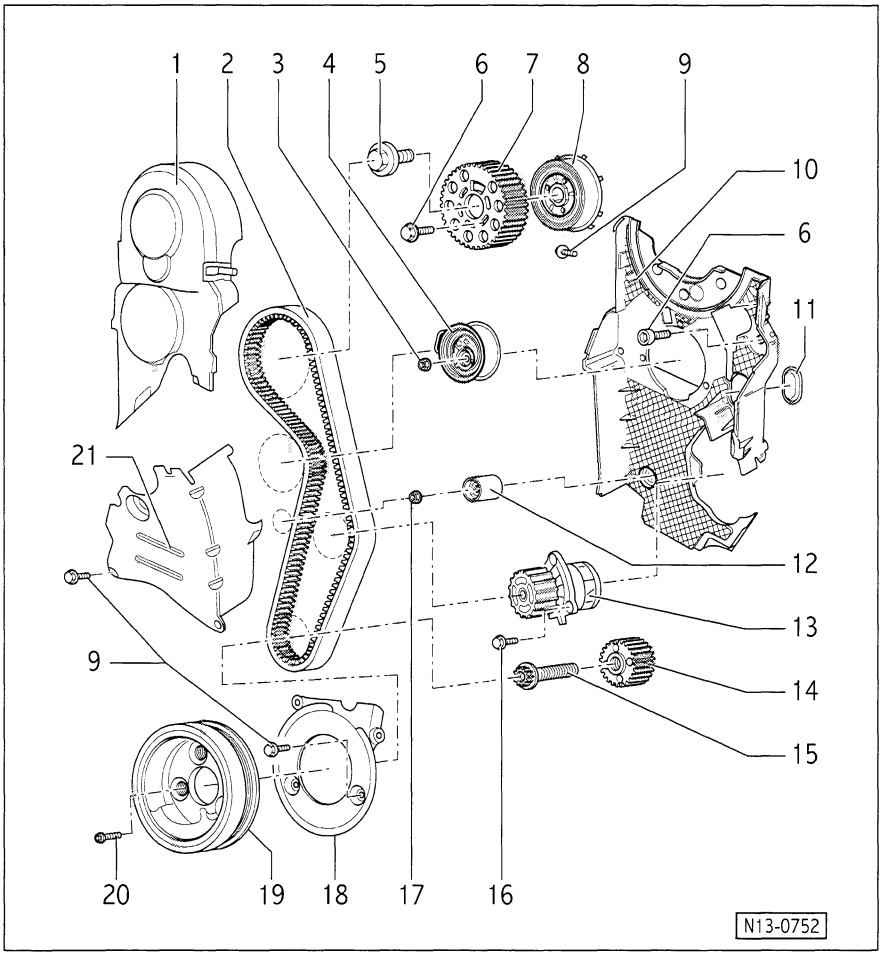
– Remaining installation is reverse of removal.

> ***CAUTION —***
> *To prevent cylinder head or camshaft damage, be sure to follow camshaft installation procedure when tightening camshaft bearing caps. See* **Camshaft, removing and installing**.

– Be sure to quality check your work, see **Quality Review** at end of this repair group.

TIMING BELT, CAMSHAFT DRIVE

The timing belt and its related parts are shown below. The timing belt is also known as the camshaft drive belt or toothed belt. Required maintenance involves inspection at the specified intervals. The belt and tensioner are to be replaced at different intervals, depending on model year and whether vehicle has a manual or automatic transmission. See **0 Maintenance** for the appropriate inspection and/or replacement intervals listed in the maintenance schedules. Belt and tensioner replacement will help prevent damage to engine due to belt stretch and long term effects of heat.



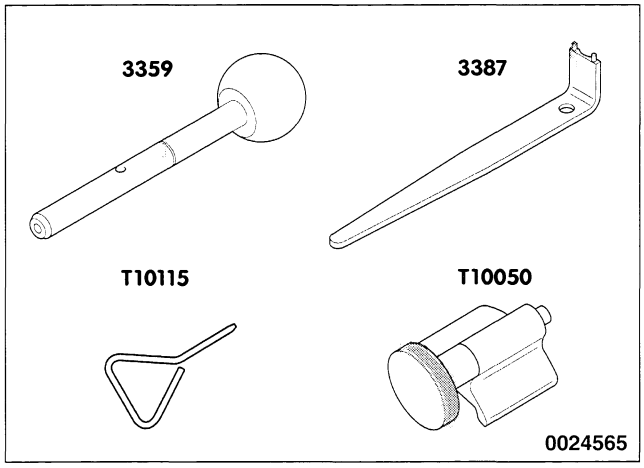
Drive belts, assembly

1. **Timing belt guard, upper outer section**
2. **Timing belt**
   - Mark engine direction of rotation before removing
   - Check for wear
   - Do not kink
3. **Nut**
   - Tighten to 20 Nm (15 ft-lb) + 1/8 turn (45°)
4. **Tensioning roller, timing belt**
5. **Bolt**
   - Tighten to 100 Nm (74 ft-lb)
6. **Bolt**
   - Tighten to 25 Nm (18 ft-lb)
7. **Camshaft sprocket, outer**
   - Loosen and remove from camshaft/hub with 2-arm puller T40001
8. **Camshaft sprocket, hub**
   - With sender wheel for camshaft position sensor
   - Counterhold with T10051
   - Remove with puller T10052
   - Removing and installing, see **Camshaft, removing & installing**
9. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
10. **Timing belt guard, rear section**
11. **Sealing grommet**
    - Replace if damaged
12. **Idler pulley**
13. **Coolant pump**
    - Check impeller for ease of movement
14. **Crankshaft timing belt drive sprocket**
15. **Bolt**
    - Always replace
    - Tighten to 120 Nm (88 ft-lb) + ¼ turn (90°)
    - To loosen and tighten, counterhold with 3099
    - Threads and shoulder must be free of oil and grease
    - Additional quarter turn can be obtained in two 1/8 turn (45°) stages
16. **Bolt**
    - Tighten to 15 Nm (11 ft-lb)
17. **Nut**
    - Tighten to 20 Nm (15 ft-lb)
18. **Timing belt guard, lower section**
19. **Belt pulley/vibration damper**
    - Can only be installed in one position, holes are offset
    - Note position when installing timing belt
20. **Bolt**
    - Tighten to 10 Nm (7 ft-lb) + ¼ turn (90°)
21. **Timing belt guard, center outer section**

Timing belt for camshaft drive, removing and installing

Removing

NOTE —
Perform adjustment/replacement work on timing belts on cold engines only. The tensioning element is temperature compensating and alters belt tension depending on the engine temperature.



In addition to the normal complement of hand tools and selected special tools, several additional special tools are needed, some of which are shown here. Where needed, other tools are noted in the procedure.

– Remove ribbed V-belt and tensioner.

– Remove right side headlight assembly.

– Remove lower sound absorber panel (belly pan).

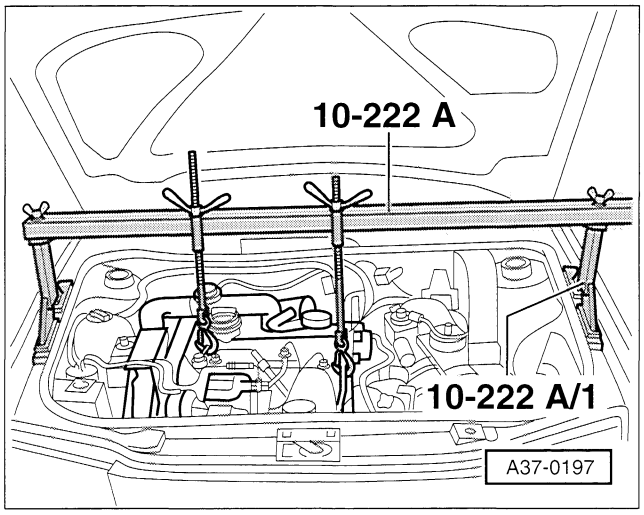
– Remove air pipe/duct between turbo-charger and charge air cooler (intercooler).

– Remove coolant expansion tank (coolant hoses remain attached).

– Remove power steering fluid reservoir (hoses remain attached).

– Disconnect and label fuel lines at valve cover.

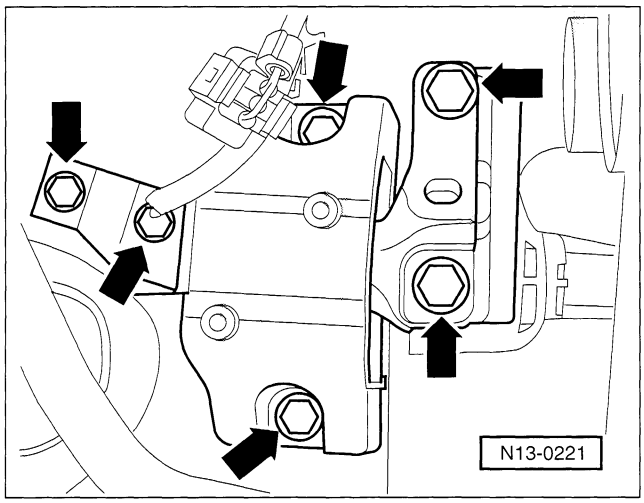
WARNING —
- *The fuel and the fuel lines in the PD fuel system can become very hot as a result of heat generated by the extremely high operating pressures. Use caution; there is danger from scalding!*
- *The fuel system is under pressure and fuel will be expelled when lines are opened! Before opening the system place a cloth around the connection and release the pressure by carefully loosening the connection. Wear eye and hand protection when performing any type of repair work on the fuel system!*
- *Fire hazard! Do not smoke or work near heaters or other fire hazards. Have a fire extinguisher handy.*



– Seal off disconnected fuel and vacuum lines to prevent contamination.

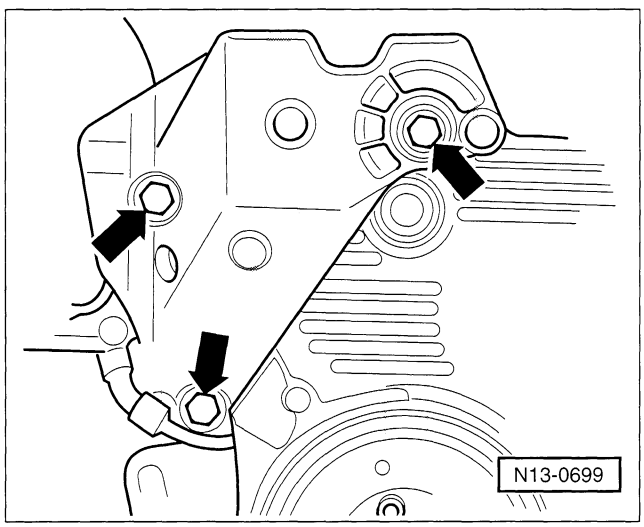
Support engine with a suitable fixture that is designed to support weight of engine and transmission without damaging body.

– Lift supporting device slightly, so that weight of engine and transmission is on supporting device.



➢ Remove the bolts (**arrows**) securing the right side engine mounts and remove the mount and the support.

NOTE —
The engine mounts and support should only be loosened and/or removed if the engine assembly is properly supported.

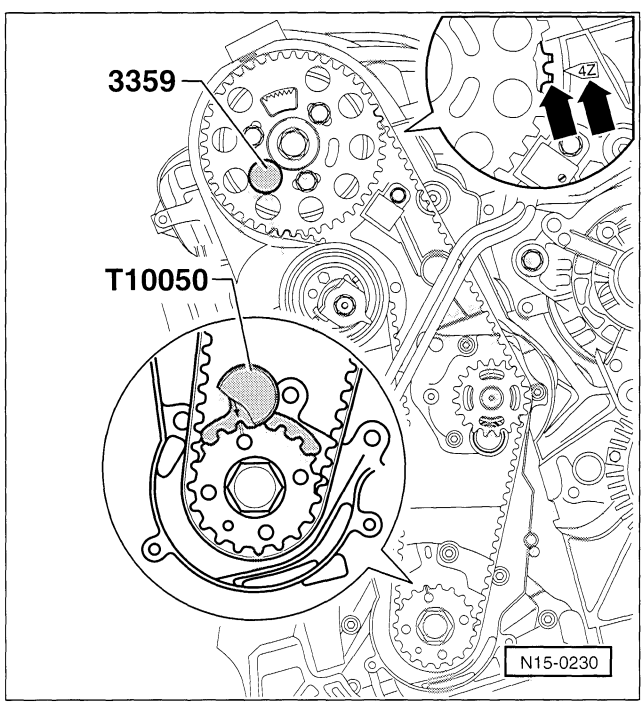


➢ Unbolt engine mounting on cylinder block (**arrows**) and remove.

– Remove belt pulley/vibration damper.

– Remove center outer and lower timing belt guard sections.

– Turn crankshaft to TDC for #1 cylinder.



➢ Turn the crankshaft further so that the marking on the crankshaft sprocket is at the top and the arrow on the rear section of the timing belt guard aligns with the lugs on the sender wheel of the hub (**upper inset, arrows**).

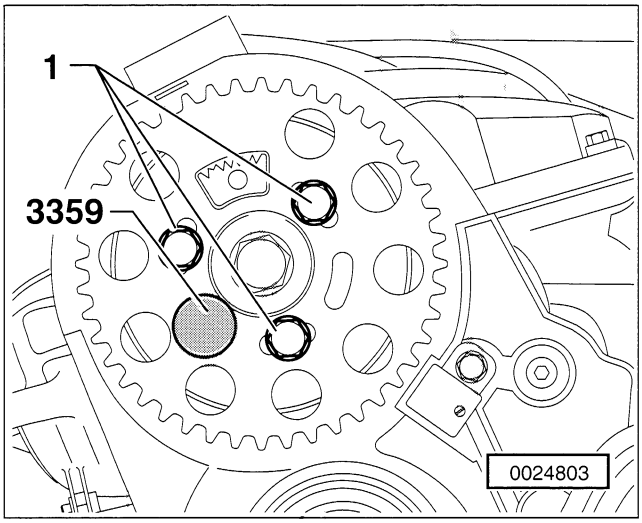
– Lock hub with locking pin 3359. To do this, slide locking pin through the empty elongated hole on left side of cylinder head.

– Lock crankshaft pulley with crankshaft lock T10050 (lower inset). To do this, push crankshaft lock from face side of timing belt pulley into pulley teeth.

– Confirm that with locks in place, marks for crankshaft and camshaft remain aligned.

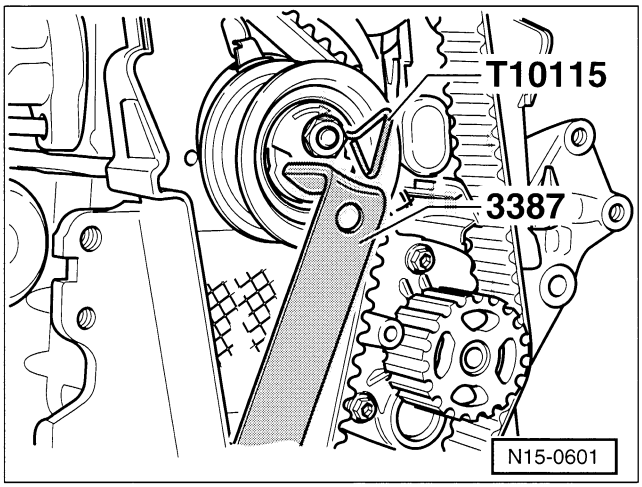
– Mark timing belt direction of rotation.

– Loosen tensioning roller securing nut.



➤ Loosen camshaft sprocket securing bolts (**1**) only sufficiently so that camshaft pulley can be moved within elongated holes (slots).

NOTE —
Locking pin 3359 remains in position to keep camshaft locked.



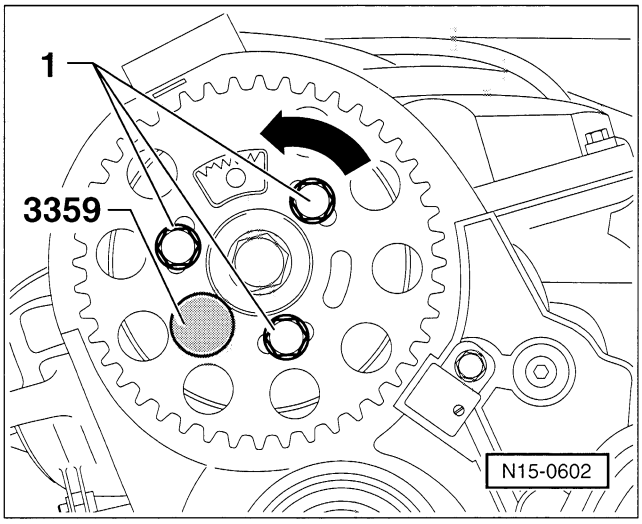
➤ Turn pin wrench 3387 counter-clockwise (opposite direction of arrow on tensioner). Release tension until timing belt tensioner can be locked in position with pin T10115.

– With locking pin T10115 in place, turn pin wrench clockwise to the stop and tighten securing nut finger tight.

– Remove timing belt from coolant pump first and then from remaining pulleys.

Installing

NOTE —
Perform adjustment/replacement work on timing belts on cold engines only. The tensioning element is temperature compensating and alters belt tension depending on the engine temperature.

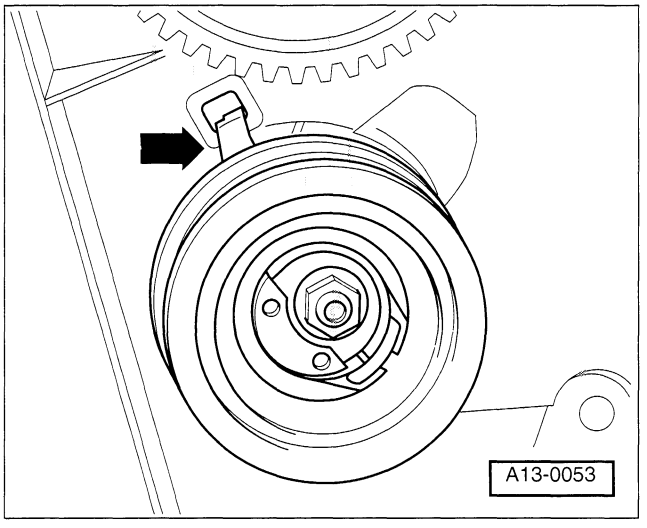


– Lock tensioning roller with locking pin T10115 (if not already locked) and secure to the right limit stop.

➤ Ensure that bolts (**1**) are no more than finger tight. Turn camshaft sprocket outer section counterclockwise (**arrow**) in elongated holes (slots) as far as possible.

– Install timing belt onto crankshaft pulley, belt tensioner and camshaft pulley.

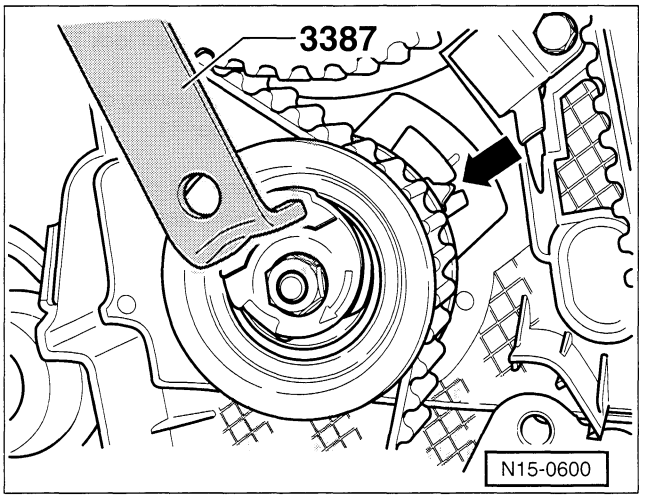
– Install timing belt onto coolant pump pulley last.



➢ Ensure that tensioning roller tab is seated correctly in timing belt guard rear section (**arrow**).

– Loosen tensioning roller securing nut.

– Release tension on tensioning roller by turning pin wrench 3387 in opposite direction of arrow on tensioner and remove locking pin T1015 from tensioning roller.



➢ Carefully turn tensioning roller with pin wrench 3387 until indicator is in middle of gap in timing belt guard rear section (**arrow**).

– Hold tensioning roller in this position and tighten tensioning roller securing nut.

Tightening torques

- Nut,
  tensioning roller . . . . 20 Nm (15 ft-lb) + $^{1}/_{8}$ turn (45°)
- Camshaft sprocket
  outer section bolts . . . . . 25 Nm (18 ft-lb)

– Tighten camshaft pulley securing bolts.

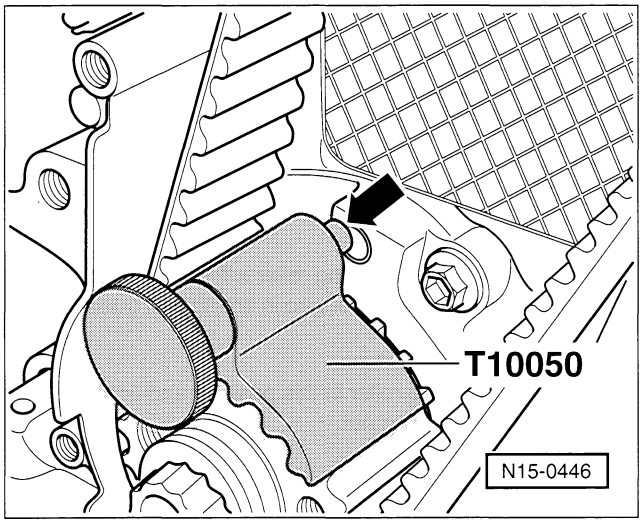
– Remove locking pin 3359 and crankshaft lock T10050.

– Turn crankshaft two rotations in the running direction and set engine again to TDC for cylinder #1.

– Without turning engine backwards, fit pin of crankshaft lock T10050 into position in sealing flange.

– If crankshaft was turned too far in the running direction, turn backwards at least ¼ turn and then rotate forward in the running direction until the crankshaft lock can be installed. Do not turn the engine backwards (opposite the running direction) to install the lock.

– When crankshaft lock T10050 is properly in place, check to see that camshaft sprocket locking pin 3359 can be installed into hub.



– If locking pin 3359 fits into hub and **CAN** be locked, skip to **Continued**. If locking pin 3359 **CANNOT** be fitted to lock hub, readjust in the following steps.

– Pull crankshaft stop pin out of hole in sealing flange and turn crankshaft until camshaft sprocket hub can be locked with locking pin 3359.

– Loosen camshaft sprocket outer section securing bolts.

➤ Turn crankshaft slightly against the running direction of the engine (backwards) until crankshaft lock pin is positioned just **before** hole in sealing flange (**arrow**).

– Turn crankshaft in the running direction of the engine until crankshaft lock pin engages in hole in sealing flange while turning.

– Tighten camshaft pulley securing bolts.

– Remove locking pin 3359 and crankshaft lock T10050.

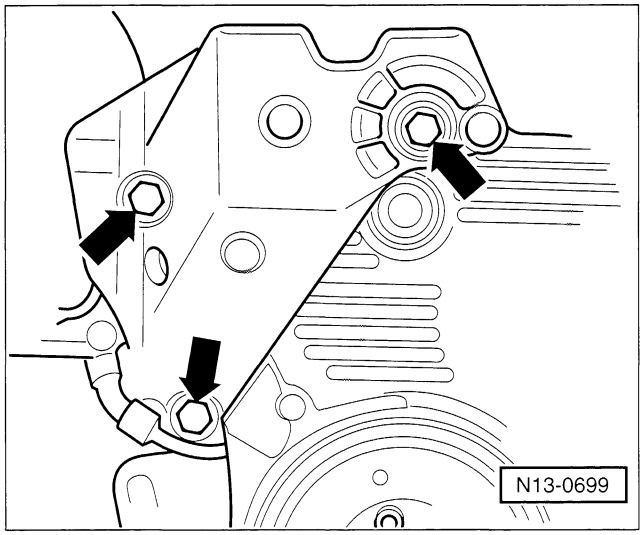
– Turn crankshaft two rotations in the running direction and set engine again to TDC for cylinder #1.

– Without turning engine backwards, fit pin of crankshaft lock T10050 into position in sealing flange.

– If crankshaft was turned too far in the running direction, turn backwards at least ¼ turn and then rotate forward in the running direction until the crankshaft lock can be installed. Do not turn the engine backwards (opposite the running direction) to install the lock.

– When crankshaft lock T10050 is properly in place, check to see that camshaft sprocket locking pin 3359 can be installed into hub.

– If locking pin 3359 fits into hub and **CAN** be locked, proceed with **Continued** below. If locking pin 3359 **CANNOT** be fitted to lock hub, repeat adjustment as outlined above until it can.



Continued

– Install timing belt guard, lower section.

– Install belt pulley/vibration damper.

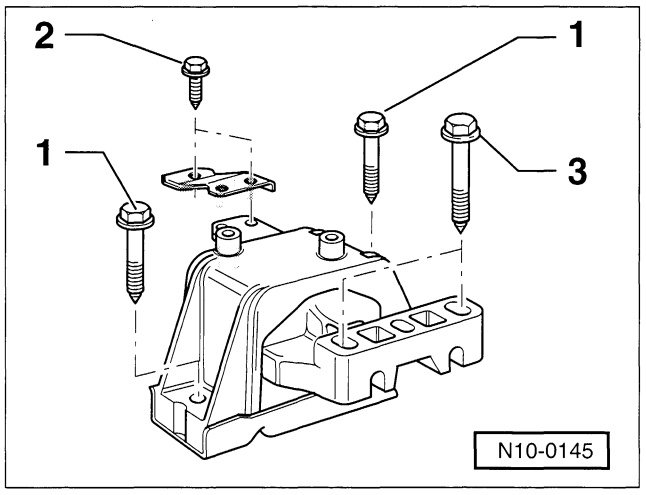
– Install timing belt guard, center section.

➤ Install engine mounting on cylinder block and tighten bolts (**arrows**).

Tightening torque

Engine mount to cylinder block . . . . 45 Nm (33 ft-lb)

– Install timing belt guard, upper outer section.



➤ Install right side engine mount and align. Install new stretch bolts where indicated.

1. **Mount to body bolt**
   - 40 Nm (30 ft-lb) plus 90° (¼ turn)
   - always replace
2. **Mount bracket to body bolt**
   - 25 Nm (18 ft-lb)
3. **Mount to engine bracket bolt**
   - 100 Nm (74 ft-lb)

– Remove engine support device.

– Install fuel lines at valve cover.

– Install power steering fluid reservoir.

– Install coolant expansion tank.

– Install air pipe/duct between turbo-charger and charge air cooler (intercooler)

– Install lower sound absorber panel (belly pan).

– Install right side headlight assembly.

– Install ribbed V-belt and tensioner.

– Be sure to quality check your work, see **Quality Review** at end of this repair group.

CYLINDER HEAD, REMOVING AND INSTALLING

The cylinder head can be removed and installed with engine in vehicle. Cylinder head assembly views given earlier show a view of the 1.9L PD cylinder head and related components. Note that cylinder head bolts are stretch type fasteners and should never be reused. In addition, whenever the cylinder head or cylinder head gasket is replaced, the coolant must also be replaced, see **19 Engine–Cooling System**.

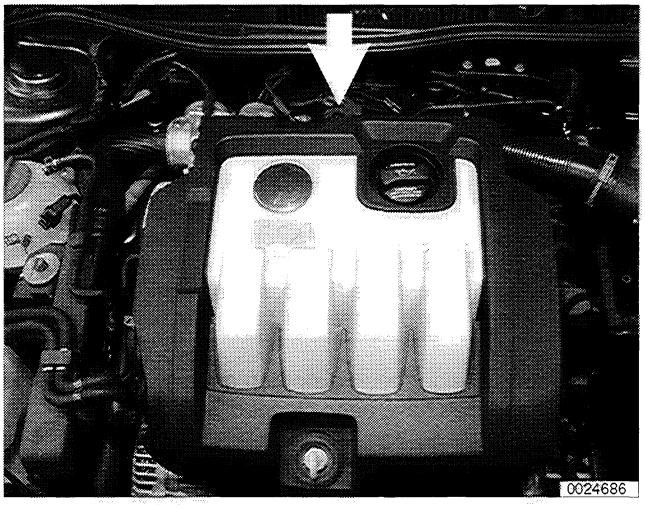
Cylinder head, removing

The cylinder head can be removed with exhaust manifold, turbo-charger and intake manifold still attached. The plenum close-out panel at the base of the windshield will be removed to allow easier access to cylinder head and provide space needed for an engine support.

> ***WARNING —***
> *Do not start work on a hot engine. Allow to cool sufficiently before proceeding. Engine temperature must be no hotter than warm to the touch. Cylinder head warpage can result due to uneven cooling rates.*

NOTE —

- *Disconnecting battery cables will erase fault codes and basic settings in engine management and automatic transmission control unit memories. Some driveability problems may be noticeable until system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. See* **23 Fuel Injection–Diesel (1.9L Engine)** *for additional information. In some instances proper diagnosis will require use of a scan tool such as Volkswagen supplied VAG 1551 or 1552. Use and operation of this tool is outside the scope of this repair manual.*
- *It will be necessary to cut many wire tie wraps when removing the engine. The tie wraps are installed to prevent the wiring harnesses from chaffing or contacting engine parts. Be sure to make note of all tie wraps removed and install new ones during engine installation.*
- *Route all lines (e.g. for fuel, hydraulics, EVAP system, coolant, refrigerant, brake fluid and vacuum, etc.) as well as electrical wiring so that the original positions are maintained. Ensure sufficient clearance to all moving or hot components.*
- *Most of the hardware used in the vehicles covered by this repair manual is specially coated to prevent corrosion. This coating is known as "dacromet" or "delta tone" and is identified by a green tinted finish. Always use replacement hardware with the same specification.*
- *Be sure to have the anti-theft radio code on hand before disconnecting the battery.*



– With ignition switched off, disconnect battery negative terminal from battery.

NOTE —
Be sure to have anti-theft radio code on hand before disconnecting battery.

– Remove lower sound absorber panel (belly pan).

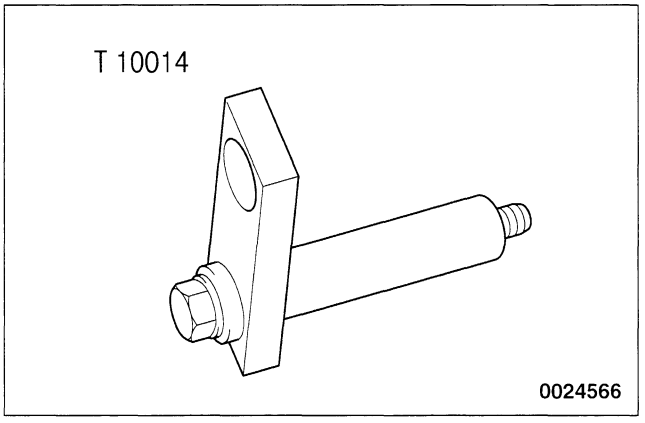
– Drain engine coolant, see **19 Engine–Cooling System**.

– Unbolt front exhaust pipe from turbo-charger, see **26 Exhaust System and Emission Controls**.

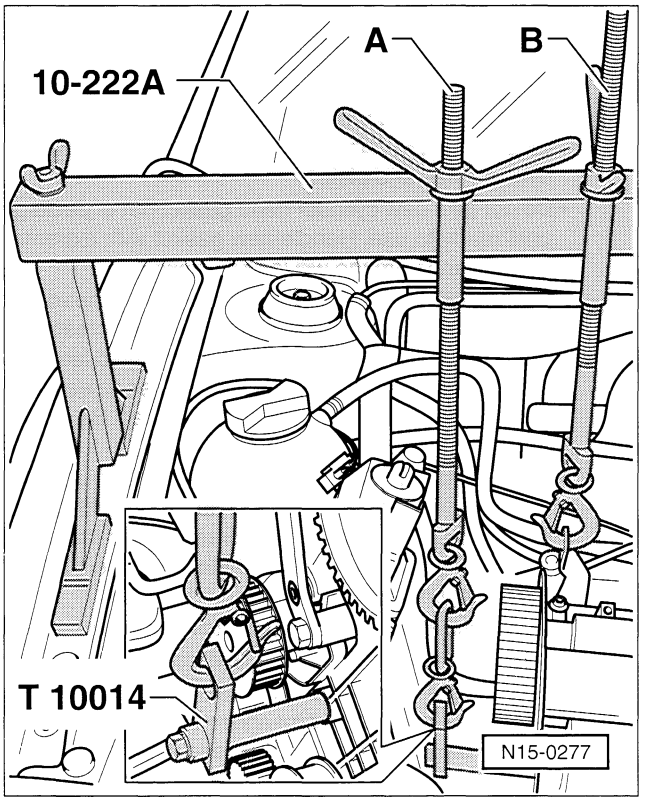
– Disconnect electrical connector on Turbocharger (TC) vane position sensor, G500.

➢ Remove engine cover by pulling forward edge upward and pulling forward out of rear securing clip (**arrow**).

– Remove timing belt from camshaft as previously described.



➢ Both lifting eyes for the engine support are located on the cylinder head, so an additional bracket for supporting the engine must be secured to the cylinder block. Factory tool T10014 is shown.



➢ Install bracket T10014 to cylinder block using a threaded hole in water pump area as shown. Tighten to 20 Nm (15 ft-lb).

– Install engine support 10-222A as shown.

– Lift engine slightly using spindle (**A**) until second spindle (**B**), (attached to cylinder head) is relieved of all tension. Remove second spindle (**B**).

– Before removing cylinder head, extract fuel at tandem pump using a hand vacuum pump such VAG 1390 with bleed receptacle VAG 1390/1 or equivalent.

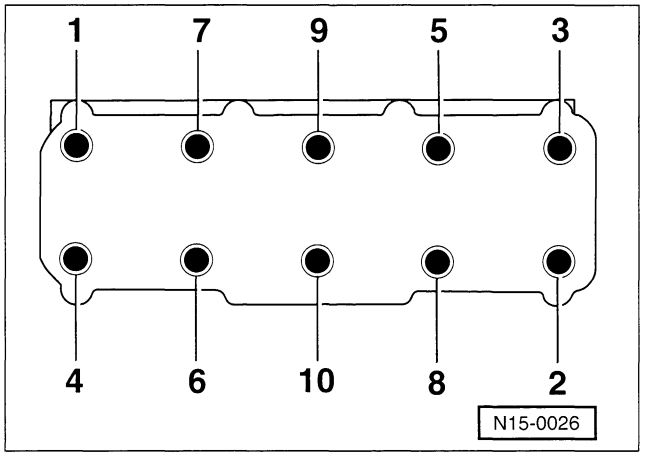
– Remove tandem pump.

– Remove valve cover, see **Cylinder head (valve) cover, removing and installing**.

– Remove camshaft sprocket, outer and hub. See **Camshaft removing and installing**, given earlier.

– Pull off and/or disconnect all other electrical connections, and wiring connected to cylinder head.

– Pull off and/or disconnect all vacuum, coolant, and intake hoses connected to, or routed over cylinder head.



➢ Loosen socket head bolts slightly in sequence shown but do not remove until all 10 bolts have been loosened.

– Carefully lift off cylinder head and place in a clean area. If head is stuck, use a soft-faced mallet or pry gently with a wooden stick.

> ***CAUTION —***
> *Some of the valves will be open. Use extra care when removing and handling to avoid damage. Place cylinder head on bench or table so that weight of cylinder head will not rest on valves.*

– Check cylinder head distortion once cylinder head sealing surfaces have been cleaned.

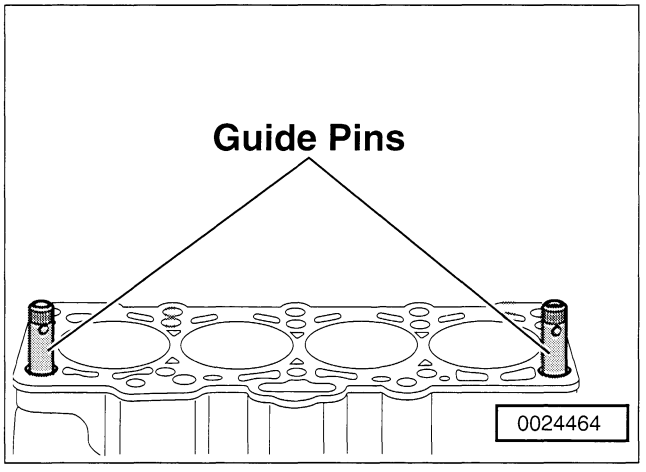
Cylinder head, installing

Before proceeding with installation of the cylinder head, whether an original or a new unit, observe following important points:

- Check cylinder head and block for distortion and warpage, see **Cylinder Head Components**, given later in this section.
- Carefully clean cylinder block and cylinder head sealing surfaces being sure to avoid scratching them during cleaning process. Do not use metal scrapers or wire brushes.
- When using abrasive paper do not use any grades coarser than 100 grit (such as 80 grit). Lower numbers are coarser.
- If cylinder head will not be reinstalled immediately, take precautions to prevent rust from forming on cylinder block walls and gasket sealing surfaces.
- When cleaning old gasket material off of cylinder block, take precautions to keep old gasket material and the used abrasive particles and dirt out of cooling and oiling system passages. Place a clean shop cloth over cylinders to prevent contamination from getting between cylinder wall and piston.
- Do not take new cylinder head gasket out of packaging until ready to use. Handle new gasket with extreme care as any damage will lead to leaks.
- There MUST NOT BE any oil or coolant in head bolt holes in cylinder block. Any fluids in holes creates danger of hydrolock while torquing which could lead to structural damage of cylinder block. Use thread chasers to remove foreign material as required. Be sure that all 10 bolt holes are clean and dry.
- When all traces of old gasket material have been removed from cylinder block and head, carefully remove all traces of metal particles, abrasives and lint. All gasket sealing surfaces and bolt holes must be clean and dry to ensure a proper seal.
- Always use a new cylinder head gasket and new head bolts.
- Do not use any gasket sealer on new cylinder head gasket.
- If installing a Volkswagen supplied replacement cylinder head, be sure to inspect for and remove any plastic packaging materials used to protect head and the open valves.

Cylinder head, installing (continued)

– Position crankshaft to TDC for cylinder #1 and then turn backwards until all pistons are equally spaced below TDC.



➤ Install guide pins (VW special tool 3450) into two head bolt holes of cylinder block. Pins allow for proper alignment of the head on block, preventing slippage and damage to head gasket. Old head bolts with the socket head cut off and a screwdriver slot cut in with a hacksaw can also be used as alignment pins when used with a small magnet.

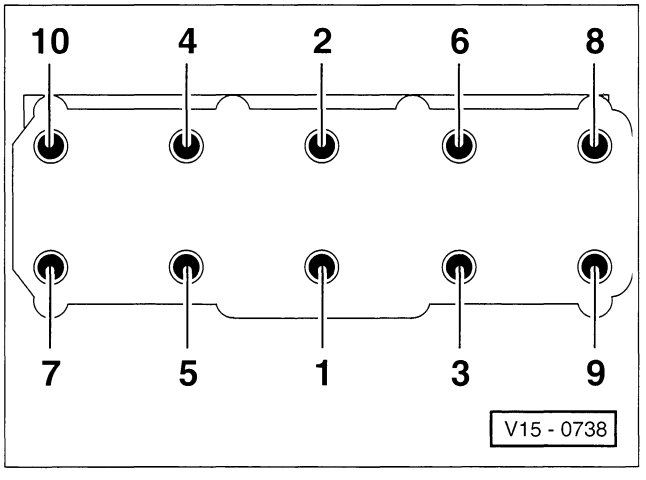
– Install new cylinder head gasket onto block with numbers and letters facing up. Be sure that none of the wiring or any vacuum hoses are caught between cylinder head and block.

NOTE —
Be sure that cylinder head gasket is the same thickness as the original, or, that the correct thickness gasket is being installed on the basis of actual measurements. See **13a Crankshaft/Cylinder Block (4-cylinder), Piston Projection at TDC (diesel engines).**

– Carefully install cylinder head onto block over alignment pins and screw in 8 new head bolts. Tighten bolts hand-tight only.

NOTE —
New head bolts may require different hex head socket tool than old ones (12 pt. vs. 6 pt.).

– Remove alignment pins from bolt holes with tool and install remaining 2 new head bolts. Tighten these bolts hand-tight.

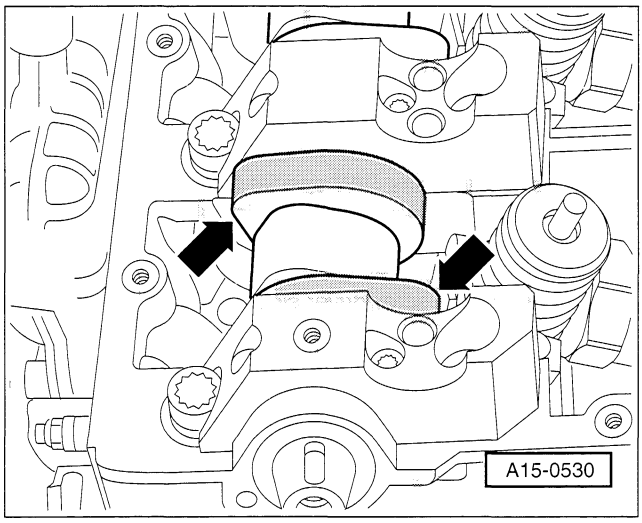


➤ Tighten 10 cylinder head bolts in three stages following tightening order shown at left.

Tightening torque

- Cylinder head to cylinder block, engine code BEW (stretch bolt - always replace)

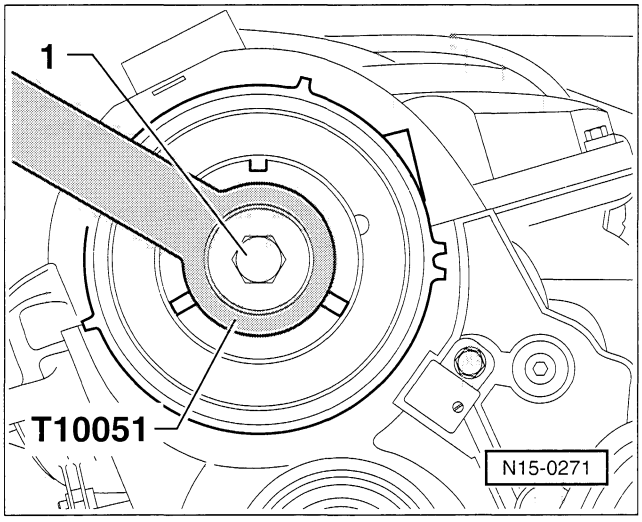
stage I	40 Nm (30 ft-lb)
stage II	60 Nm (44 ft-lb)
stage III	additional ¼ turn (90°)
stage IV	additional ¼ turn (90°)



➢ After tightening cylinder head, turn camshaft so that cam lobes for No. 1 cylinder point equally upward.

– Before installing timing belt, turn crankshaft in direction of engine rotation to TDC.

– Position hub on camshaft.

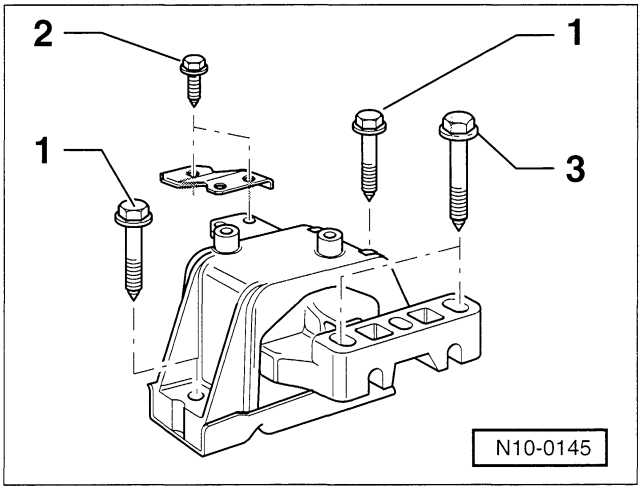


➢ Counterhold camshaft sprocket hub with T10051 and tighten hub securing bolt (**1**).

Tightening torque

- Camshaft sprocket hub to camshaft . . . . . 100 Nm (74 ft-lb)

– Install timing belt, see: **Timing Belt for Camshaft Drive Removing and Installing**.



➢ Install right side engine mount and align. Install new stretch bolts where indicated.

1. **Mount to body bolt**
   - 40 Nm (30 ft-lb) plus 90° (¼ turn)
   - always replace
2. **Mount bracket to body bolt**
   - 25 Nm (18 ft-lb)
3. **Mount to engine bracket bolt**
   - 100 Nm (74 ft-lb)

– Remove engine support device and lifting eyes.

– Connect all vacuum, coolant, and intake hoses connected to, or routed over cylinder head.

– Connect all other electrical connections, and wiring connected to cylinder head previously removed.

– Install cylinder head (valve) cover and fuel lines.

– Install tandem pump.

– Refill cooling system with fresh coolant.

> ***CAUTION —***
> - *Use only Volkswagen original anti-freeze when filling cooling system. Use of any other anti-freeze may be harmful to cooling system. Do not use an anti-freeze containing phosphates.*
> - *Do not use tap water in cooling system. Use distilled water only to mix anti-freeze.*

– Balance of installation is reverse of removal.

– Be sure to quality check your work, see **Quality Review** at end of this repair group.

Tightening torques

- Cylinder head cover to cylinder head (in sequence) . . . . . 10 Nm (89 in-lb)
- Cylinder head to cylinder block, engine code BEW (stretch bolt - always replace)
  - stage I . . . . . 40 Nm (30 ft-lb)
  - stage II . . . . . 60 Nm (44 ft-lb)
  - stage III . . . . . additional ¼ turn (90°)
  - stage IV . . . . . additional ¼ turn (90°)
- Front exhaust pipe to exhaust manifold (special nuts - always replace) . . . . . 25 Nm (18 ft-lb)
- Timing belt tensioner . . . . . 20 Nm (15 ft-lb)
- Camshaft sprocket to camshaft . . . 100 Nm (74 ft-lb)

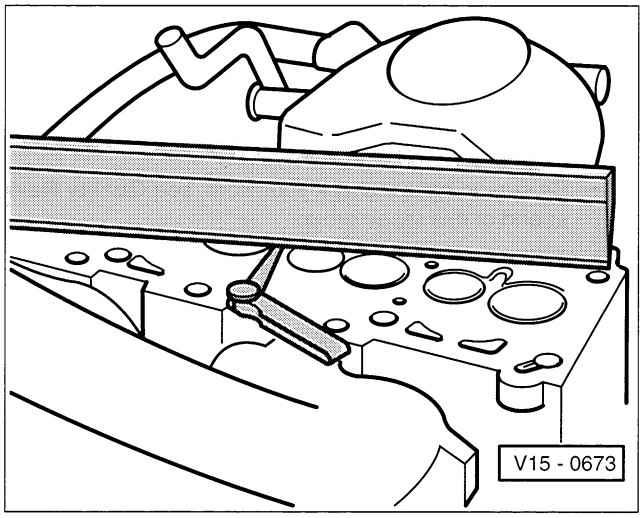
CYLINDER HEAD COMPONENTS

This section provides specifications and special information necessary to repair the cylinder head that has been removed from the Volkswagen 1.9L PD diesel engine. Special service tools and machine shop services are required for most cylinder head repair.

NOTE —

- *The information given under this heading assumes that cylinder head is removed. For cylinder head removal procedures, see* **Cylinder head, removing** *given earlier.*

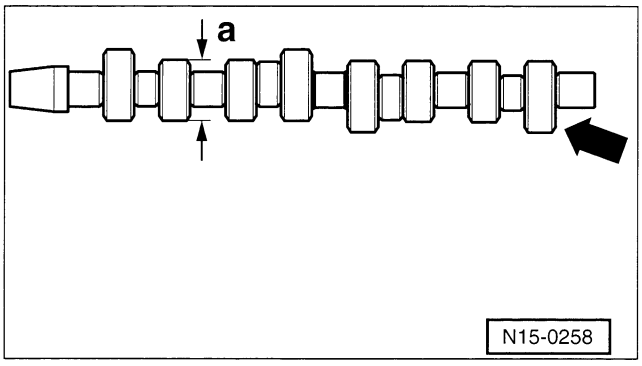
Cylinder Head and Camshaft



Check cylinder head for warpage and distortion with an accurate straight edge and a feeler gauge. Resurfacing of cylinder head is specifically not recommended by Volkswagen. Excessively warped or distorted cylinder heads must be replaced.

Specification

- Maximum cylinder head distortion/warpage . . . . . 0.1 mm (0.004 in.)

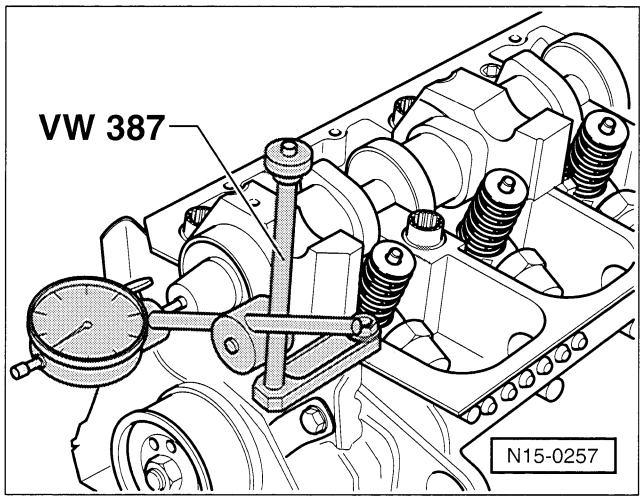


The camshaft for 1.9L PD diesel engines is easily identified by markings cast into it during manufacture.

- **Large arrow** - identifier is 38R or 858R
- **Small arrows a** - camshaft lobe base circle = 52.8 mm (2.0787 in.)

Specification

- Valve timing at 1 mm valve lift
  - Intake opens after TDC . . . . . 15.8°
  - Intake closes after BDC . . . . . 25.3°
  - Exhaust opens before BDC . . . . . 28.2°
  - Exhaust closes before TDC . . . . . 18.7°

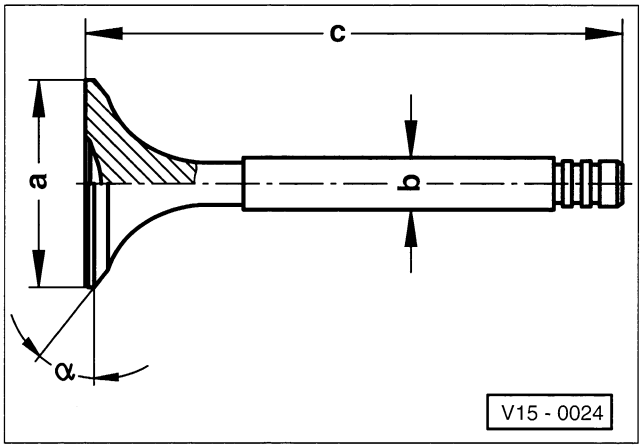


The in and out movement of camshaft is known as axial play and is measured with cam followers removed and only the first and last bearing caps installed.

Set up a dial gauge on sprocket end of camshaft and check camshaft clearance by moving camshaft as far as it can go in each direction (**arrow**).

Specification

- Camshaft axial clearance. . . . . 0.15 mm (0.006 in.)

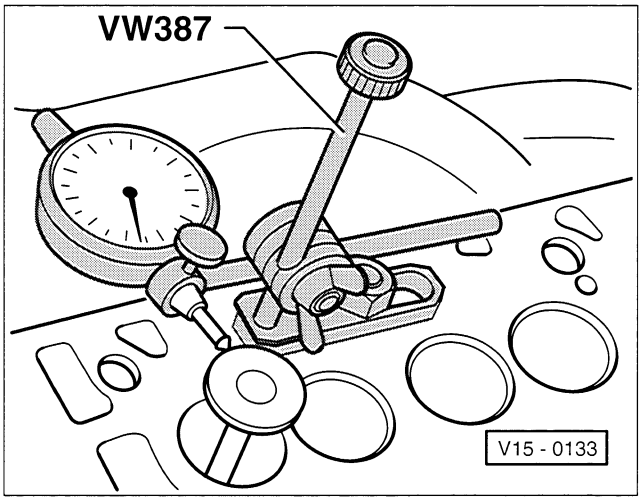


Valves

Valves should not be re-worked on a machine. Only lapping by hand with valve compound is permitted. Valve dimensions listed in **Table a** apply to valve shown at left which is representative of both intake and exhaust valves.

Table a. Valve Dimensions

Engine: 1.9L PD Diesel	
Valve head diameter (**a**)	
intake	35.95 mm (1.415 in.)
exhaust	31.45 mm (1.238 in.)
Valve stem diameter (**b**)	
intake	6.980 mm (0.274 in.)
exhaust	6.956 mm (0.274 in.)
Valve length (**c**)	
intake	89.95mm (3.541 in.)
exhaust	89.95 mm (3.541 in.)
Valve face angle (α)	
intake	45°
exhaust	45°



Valve guides

Special tools and a press are required to replace valve guides. Check valve guide wear with a new valve and a dial indicator (VW 387 shown). Insert valve until stem end is flush with end of guide. Rock valve back and forth to check total travel.

Specification

- Valve guide (wear limits-maximum play) with new valve
  intake and exhaust valve guide . . 1.3 mm (0.051 in.)

CAUTION —
*When checking valves guides, be sure to use an exhaust valve on the exhaust side and an intake valve on the intake side. Exhaust and intake valve stem diameters are slightly different. See **Table a**.*

NOTE —
Replacement valve guides for the 1.9L PD diesel engines are not available through the Volkswagen/Audi parts system. In cases where the wear limits are exceeded, Volkswagen recommends cylinder head replacement.

QUALITY REVIEW

When you have finished working under hood and around other areas of the vehicle it is advisable to take a moment to quality check or review your work. This helps to ensure that operation or repair has been completed properly with all affected systems functioning within normal parameters. This may include the following:

- Make sure that radiator fan cycles properly and that coolant level and concentration are correct.
- Ensure that all cable ties and hose clamps that were removed as part of repair are replaced.
- Clean off any diesel fuel that may have spilled onto rubber hoses and belts. It will cause deterioration.
- Check and adjust all other applicable fluid levels.
- Make sure that there are no fluid leaks.
- Make sure that there are no air, vacuum or exhaust leaks.
- Make sure that all components involved in repair are positioned correctly and function properly.
- Male sure all tools, shop cloths, fender covers, and protective tape are removed.
- Clean grease from painted surfaces and steering wheel.
- Unlock anti-theft radio and reset clock.

In addition to above noted points, ECM and TCM may need to be checked using Volkswagen supplied VAG 1551 or 1552 scan tool as mentioned at the start of this repair.

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GENERAL

Proper engine lubrication relies on a constant supply of oil, fed to the moving parts under pressure. Pressure is supplied by a gear-type oil pump located inside the engine oil pan. Engine oil returns to the oil pan by way of internal passages in the cylinder block and head. Returned oil collects in the oil pan where it is stored for eventual pickup by the oil pump. Engines with turbo-chargers also have external oil supply and return lines.

Engine Codes

- AWD, AWW, AWP . . . 1.8L 4-cylinder turbo gasoline
- ALH . . . . . 1.9L 4-cylinder turbo diesel
- BEW . . . . . 1.9L 4-cylinder PD turbo diesel
- AEG, AVH, AZG, BBW, BEV 2.0L 4-cylinder gasoline
- AFP, BDF . . . . . 2.8L 6-cylinder gasoline

Oil capacities with filter

- 1.8L . . . . . 4.4 liters (4.6 qt.)
- 1.9L . . . . . 4.5 liters (4.8 qt.)
- 2.0L . . . . . 4.2 liters (4.4 qt.)
- 2.8L . . . . . 5.8 liters (6.1 qt.)

NOTE —
For changing the oil and filter, see **0 Maintenance**.

NOTE —

- *If, when repairing an engine, metal shavings or large amounts of small metal particles are found in the engine oil, caused for example by partial seizure of crankshaft or connecting rod bearings, perform the following work sequences to prevent consequential damage once repairs are complete:*

- *Thoroughly clean all oil passages and insides of cylinder block and head.*
- *Replace oil spray jets.*
- *Replace oil cooler.*
- *Replace oil filter.*
- *Replace oil non-return (check) valve.*



ENGINE OIL

Some engine codes covered by this manual require oils of a type specifically developed for their special needs. The PD diesel engine, in particular, must be supplied with oils (VW 505 01) that have the ability to withstand the high loads caused by the pressures generated by the individual pump injectors on the camshaft.

Also note that all 1.8L turbo-charged gasoline engines covered by this manual require engine oils of the highest quality due to the very high operating demands imposed by the turbo-charger. These high standards can only met by synthetic oils, which are now required.

With all engine codes, failure to use oils meeting the Factory requirements can result in shortened engine life and/or engine failure. For this reason, close attention should be paid to the engine oil viscosity requirements and specifications as listed in the vehicle Owner's Manual. Also see **0 Maintenance** for additional information on Factory recommended engine oils. If in doubt, always consult an Authorized Volkswagen Dealer.

OIL PRESSURE WARNING SYSTEM

To prevent serious engine damage, a dynamic oil pressure warning system warns the driver of insufficient oil pressure.

For gasoline engines, this system includes a single oil pressure switch (F1) with a nominal closing pressure of 1.4 bar (20 psi). An electronic control unit with a buzzer and warning light completes the system and is integrated into the instrument cluster.

For diesel engines, this system includes a single oil pressure switch (F1) with a nominal closing pressure of 0.7 bar (10 psi) or 0.9 bar (13 psi). An electronic control unit with a buzzer and warning light also completes this system and is integrated into the instrument cluster.

Oil pressure warning system, checking

With the ignition off, the single oil pressure switch is open (no continuity between the terminal connection and the switch body). When the ignition is switched on, but the engine is not started, the oil pressure warning light should come on for approximately 3 seconds and then go out.

When the engine is started and the oil pressure rises, the oil pressure switch should close at the specified pressure completing a circuit to ground. When the engine reaches approximately 1500 rpm, the electronic control unit checks to see if the ground is complete and if so, the system is functioning normally. If the ground is not complete, the warning light and buzzer are activated. Several small time delays are programmed into the system to prevent accidental warnings due to normal minor fluctuations in pressure.

> ***CAUTION —***
> *If the warning indicators stay on after the engine is started, or while driving, always assume that there is insufficient oil pressure. Check oil level and test oil pressure before proceeding.*

A quick-check of the system can be accomplished as follows:

- Check instrument cluster warning light.
  - Turn key on, but do not start engine.
  - Warning light should come on for about 3 seconds and then go out.
- Turn key off. Disconnect the wire at the oil pressure switch and ground the wire. A jumper wire with alligator clips works well.
- Turn key on, but do not start engine.
- Warning light should flash and the buzzer should beep 3 times.
- Turn key off. Dis-connect the jumper wire but do not reconnect to oil pressure switch (leave unplugged).
- Start engine and let idle.
  - Warning light and buzzer should not come on.
- Increase engine speed to approx. 1500-2000 rpm.
  - Warning light and buzzer should come on after a 2-3 second delay.

If the above tests give results as noted, the oil pressure warning system is functioning within normal parameters. If the above test results deviate from specification, continue by testing the oil pressure and the oil pressure switch, given later.

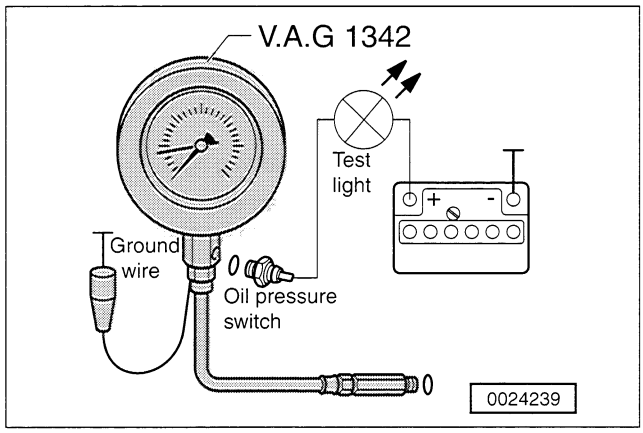
NOTE —

- *Since oil temperature can have a considerable influence on oil pressure, it may be advisable to conduct the above noted tests on both a cold and a warmed-up engine.*
- *Thin engine oils (oils with lower viscosity numbers) will also have a considerable influence on oil pressure. If in doubt, consult the owner's manual and change the engine oil to the correct viscosity.*

Oil pressure and oil pressure switch, testing

It is possible for the oil pressure warning system to be functioning properly and still give an occasional indication of a malfunction. In this case, it is advisable to check the oil pressure switch. This switch is located on the oil filter flange for both gas and diesel engines, see **Oil filter flange assembly**, given later.

– Disconnect wire from oil pressure switch and leave it unplugged for this test.



➤ Remove oil pressure switch and thread it into tester (VAG 1342 shown).

– Thread oil pressure tester hose into hole previously occupied by switch.

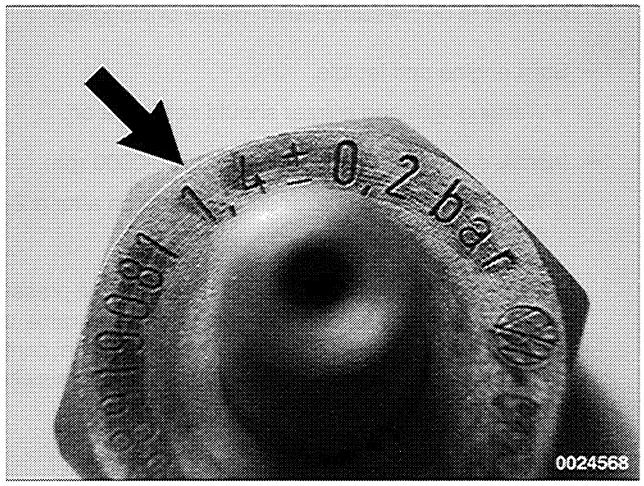
– Connect ground wire from tester to a good ground.

– Connect a test light from battery positive to oil pressure switch terminal. Light should not come on at this time; if it does, oil pressure switch is defective and must be replaced.

– Start engine and let it warm up.

– Disregard oil pressure light in instrument cluster for this test.

– When radiator fan has cycled at least once, accelerate engine until test light comes on and observe pressure gauge. The light must come on at the specified value. If light does not illuminate at specified value, switch is defective and should be replaced.



➤ Factory installed and original equipment replacement switches can usually be identified by their color and by their pressure rating marked on the switch body (**arrow**).

Oil pressure switch closing pressure

- Gasoline engines
  (1.4 bar nominal, black) . . . 1.2-1.6 bar (17.5-23 psi)
- Diesel engine
  (0.7 bar nominal, brown) . . 0.55-.85 bar (8-12.5 psi)
- Diesel engine
  (0.9 bar nominal, gray) . . . . 0.75-1.05 bar (11-15 psi)

– Continue system test by checking oil pressure. With tester still attached, run engine at specified speeds and compare readings on gauge to specification.
  - If specification is not reached, oil pump or other mechanical deficiencies are indicated.
  - If oil pressure exceeds maximum specification, malfunctions with the high pressure relief valve are indicated.

NOTE —

• Incorrect engine oil viscosity can influence engine oil pressures. Before performing repairs, ensure that engine has a sufficient quantity of fresh oil of correct viscosity.

• Excessive oil pressure can cause problems with hydraulic valve lifters along with oil seal and oil filter leakage.

Oil pressure specifications

Oil pressure at idle rpm and 80°C (176°F):

• Gasoline engine (only engine with factory specification):
2.8L (code: AFP). . . . . 2.0 bar (29 psi) minimum

Oil pressure at 2000 rpm and 80°C (176°F):

• Gasoline engines:
1.8L. . . . . 2.7 to 4.5 bar (39 to 65 psi)
2.0L. . . . . 2.7 to 4.5 bar (39 to 65 psi)
2.8L (code: AFP). . . . . 2.0 bar (29 psi) minimum
2.8L (code: BDF) . . . . . 3.0 to 5.5 bar (44 to 80psi)

• Diesel engines
1.9L (code ALH) . . . . . 2.5 bar (36 psi) minimum
1.9L (code BEW) . . . . . 2.0 bar (29 psi) minimum

Oil pressure maximum:

• Gasoline and Diesel engines . . . . . 7.0 bar (102 psi)

– When testing is completed, remove the test light and tester. Install the oil pressure switch and the wiring.

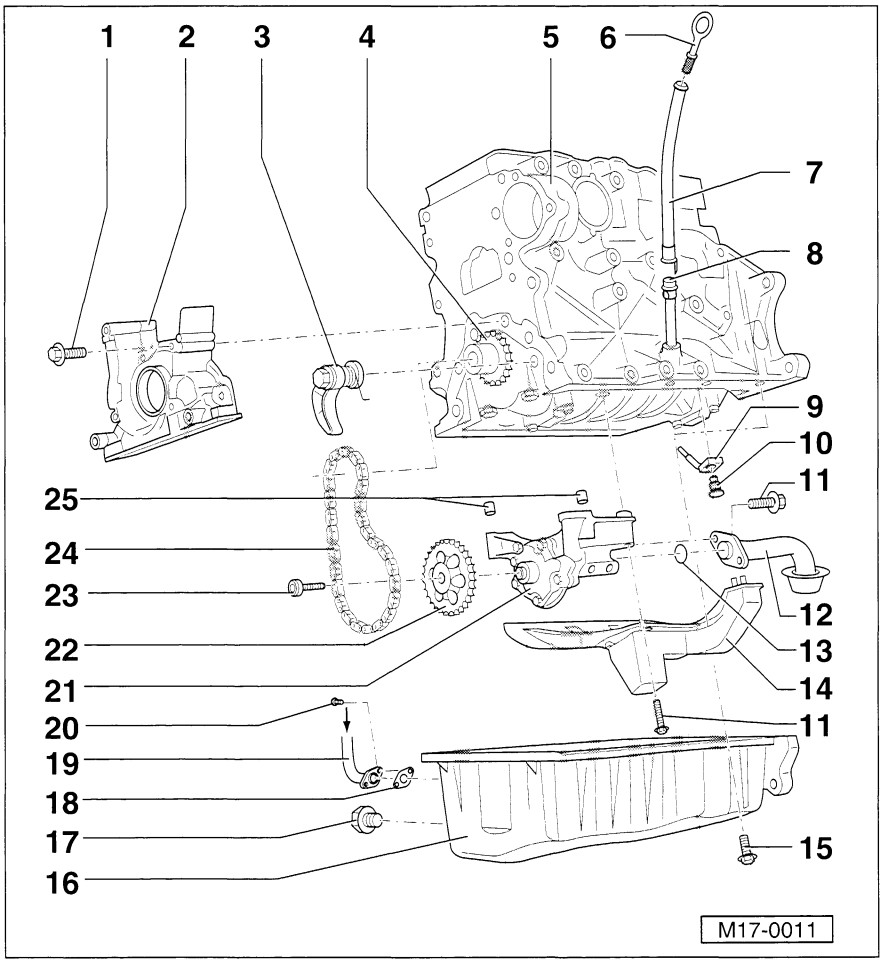
NOTE —

If an oil pressure switch seal is leaking, a new sealing washer should be installed. The sealing washer is held captive on the switch and must be cut off. New sealing rings are available from authorized Volkswagen parts dealers or aftermarket parts specialists.

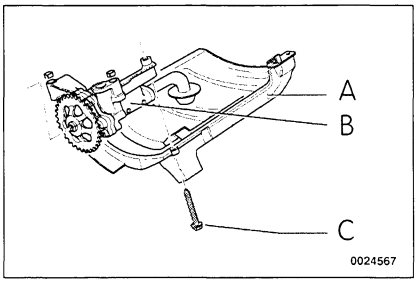
LUBRICATION SYSTEM COMPONENTS

Information in this section details specific components for each individual engine or engine group. Part numbers given are taken from Factory information. Confirm this information with an authorized Volkswagen Dealer's parts department or other Aftermarket parts specialist before starting repairs.

Lubrication system assembly (1.8L engine)



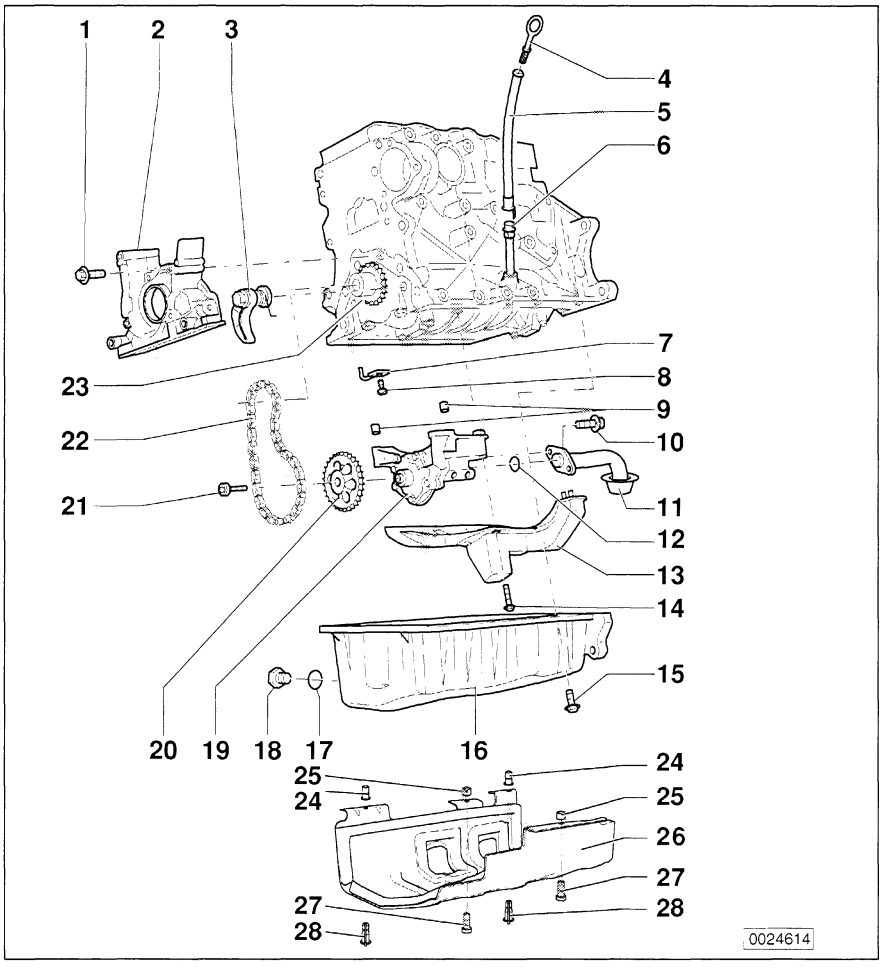
1. **Bolt**
   - Tighten to 15 Nm (11 ft-lb)
2. **Sealing flange**
   - Must be located on dowel sleeves
   - Clean sealing surface before installing
   - Install with sealant D 176 404 A2
3. **Chain tensioner with tensioning track**
   - Tighten to 15 Nm (11 ft-lb)
   - When installing, pre-tighten spring and engage
   - Inspect for wear
4. **Chain sprocket**
   - For oil pump drive
   - Inspect for wear
5. **Engine block**
6. **Dipstick**
   - Oil level must not exceed max mark
   - If oil level is in cross-hatched area or below, top off
   - See **0 Maintenance**
7. **Dipstick guide tube**
   - Pull off if using oil extraction equipment to change oil
8. **Guide tube, lower**
9. **Oil spray jet**
   - For piston cooling
   - Only operate at pressures set by relief valve
10. **Pressure relief valve**
    - Tighten to 27 Nm (20 ft-lb)
    - Opening pressure 1.3 to 1.6 bar
11. **Bolt**
    - Tighten to 15 Nm (11 ft-lb)
12. **Suction pipe**
    - Clean strainer
13. **O-ring**
    - Always replace
14. **Baffle plate**
15. **Oil pan bolts**
    - Tighten to 15 Nm (11 ft-lb)
16. **Oil pan**
    - Clean sealing surfaces before installing
    - Install with sealant D 176 404 A2
17. **Oil drain plug**
    - Tighten to 30 Nm (22 ft-lb)
    - Some engine codes require replacement at every oil change
    - If reusing old drain plug, cut off old seal and install new
18. **Gasket**
    - Always replace
19. **Oil return pipe**
    - From turbocharger
20. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
21. **Oil pump**
    - 12 bar (174 psi) relief valve
    - Ensure that both centering dowels are installed
    - Replace if any running surfaces or gears are scored
22. **Chain sprocket**
    - For oil pump
    - Check for wear
23. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
24. **Chain**
    - For oil pump
    - Mark direction of rotation before removing
    - Check for wear
25. **Dowel sleeves**
    - Check for tight fit



Baffle plate

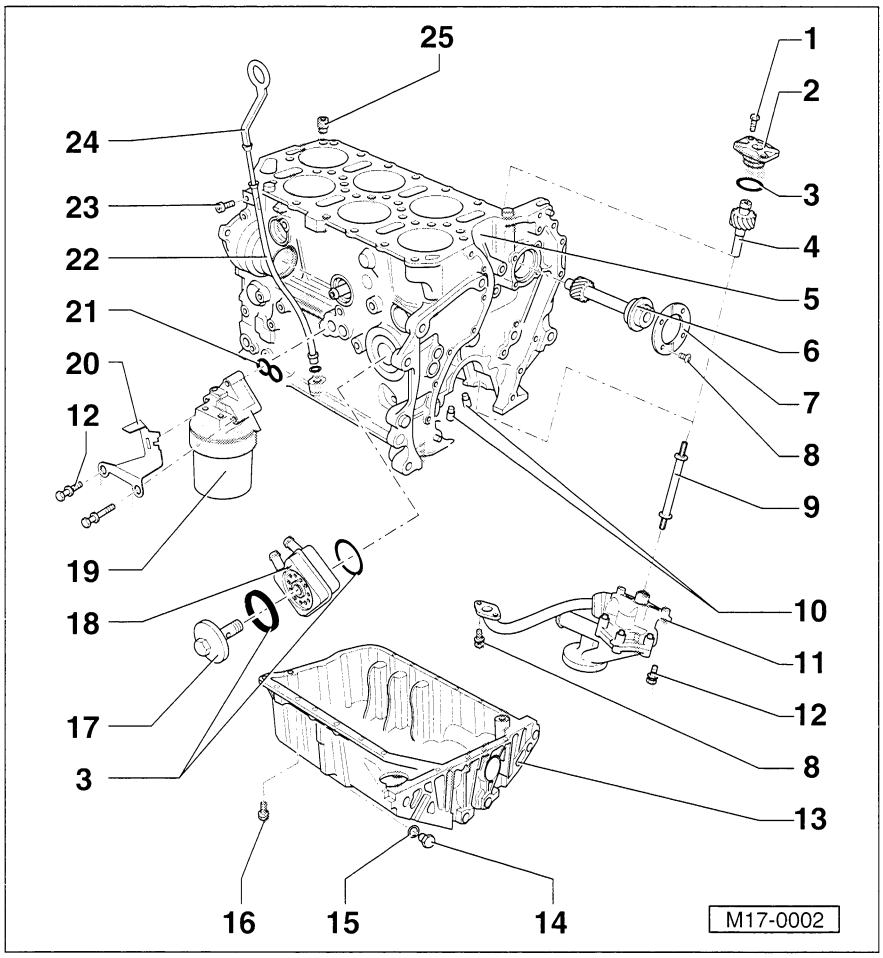
A Baffle plate (also known as "windage tray"), prevents oil starvation during cornering
B Oil pump
C Securing bolt

Lubrication system assembly (1.9L and 2.0L engines)



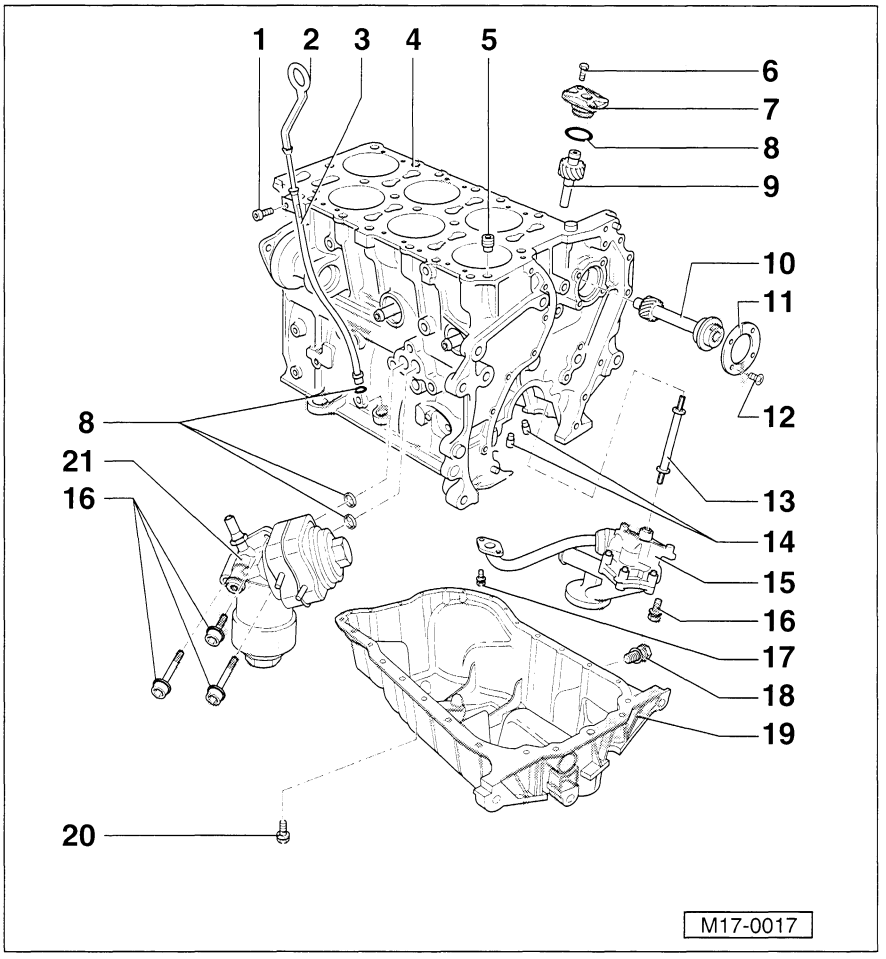
1. **Bolt**
   - Tighten to 15 Nm (11 ft-lb)
2. **Sealing flange**
   - With seal
   - Must be located on dowel sleeves
   - Clean sealing surface before installing
   - Install with silicone sealant D 176 404 A2
3. **Chain tensioner (with tensioning rail)**
   - Tighten to 15 Nm (11 ft-lb)
   - To install, first pretension spring and engage
4. **Dipstick**
   - Oil level must not exceed max. marking
   - If oil level is in cross-hatched area or below, top off
   - See **0 Maintenance**
5. **Dipstick guide tube**
   - Pull off if using oil extraction equipment to change oil
6. **Guide tube, lower**
7. **Oil spray jet**
   - For piston cooling
   - Only operate at pressures set by relief valve
   - Not applicable to all engine codes
8. **Pressure relief valve**
   - Tighten to 25 Nm (18 ft-lb)
   - Tighten to 27 Nm (20 ft-lb) (code BBW only)
9. **Dowel sleeves**
   - Check for tight fit
10. **Bolt**
    - Tighten to 15 Nm (11 ft-lb)
11. **Suction pipe**
    - Clean strainer
12. **O-ring**
    - Always replace
13. **Baffle plate**
14. **Bolt**
    - Tighten to 15 Nm (11 ft-lb)
15. **Oil pan bolts**
    - Tighten to 15 Nm (11 ft-lb)
16. **Oil pan**
    - Clean sealing surfaces before installing
    - Install with sealant D 176 404 A2
17. **Seal**
    - See item 18 below
18. **Oil drain plug**
    - Tighten to 30 Nm (22 ft-lb)
    - Some engine codes require replacement of drain plug at every oil change
    - If reusing old drain plug, cut off old seal and install new
19. **Oil pump**
    - 12 bar (174 psi) pressure relief valve
    - Ensure that both centering dowels are installed
    - Replace if any running surfaces or gears are scored
20. **Chain sprocket**
    - For oil pump
    - Check for wear
    - Tool T10051 can be used to counterhold for removal for most engine codes
21. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
22. **Chain**
    - For oil pump
    - Mark direction of rotation before removing
    - Check for wear
    - Tighten to 15 Nm (11 ft-lb)
23. **Chain sprocket**
    - For oil pump drive
    - Inspect for wear
24. **Rubber bushing (code BBW only)**
    - On cylinder block
    - Replace if damaged
25. **Sleeves (code BBW only)**
26. **Oil pan guard (code BBW only)**
27. **Bolt (code BBW only)**
    - Tighten to 37 Nm (27 ft-lb)
28. **Expansion rivet (code BBW only)**
    - With spreader pin

Lubrication system assembly (2.8L AFP engine)



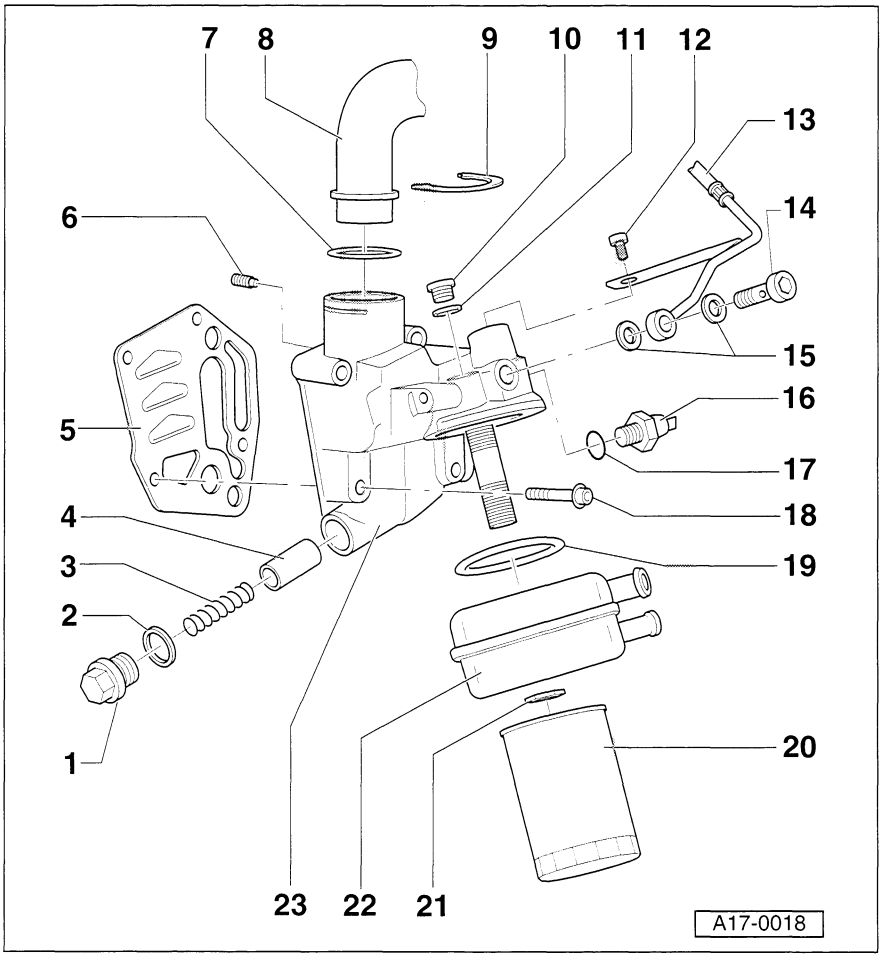
1. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
2. **Cover for oil pump drive**
   - Install with sealant D 176 404 A2
3. **O-ring**
   - Always replace
   - Lubricate before assembly
4. **Oil pump drive gear**
5. **Cylinder block**
6. **Intermediate shaft**
7. **Thrust washer**
8. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
   - Insert with thread lock "D6"
9. **Drive shaft**
   - For oil pump drive
10. **Spray nozzle**
    - Installed at crankshaft bearing positions 2-6
    - For piston cooling
    - Opening pressure: 2.0 bar
11. **Oil pump**
    - Coat oil pressure pipe on engine block and oil pump body with sealant AMV 188 001 02
12. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
13. **Oil pan**
14. **Oil drain plug**
    - Tighten to 30 Nm (22 ft-lb)
    - Some engine codes require replacement of drain plug at every oil change
    - If reusing old drain plug, cut off old seal and install new
    - Do not interchange with older versions with separate seal
15. **Seal**
    - See item 14 above
    - Always replace
    - Integral with drain plug
16. **Bolt**
    - Tighten to 15 Nm (11 ft-lb)
17. **Oil cooler cover**
    - Tighten to 25 Nm (18 ft-lb)
18. **Oil cooler**
    - Coat all contact surfaces outside the gasket with sealant AMV 188 001 02
    - When installing, do not allow cooler to come into contact with surrounding components
19. **Oil filter housing assembly with cartridge filter**
20. **Bracket**
    - For intake manifold changeover valve (N156)
21. **Gasket**
    - Always replace
    - Lubricate before assembly
    - Note installation position
22. **Dipstick guide tube**
    - Fastened to top of the intake manifold with bolts
23. **Bolt**
    - Tighten to 5 Nm (44 in-lb)
24. **Dipstick**
    - Oil level must not exceed max. marking
    - If oil level is in cross-hatched area or below, top off
    - See **0 Maintenance**
25. **Check valve**
    - Prevents oil from draining back into pump/filter to allow for immediate oil availability at cylinder head.
    - Note correct installation position
    - Tighten to 5 Nm (44 in-lb)
    - Inspect during repairs
    - Clean if dirty

Lubrication system assembly (2.8L BDF engine)



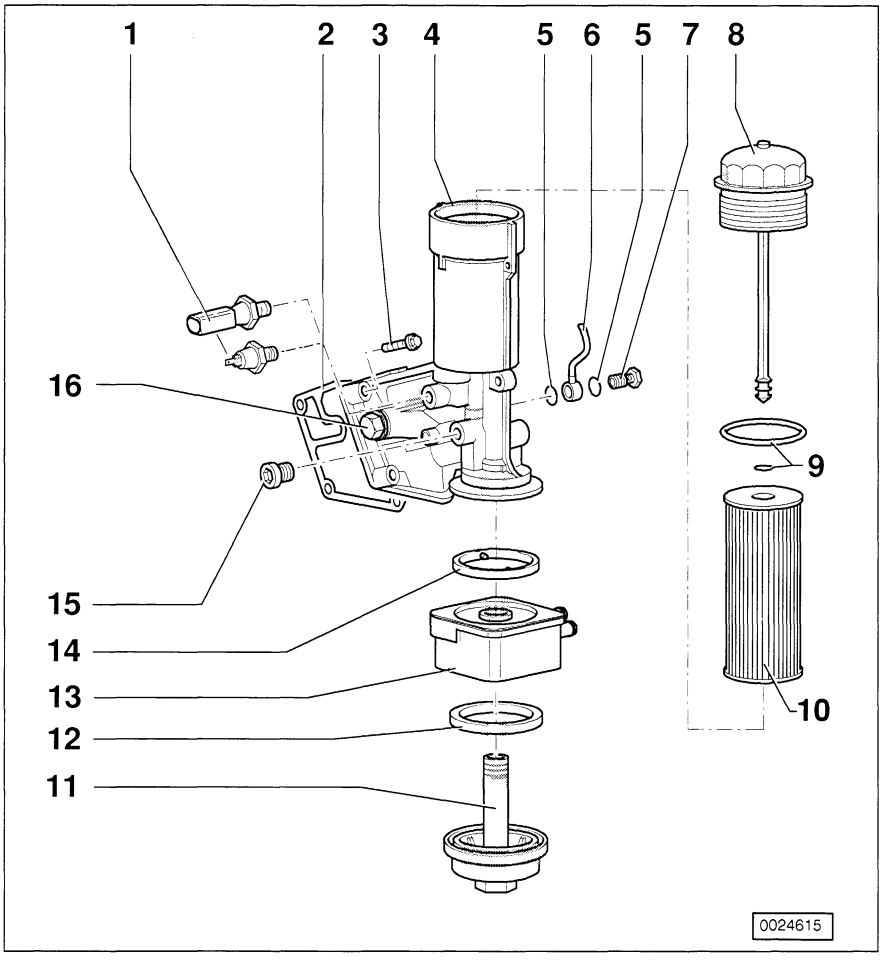
1. **Bolt**
   - Tighten to 8 Nm (71 in-lb)
2. **Dipstick**
   - Oil level must not exceed max. marking
   - If oil level is in cross-hatched area or below, top off
   - See **0 Maintenance**
3. **Dipstick guide tube**
   - Fastened to top of the intake manifold with bolt
4. **Cylinder block**
5. **Check valve**
   - Prevents oil from draining back into pump/filter to allow for immediate oil availability at cylinder head
   - Note correct installation position
   - Tighten to 5 Nm (44 in-lb)
   - Inspect during repairs
   - Clean if dirty
6. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
7. **Cover for oil pump drive**
   - Install with sealant D 176 404 A2
8. **O-ring**
   - Always replace
   - Lubricate before assembly
9. **Oil pump drive gear**
10. **Intermediate shaft**
11. **Thrust washer**
12. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
    - Insert with thread lock "D6"
13. **Drive shaft**
    - For oil pump drive
14. **Oil spray nozzle**
    - Installed at crankshaft bearing positions 2-7
    - For piston cooling
    - Opening pressure: 2.0 bar
15. **Oil pump**
    - Coat oil pressure pipe on engine block and oil pump body with sealant AMV 188 001 02
16. **Bolt**
    - Tighten to 23 Nm (17 ft-lb)
17. **Bolt**
    - Tighten to 8 Nm (71 in-lb)
    - Insert with thread lock "D6"
18. **Oil drain plug**
    - Tighten to 30 Nm (22 ft-lb)
    - With integral with seal
    - Some engine codes require replacement of drain plug at every oil change
    - If reusing old drain plug, cut off old seal and install new
    - Do not interchange with older versions with separate seal.
19. **Oil pan**
20. **Bolt**
    - Tighten to 12 Nm (9 ft-lb)
21. **Oil filter housing assembly with cartridge filter**
    - With oil cooler

Oil filter flange assembly (1.8L engines)



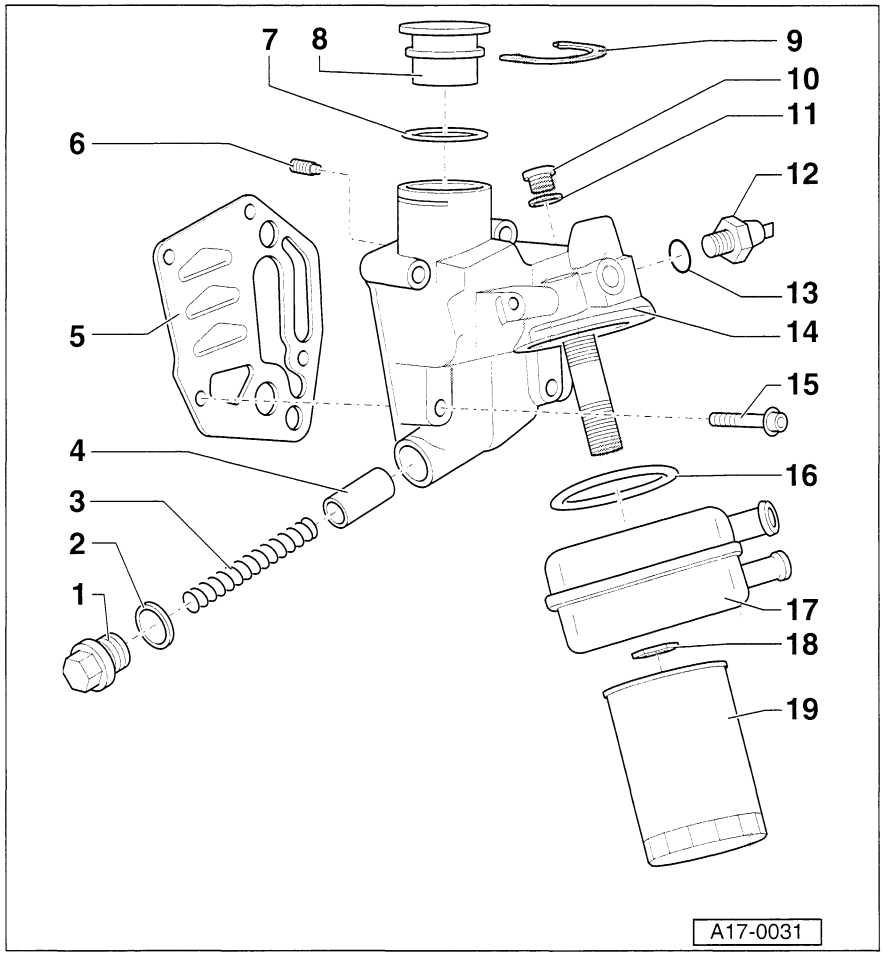
1. **Sealing plug**
   - Tighten to 40 Nm (30 ft-lb)
2. **Seal**
   - If seal leaks, cut off old seal and install new
   - Integral with sealing plug
3. **Spring**
   - For pressure relief valve, approx. 4 bar (58 psi)
4. **Piston**
   - For pressure relief valve
5. **Gasket**
   - Always replace
6. **Check valve**
   - Tighten to 8 Nm (71 in-lb)
7. **O-ring**
   - Always replace
   - Install onto connecting pipe up to shoulder (item 8)
8. **Connecting pipe**
9. **Retaining clip**
10. **Sealing plug**
    - Tighten to 15 Nm (11 ft-lb)
11. **Seal**
    - If seal leaks, cut off old seal and install new
    - Integral with sealing plug
12. **Bolt**
    - Tighten to 20 Nm (15 ft-lb)
13. **Oil supply pipe**
    - To turbocharger
14. **Banjo bolt**
    - Tighten to 30 Nm (22 ft-lb)
15. **Seals**
    - Always replace
16. **Oil pressure switch (F1)**
    - Tighten to 25 Nm (18 ft-lb)
    - Black plastic housing
    - Closes at 1.4 bar (20 psi)
17. **Seal**
    - Always replace
    - If reusing switch, cut off old seal and install new
18. **Bolt**
    - Tighten to 15 Nm (11 ft-lb) + ¼ turn (90°) further
    - Always replace
19. **O-ring**
    - Always replace
    - Fit into groove on oil cooler
20. **Oil filter**
    - "Spin-on" type
    - Loosen with strap wrench, hand tighten
    - Observe directions on filter
21. **Nut**
    - Tighten to 25 Nm (18 ft-lb)
22. **Oil cooler**
    - Installed position: must be turned fully clockwise (viewed from below) until touching its own bracket
    - Coat contact area where cooler meets flange with sealant AMV 188 001 02
    - Inspect carefully before reusing, especially if repairing major internal engine damage, see **General**
23. **Oil filter bracket**
    - With pressure relief valve, approx. 4 bar (58 psi)

Oil filter flange assembly (1.9L engines)



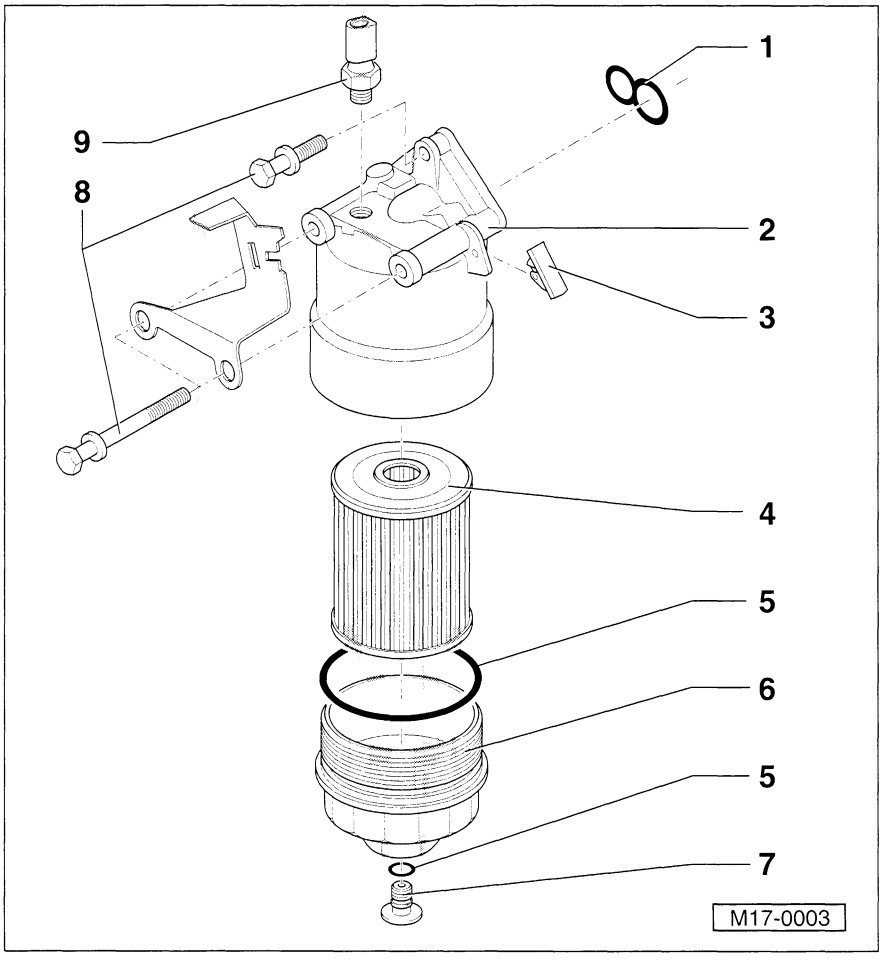
1. **Oil pressure switch (F1)**
   - ALH, tighten to 25 Nm (18 ft-lb)
   - BEW, tighten to 20 Nm (15 ft-lb)
   - If reusing switch, cut off old seal and install new; always replace
   - Single switch, 0.7 or 0.9 bar
   - Brown plastic housing closes at 0.7 bar (10 psi)
   - Gray plastic housing closes at 0.9 bar (13 psi)
2. **Gasket**
   - Always replace
3. **Bolt**
   - Tighten to 15 Nm (11 ft-lb) + ¼ turn (90°) further
   - Always replace
   - First, insert top left bolt and then lower right
   - Tighten all bolts evenly and in a crosswise pattern
4. **Oil filter bracket**
   - With pressure relief valve, approx. 4 bar (58 psi)
5. **Seals**
   - Always replace
6. **Oil supply pipe**
   - To turbocharger
7. **Banjo bolt**
   - ALH, tighten to 20 Nm (15 ft-lb)
   - BEW, tighten to 25 Nm (18 ft-lb)
8. **Sealing cap**
   - Tighten to 25 Nm (18 ft-lb)
   - Loosen and tighten using 3417 oil filter wrench
9. **O-rings**
   - Always replace
10. **Oil filter cartridge**
    - Observe installed position
11. **Oil cooler cover**
    - With securing stud
    - Tighten to 25 Nm (18 ft-lb)
12. **O-ring seal**
    - Always replace
13. **Oil cooler**
    - When installing, do not allow cooler to come into contact with surrounding components
    - Inspect carefully before reusing, especially if repairing major internal engine damage, see **General**
14. **Gasket**
    - Always replace
    - Observe installed position; fits into groove on cooler and tabs on gasket fit into slots
15. **Sealing plug**
    - Tighten to 10 Nm (7 ft-lb)
    - If seal leaks, cut off old seal and install new
16. **Sealing plug**
    - For pressure relief valve
    - Not serviceable; do NOT open

Oil filter flange assembly (2.0L engine)



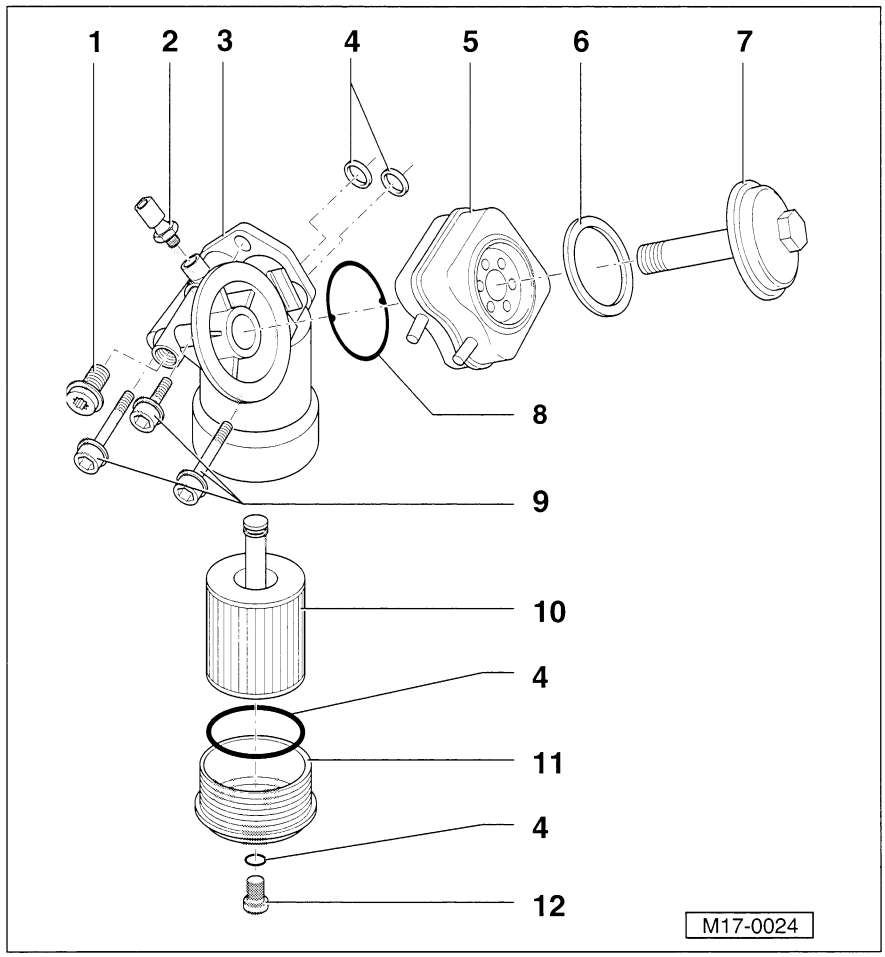
1. **Sealing plug**
   - Tighten to 40 Nm (30 ft-lb)
2. **Seal**
3. **Spring**
   - For pressure relief valve, approx. 4 bar (58 psi)
4. **Piston**
   - For pressure relief valve
5. **Gasket**
   - Always replace
6. **Check valve**
   - Press-fit or threaded into flange
   - Type depends on engine code
   - Threaded version, tighten to 8 Nm (71 in-lb)
7. **Seal**
   - Always replace
   - Install onto sealing cap up to shoulder (item 8)
8. **Sealing cap**
9. **Retaining clip**
10. **Sealing plug**
    - Tighten to 15 Nm (11 ft-lb)
11. **Seal**
    - If reusing sealing plug, cut off old seal and install new; always replace
12. **Oil pressure switch (F1)**
    - Tighten to 25 Nm (18 ft-lb)
    - If reusing switch, cut off old seal and install new; always replace
    - Black plastic housing closes at 1.4 bar (20 psi)
13. **Seal**
    - If reusing switch, cut off old seal and install new; always replace
14. **Oil filter flange**
    - With 4 bar (58 psi) relief valve
15. **Bolt**
    - Tighten to 15 Nm (11 ft-lb) + ¼ turn (90°) further
    - Always replace
16. **O-ring**
    - Always replace
    - Fit into groove on oil cooler
17. **Oil cooler**
    - When installing, do not allow cooler to come into contact with surrounding components
    - Coat contact area where cooler meets flange with sealant AMV 188 001 02
    - Inspect carefully before reusing, especially if repairing major internal engine damage, see **General**
18. **Nut**
    - Tighten to 25 Nm (18 ft-lb)
19. **Oil filter**
    - "Spin-on" type
    - Loosen with strap wrench, hand tighten
    - Observe directions on filter

Oil filter flange assembly (2.8L AFP engine)



1. **Gasket**
   - Always replace
   - Lubricate before installation
   - Note installation position
2. **Oil filter housing/flange**
   - May have additional openings closed with sealing plugs.
3. **Stop (buffer)**
   - For oil cooler
   - Fastened to oil filter housing
4. **Oil filter cartridge**
   - With by-pass valve, opening pressure: 2.0 bar
   - Snap into lower section of oil filter housing before installing
5. **O-rings**
   - Always replace
   - Lubricate with oil before installation
6. **Lower section, oil filter housing**
   - Can be removed with 36 mm wrench
   - Empty before disassembling
7. **Oil drain plug**
   - Can be removed with 6 mm hex key wrench
   - Tighten to 10 Nm (7 ft-lb)
8. **Bolt**
   - 25 Nm (18 ft-lb)
9. **Oil pressure switch (F1)**
   - Tighten to 25 Nm (18 ft-lb)
   - If reusing switch, cut off old seal and install new; always replace
   - Black plastic housing closes at 1.4 bar (20 psi)

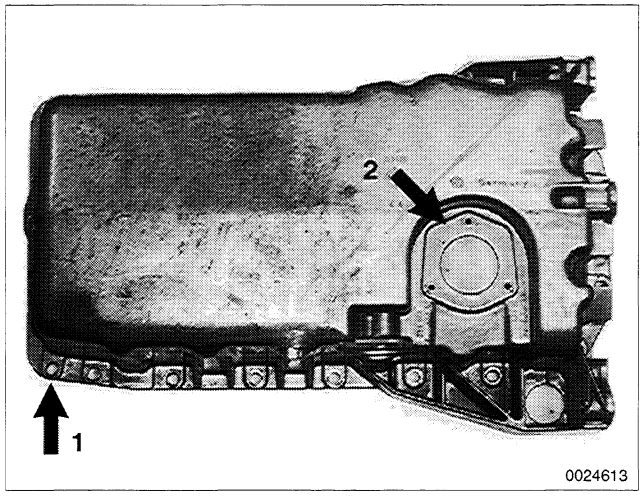
Oil filter flange assembly (2.8L BDF engine)



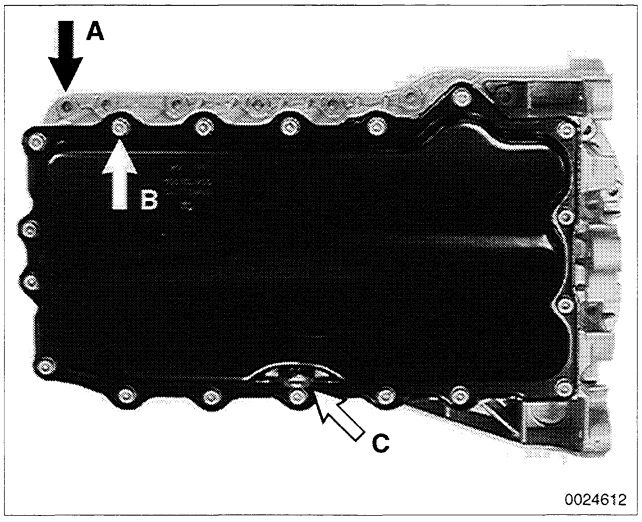
1. **Sealing plug**
   - Tighten to 15 Nm (11 ft-lb)
   - If reusing sealing plug, cut off old seal and install new; always replace
2. **Oil pressure switch (F1)**
   - Tighten to 25 Nm (18 ft-lb)
   - If reusing switch, cut off old seal and install new; always replace
   - Black plastic housing closes at 1.4 bar (20 psi)
3. **Filter housing**
   - With check valve to prevent drainback
   - Opening pressure 0.05 bar (0.7 psi)
4. **O-ring seals**
   - Always replace
   - Lubricate before installation
5. **Oil cooler**
   - When installing, do not allow cooler to come into contact with surrounding components
   - Coat contact area where cooler meets flange with sealant AMV 188 001 02
   - Inspect carefully before reusing, especially if repairing major internal engine damage, see **General**
6. **O-ring**
   - Always replace
   - Fit into groove on oil cooler
   - Lubricate with oil when installing
7. **Oil cooler cover**
   - With securing stud
   - Tighten to 25 Nm (18 ft-lb)
8. **O-ring**
   - Always replace
   - Lubricate with oil when installing
   - Insert onto oil cooler before installing cooler to flange
9. **Bolts**
   - Tighten to 23 Nm (17 ft-lb)
10. **Oil filter cartridge**
    - With by-pass valve, opening pressure: 2.5 bar
11. **Lower section, oil filter housing**
    - Empty before disassembling
    - With by-pass valve, opening pressure: 2.5 bar
12. **Oil drain plug**
    - Can be removed with 6 mm hex key wrench
    - Tighten to 10 Nm (7 ft-lb)

Oil pan

Two main types of engine oil pan are installed on engines covered by this manual.



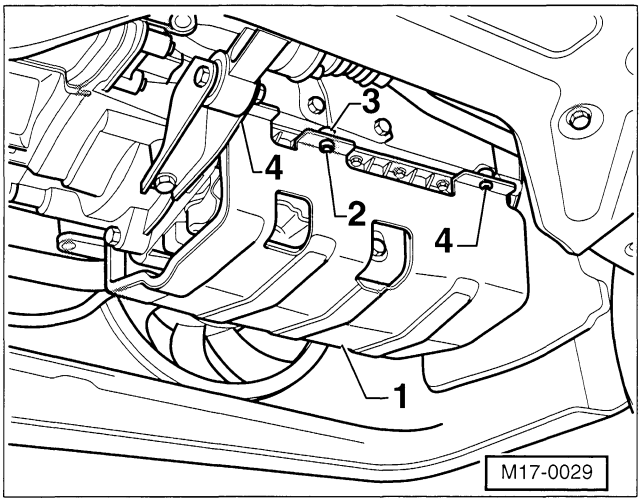
One version is cast aluminum with different configurations available. All versions are bolted to the cylinder block by numerous small bolts (**1**) and to the transmission. Silicone sealant is used instead of a conventional gasket at the joint to the cylinder block. Some configurations will have cast-in areas (**2**) for optional equipment that is not installed in the vehicle.



The second version is a two piece aluminum and steel assembly known as a "hybrid" oil pan. Hybrid oil pans have an aluminum section bolted to the cylinder block by numerous small bolts (**A**) with a stamped steel section bolted (**B**) to the aluminum section. Silicone sealant is used instead of a conventional gasket at the joint to the cylinder block and at the aluminum and steel joining surface. The aluminum section is also bolted to the transmission. The drain plug (**C**) can be either a conventional hex or a socket head (Allen) design. Guard (shown below **1**) is not generally used with this version.

If the drain plug threads in the oil pan are stripped or pulled out, particularly in aluminum oil pans, repair kits are available commercially to effect a satisfactory repair. Always follow the manufacturers's instructions to ensure a permanent leak-free repair that still allows the drain plug to be reliably removed for oil changing.

Oil pan, removing



All oil pan versions are removed in a similar manner.

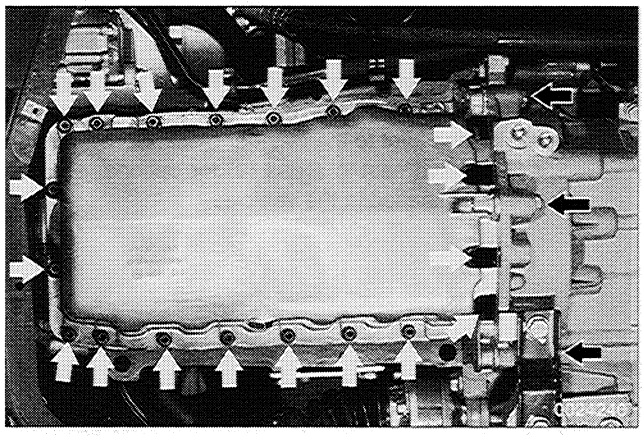
– Remove lower sound absorber panel (belly pan).

If engine is equipped with an oil pan guard (**1**), remove bolts (**2**) and sleeves (**3**).

– Press spreader pin through expansion rivet (**4**) taking care to retain pin for reuse.

– Remove guard.

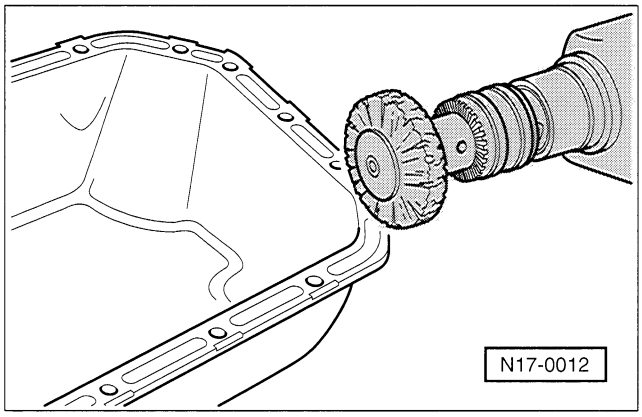
– On BDF 2.8L engine, remove bracket for secondary air injection pump motor from oil pan and cylinder block, see **26 Exhaust System and Emission Controls**.



- On AWD, AWW, and AWP 1.8L engines, disconnect turbocharger oil return line at oil pan.
- Remove oil drain plug and drain oil into a suitable container.
- Remove bolts holding the oil pan to the transmission (**black arrows**).
- Remove the bolts (**white arrows**) holding the oil pan to the cylinder block.

NOTE —
Factory suggested special tools for removal of oil pan bolts include sockets 3249 or T10058, used with extension wrench 3145. Experience has shown that standard metric sockets (especially ¼ inch drive) will allow removal when used with appropriate universal joints and extensions.

- Remove oil pan. It may be necessary to free oil pan by tapping it lightly with a rubber hammer/mallet.
- Remove old sealant residue from cylinder block with a flat scraper.



- Remove old sealant residue from aluminum oil pan with a suitable rotating brush/pad. Remove sealant from steel hybrid oil pan section if separated.

NOTE —
Use care to avoid scratching aluminum oil pan.

> ***WARNING —***
> *Always wear suitable eye protection when using a rotating brush/pad.*

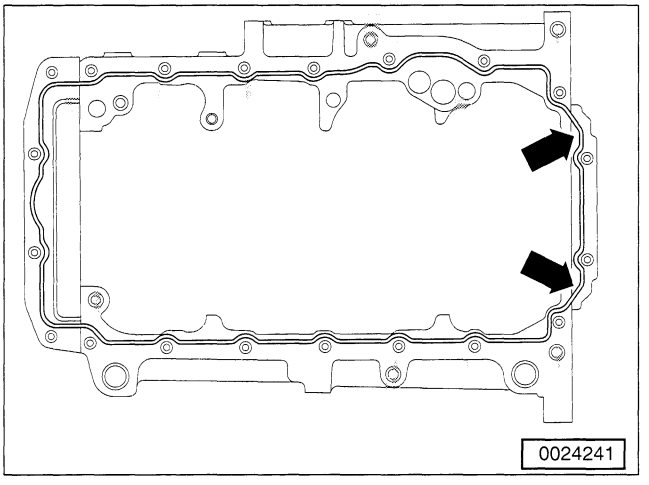
- Clean all sealing surfaces on oil pan and cylinder block so that there are no traces of oil or grease.

Oil pan, installing

All oil pan versions are installed in a similar manner with the hybrid oil pan requiring an additional step if the aluminum and steel sections have been separated. Before installing the oil pan, observe the following points:

- Volkswagen recommends using special silicone sealant D 176 404 A2 on the oil pan and cylinder block and D176 501 A1 at the steel/aluminum joint of the hybrid oil pan.
- The above sealants are date coded. Observe the "Use by date" on the sealant container.
- Oil pan must be installed within 5 minutes of applying sealant.
- Allow sealant to cure for 30 minutes before adding engine oil to the pan.

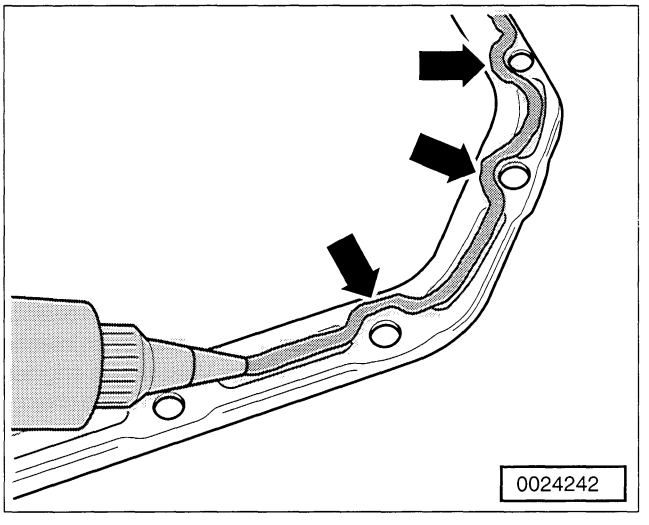
NOTE —
Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.



– Be sure that the sealing surfaces on the oil pan and cylinder block are clean with no traces of oil or grease.

➢ Cut sealant tube nozzle at first mark and apply a 2 to 3 mm (slightly less than 1/8 inch) bead of new sealant to cylinder block sealing surface. Be sure to run bead on inside of bolt holes. Use extra care in areas where bolt hole are close to edges (**arrows**). Keep sealant out of bolt holes.

> ***WARNING —***
> *The sealing compound bead thickness must not be wider than 3 mm (slightly less than 1/8 inch). If this width is exceeded, excess sealing compound will enter the oil pan and could block the oil pump pick-up tube strainer.*



➢ Apply a 2 to 3 mm (slightly less than 1/8 inch) bead of new sealant to oil pan sealing surface. Be sure to run bead on the inside (**arrows**) of the bolt holes.

– Immediately install oil pan to cylinder block and loosely install M7 bolts diagonally.

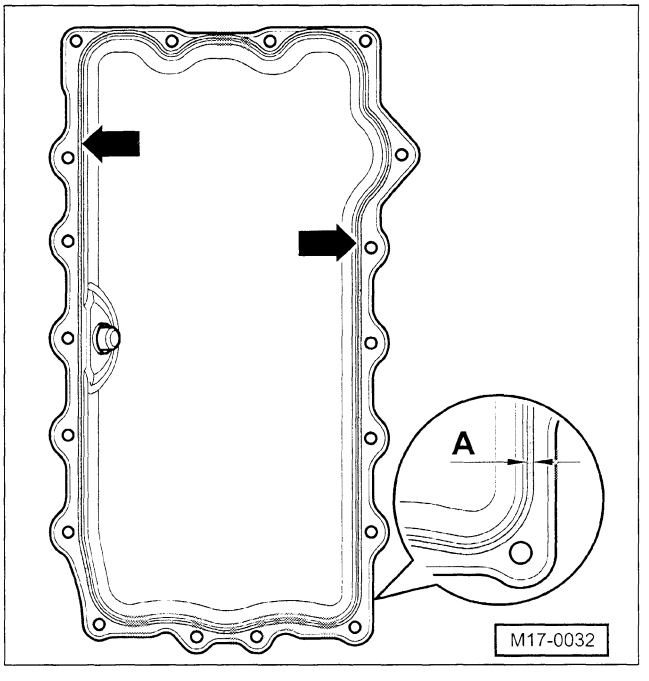
> ***NOTE —***
> *If the engine and transmission are separated for this operation, install the oil pan flush with the flywheel edge of the cylinder block.*

– Install and lightly tighten M10 bolts securing oil pan to transmission.

– Diagonally tighten M7 oil pan bolts further, but not to final torque.

– Torque M10 bolts securing oil pan to transmission.

– Diagonally torque M7 bolts securing oil pan to cylinder block.



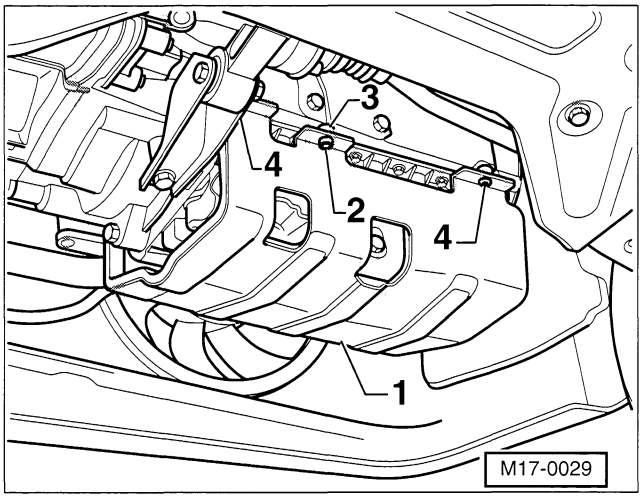
Tightening torques

- Oil pan to transmission (M10) . . . . . 45 Nm (33 ft-lb)
- Oil pan to cylinder block (M7) . . . . . 15 Nm (11 ft-lb)
- Oil pan guard to cylinder block . . . . 37 Nm (27 ft-lb)
- Oil drain plug (M14)
  - 4-cylinder engines . . . . . 30 Nm (22 ft-lb)
  - 6-cylinder engines . . . . . 30 Nm (22 ft-lb)

➢ If hybrid oil pan was separated, apply sealant D 176 501 A1 to clean sealing surface of lower (steel) section. Apply a 2 to 3 mm (slightly less than 1/8 inch) bead of new sealant (**A**) to oil pan sealing surface. Be sure to run bead on the inside (**arrows**) of the bolt holes.

Tightening torque

- Hybrid oil pan, lower section . . . . . 10 Nm (7 ft-lb)



– Install original drain plug, new drain plug, and/or new seal as required.

– Install turbocharger oil return line where applicable.

➤ If engine is equipped with an oil pan guard, inspect rubber bushings in cylinder block before installing guard.

– Position guard (**1**) on cylinder block and push rivets into rubber bushings so that heads are against the guard. Press spreader pins into expansion rivets (**4**).

– Install sleeves (**3**). Install bolts (**2**) with locking compound D6 and tighten.

– Install lower sound absorber panel (belly pan).

– Wait at least 30 minutes as prescribed and refill with proper viscosity, quality, and quantity of engine oil.

– Be sure to quality check your work, see **Quality Review** at the end of this repair group.

Oil pump

On 4-cylinder engines the oil pump is located inside the engine oil pan and is bolted to the cylinder block below the front of the crankshaft. The oil pump is driven by a short chain connected directly to the crankshaft rather than by an intermediate shaft as on previous 4-cylinder Volkswagen engines. A spring loaded tensioner takes up any slack in the chain.

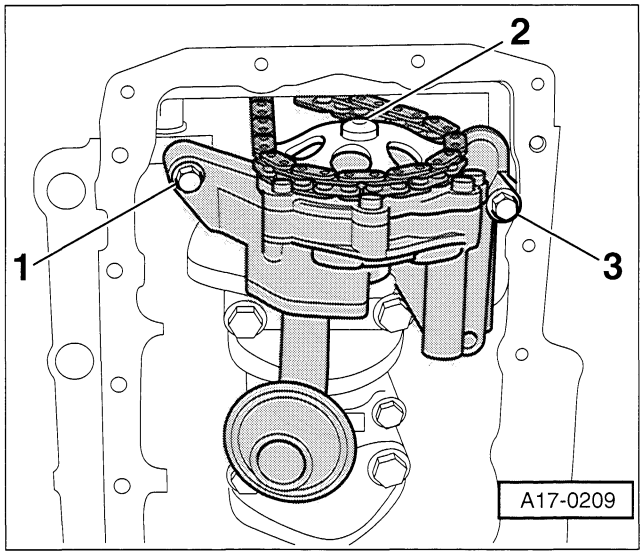
There is normally no need to remove and inspect the oil pump unless oil pressure is inadequate. Check the oil pressure as described earlier in **Oil pressure and oil pressure switch, testing**.

There are no serviceable parts inside the oil pump, however the pump can be disassembled and visually inspected for scoring and wear on the gears and running surfaces. If abnormal scoring is found, the pump must be replaced.

On 6-cylinder engines, the oil pump is located inside the engine oil pan and draws engine oil through a pickup tube from near the bottom of the pan. The pump can be removed for inspection of its internal clearances (a potential source of low oil pressure problems) by first removing the oil pan, although internal replacement parts are not available from Volkswagen.

Oil pump, removing and installing (AEG, AVH, AZG engine)

The Factory service information shows a procedure for removing and installing the oil pump on 2.0L AEG, AVH, and AZG coded engines only. However, since all 4-cylinder engines covered by this manual are similar, the procedures for removal and installation on other engine codes will be similar as well.

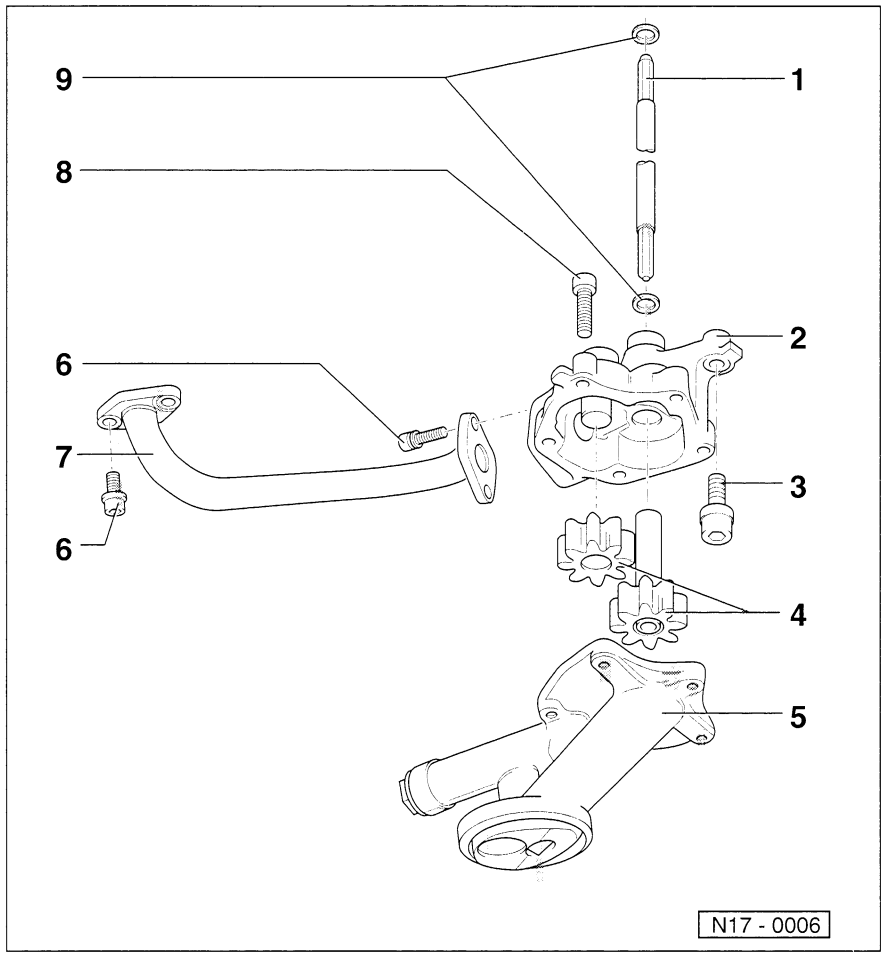


- Remove oil pan as given earlier.
- Remove baffle plate.
- Remove bolt (**2**) securing sprocket to pump. Counterhold using an appropriate tool (T10051 or equivalent) in the holes of the sprocket.
- Remove pump securing bolts (**1** and **3**) and remove oil pump.
- To install, ensure that dowel sleeves are in the upper part of the pump.
- Install sprocket into chain, and sprocket onto pump shaft.
- Bolt pump to cylinder block.
- Bolt sprocket to pump shaft.
- Balance of installation is the reverse of disassembly.

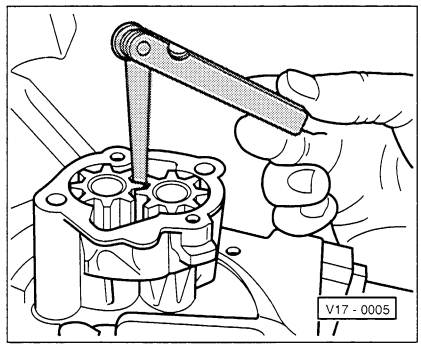
Tightening torques (4-cylinder engines)

- Oil pump to cylinder block (M7) . . . . 15 Nm (11 ft-lb)
- Sprocket to oil pump (M8) . . . . . 25 Nm (18 ft-lb)
- Oil pump cover to body (M6) . . . . . 10 Nm (7 ft-lb)
- Suction pipe to body (M7) . . . . . 15 Nm (11 ft-lb)

Oil pump assembly (2.8L engine)

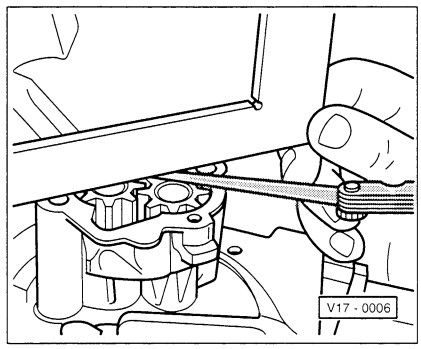


1. **Drive shaft**
   - For oil pump drive
2. **Oil pump housing**
3. **Bolt**
   - AFP, tighten to 25 Nm (18 ft-lb)
   - BDF, tighten to 23 Nm (17 ft-lb)
4. **Gears**
   - Checking tooth backlash, see **Oil pump tooth backlash, checking**
   - Checking end (axial) play, see **Oil pump gear axial play, checking**
5. **Oil pump cover with pressure relief valve**
   - Opening pressure: 5.3 - 5.7 bar (77 to 83 psi)
   - Ensure that inlet strainer is not obstructed, clean as required
6. **Bolt**
   - Install with thread lock D6
   - AFP, tighten to 10 Nm (7 ft-lb) Always replace
   - BDF, tighten to 8 Nm (6 ft-lb)
7. **Discharge pipe**
   - Coat the engine block and oil pump body mating surfaces with sealant AMV 188 001 02
8. **Bolt**
   - AFP, tighten to 10 Nm (7 ft-lb)
   - BDF, tighten to 8 Nm (6 ft-lb)
9. **O-ring**
   - Replace if damaged



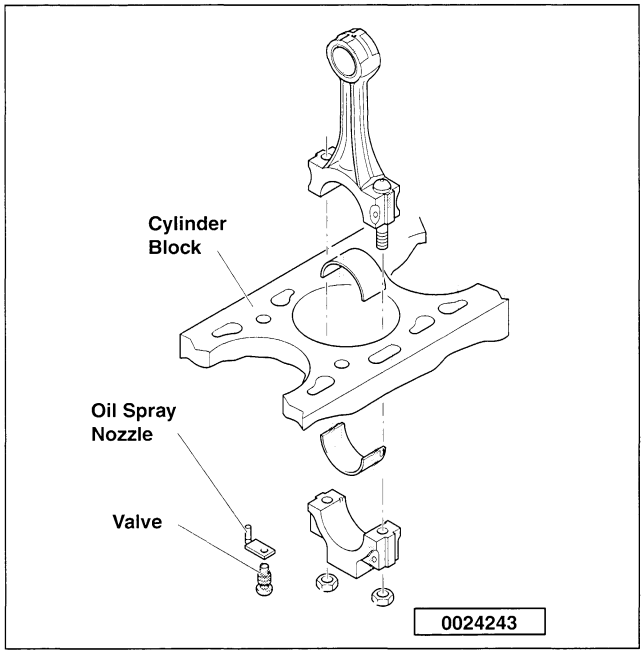
Oil pump tooth backlash, checking (2.8L engine)

- Maximum allowable backlash is 0.20 mm (0.0079 in.)



Oil pump gear axial play, checking (2.8L engine)

- Use straight edge and feeler gauge as shown.
- Wear limit (max. allowable): 0.10 mm (0.0039 in.)



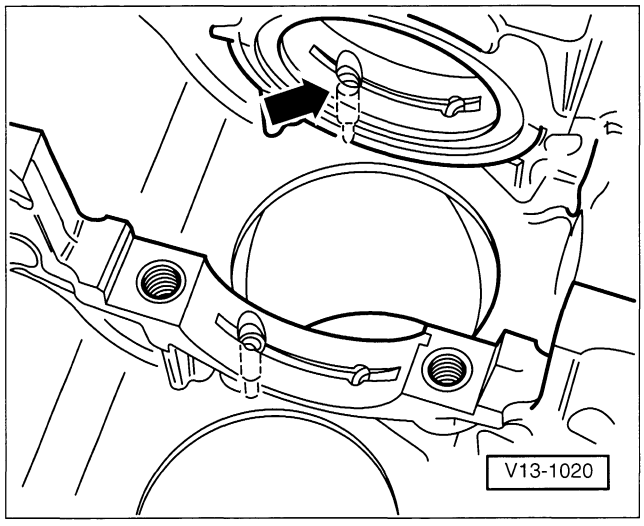
Oil spray nozzles

Some engines covered by this manual are equipped with oil spray nozzles. The oil spray nozzles atomize a fine mist of engine oil and direct it against the bottom of the piston for additional cooling and lubrication.

On 1.8L engines the oil spray nozzles are attached to the cylinder block at the base of the cylinder bore. The oil spray nozzle is regulated by the valve that secures it to the cylinder block. The valve only opens to allow flow when oil pressure is greater than 2.5 to 3.2 bar (37 to 47 psi). To access the oil spray nozzles, the oil pan must first be removed.

> ***CAUTION —***
> *If significant amounts of metal and other abrasive particles (caused by corrosion of the crankshaft, small end bearings, etc.) are discovered in the oil during engine repair work, it will be necessary to replace all spray nozzles, oil filter cartridge, oil cooler and to carefully clean all oil passages to prevent more damage.*

On 2.8L engines, the oil spray nozzles are fitted above the crankshaft main bearing shells in the cylinder block. To access the oil spray nozzles on the 2.8L engine, the engine and crankshaft must first be removed.



Use a 4 mm drift to press out the oil spray nozzle (**arrow**) toward the engine mount. The spray nozzles can be installed by hand using a 6mm drift.

Oil cooler

The oil cooler is an oil-to-coolant heat exchanger. Engine oil flows through one part of the cooler and gives up heat to the engine coolant flowing through the other part of the cooler. During warm-up, the process is reversed and engine coolant gives up heat to the engine oil because the engine coolant gets warm first. This speeds the warm-up process and gets the engine to operating temperature more quickly. The various oil coolers are shown earlier in this section, see **Oil filter flange assembly**.

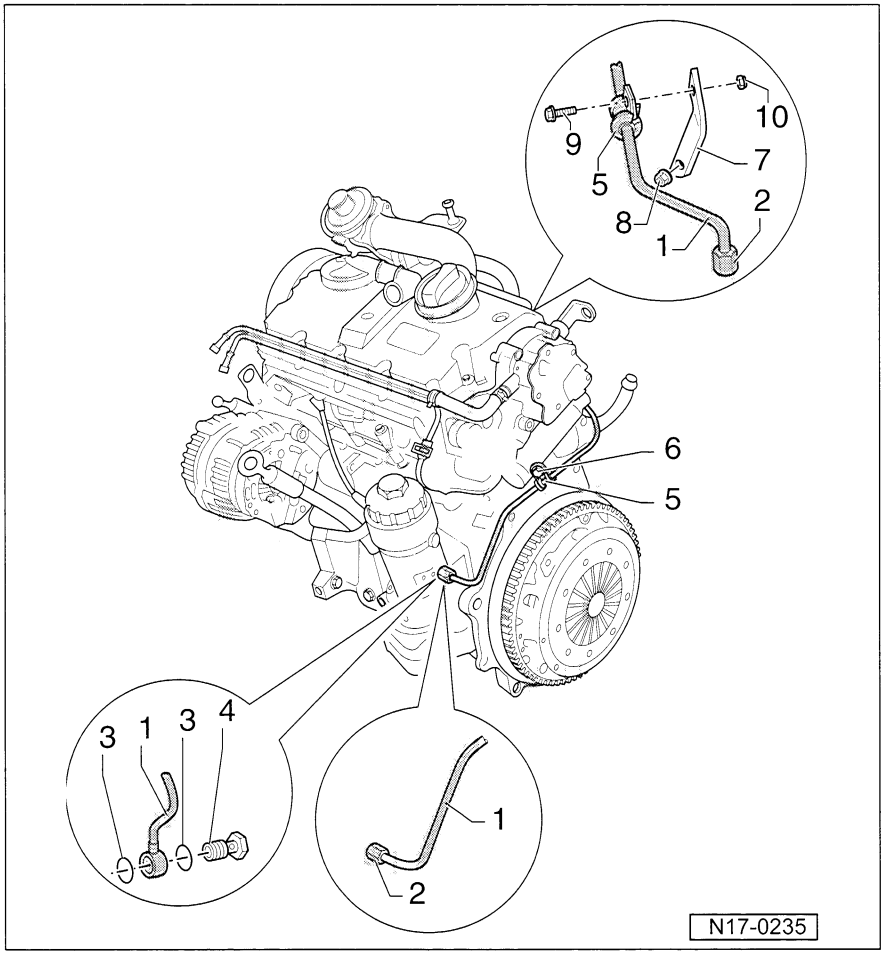
> ***NOTE —***
> - *The oil cooler should be replaced if metal particles or metal shavings are found in the engine oil.*
> - *The cooler is a potential source of leakage between the lubrication system and the cooling system and should be considered whenever such leakage is suspected.*

Remove oil cooler only if it needs to be inspected or replaced. Ensure that there is adequate space for coolant hose connections and that cooler is properly positioned.

Tightening torque

- Oil cooler sealing cap or nut to filter flange . . . . . 25 Nm (18 ft-lb)

Oil supply to turbocharger, (1.9L PD diesel engine)



1. **Oil supply line**
   - Pressure feed to turbocharger
   - Connection to oil filter flange can be either union nut or banjo bolt, depending upon production date
   - Removal and installation sequence must be followed to prevent un-necessary vibration from causing oil leakage. See **Oil supply line removing and installing**.
2. **Union nut**
   - Tighten to 22 Nm (16 ft-lb)
   - Counterhold union when loosening and/or tightening
3. **Seals**
   - Always replace
4. **Banjo bolt**
   - Tighten to 25 Nm (18 ft-lb)
5. **Line securing clamps**
   - Lined with steel mesh to hold line in position but allow for small amount of movement
6. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
7. **Mounting bracket, rear**
   - Secures line to manifold
8. **Nut**
   - Tighten to 25 Nm (18 ft-lb)
9. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
10. **Nut**
    - Tighten to 10 Nm (7 ft-lb)

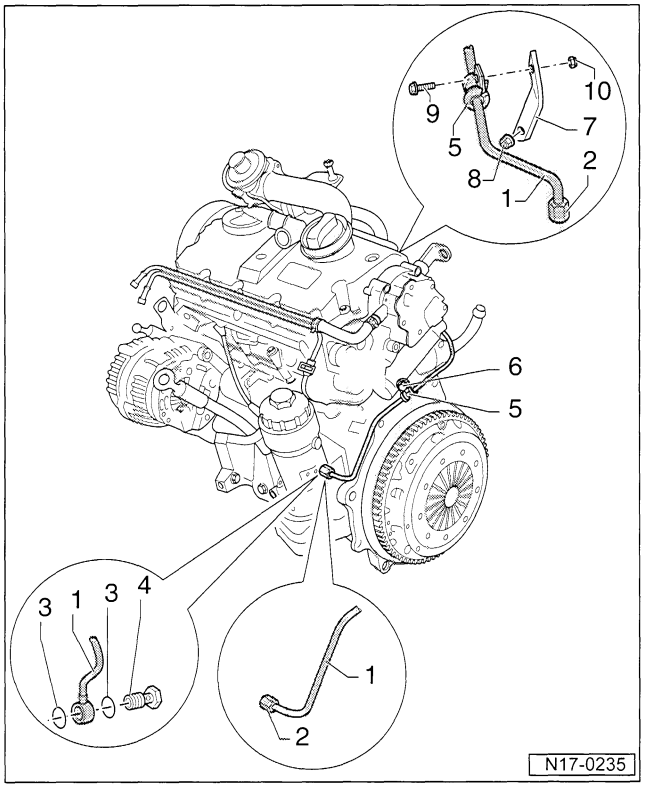
Oil supply line (1.9L PD diesel engine), removing and installing

Removing

– Remove upper and lower sound absorber panels (engine cover and belly pans) as needed for access.

– Position a drip tray under work area to catch spillage.

– Remove air cleaner housing.



➢ Remove union nut (**2**) or banjo bolt (**4**) from oil filter flange.

– Remove bolt (**6**).

– Remove union nut (**2**) on turbocharger.

– Remove bolt (**9**) from rear mounting bracket (**7**).

– Remove nut (**8**) and take off rear mounting bracket (**7**).

– Remove oil supply line (**1**).

Installing

> ***CAUTION —***
> *The installation of the oil supply line must be as described below.*

– Screw bracket (**7**) with nut (**8**) finger tight only onto exhaust manifold.

– Install union nut (**2**) or banjo bolt (**4**) on oil filter flange.

– Install union nut (**2**) on turbocharger.

– Tighten union nut (**2**) or banjo bolt (**4**) on oil filter flange to specified torque.

– Tighten union nut (**2**) on turbocharger to specified torque.

– Position clips (**5**) on oil supply line.

– Tighten bolts (**6**) and (**9**) to specified torque.

– Tighten nut (**8**) to specified torque.

– Balance of installation is reverse of removal.

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GENERAL

This section covers repairs and troubleshooting for the engine cooling system. For heater core and related heating and air conditioning components, see **80 Heating and Air Conditioning**. For information on the engine oil cooler, see **17 Engine-Lubrication**. For information on the ATF cooler used on vehicles with automatic transmissions, see **37 Automatic Transmission**.

Engine Codes

- AWD, AWW, AWP . . . 1.8L 4-cylinder turbo gasoline
- ALH . . . . . 1.9L 4-cylinder turbo diesel
- BEW . . . . . 1.9L 4-cylinder turbo PD diesel
- AEG, AVH, AZG, BBW, BEV . . 2.0L 4-cylinder gasoline
- AFP, BDF . . . . . 2.8L 6-cylinder gasoline

Warnings and cautions

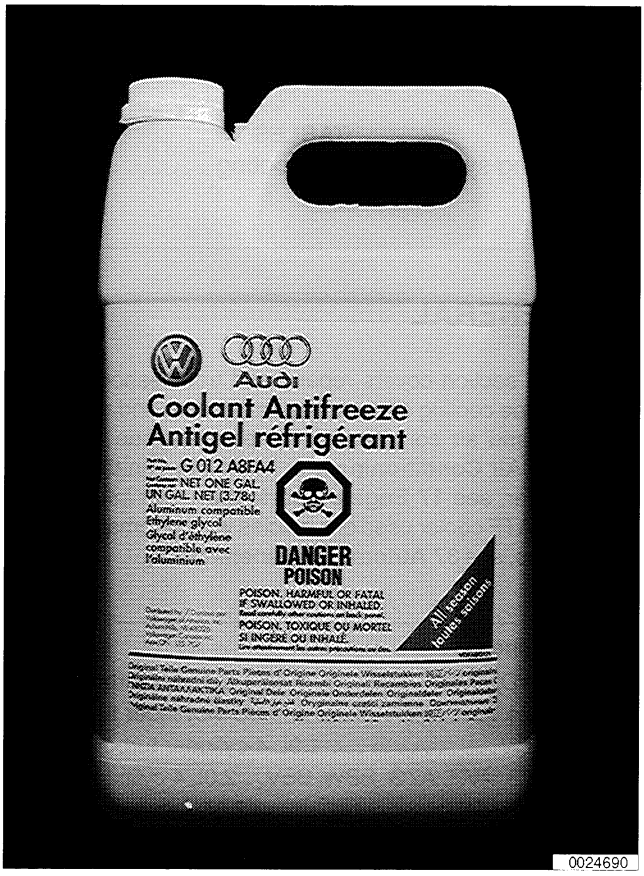
The following warnings and cautions should be observed when working on the cooling system.

WARNING —
Hot coolant can scald and result in serious personal injury. Do not work on the cooling system until it has fully cooled.

WARNING —

- *At normal operating temperature the cooling system is pressurized. Allow the system to cool as long as possible before opening, a minimum of an hour, then release the cap slowly to allow safe release of the pressure.*
- *Releasing the cooling system pressure lowers the coolant's boiling point, and the coolant may boil suddenly. Use heavy gloves and wear eye and face protection to guard against scalding.*
- *Use extreme care when working at or near the radiator cooling fans when the engine is hot. The fan can come on at any time, even if the ignition key is switched off.*
- *Use extreme care when draining and disposing of engine coolant. Coolant is poisonous and lethal. Children and pets are attracted to coolant because of its sweet smell and taste. See a doctor or veterinarian immediately if any amount of coolant is ingested.*
- *Disposal of used coolant must be done in conformance with all applicable local, state and federal laws. Do not pour into the ground or down drains or sewers. Contamination of ground water will result.*

CAUTION —
Avoid adding cold water to the cooling system while the engine is hot or overheated. If it is necessary to add coolant to a hot system, do so only with the engine running and the coolant pump operating.



Coolant, pump and thermostat

Volkswagen uses only one type of antifreeze/coolant in the Golf, Jetta and GTI models covered by this manual. Through model year 2002, it is identified by its red/pink color. From model year 2003, it is identified by its slightly purple color. In both cases, this antifreeze/coolant is phosphate and silicate free and when supplied by Volkswagen, both coolants are known as G12.

Purple G12 (VW part number G 012 A8F A4) replaces the red/pink G12 (ZVW 237 G12) and both can be mixed. However, due to the special characteristics of G12, it should **never** be mixed with any other type of coolant of any color including (but not limited to) the Volkswagen supplied green/blue G11. See **Maintenance** for additional information and cautions.

For best overall performance, the coolant additive proportion must be at least 40%, but not more than 60% to maintain the antifreeze protection and cooling efficiency. Distilled water should always be used due to the various chemicals and minerals usually associated with tap water. Under no circumstances should 100% coolant/antifreeze be used. This will generally result in overheating and poor heater operation due to the poor heat transfer characteristics of pure anti/freeze. For accurate testing of antifreeze/coolant protection, a refractometer such as VW tool CEN5021 should be used, see **Coolant/antifreeze protection, testing**. A 50/50 mixture is generally preferred and will provide freeze protection to -34°F (-37°C).

An impeller-type coolant pump is mounted into cylinder block. On 4-cylinder engines, the pump is crankshaft-driven by the same toothed belt that drives the camshaft. On 6-cylinder engines, the pump is driven by the ribbed belt. In both cases, coolant circulated through the system whenever the engine is running. Some engine also feature an electrically-driven coolant pump to help circulate coolant to remote areas of the engine. This pump will continue to run after the engine is switched off to allow for even engine cool-down.

The thermostat controls coolant flow through the radiator. When the engine is cold, the thermostat restricts flow through the radiator to allow the engine to reach operating temperature quicker. As the engine heats up, the thermostat opens and coolant circulates through the whole system, including the radiator.

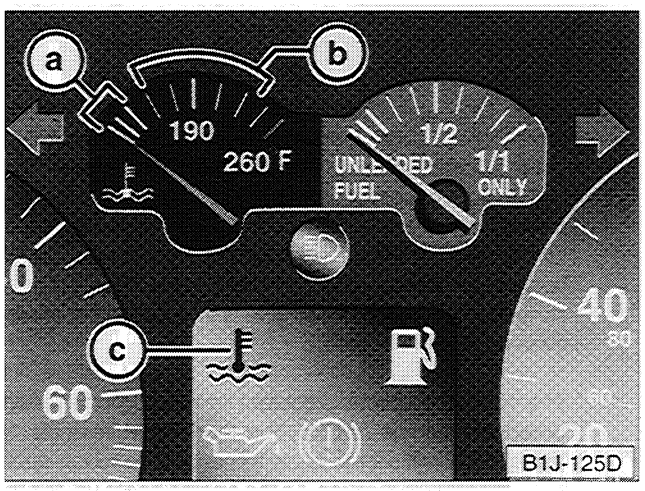
2.8 and 1.8 liter engines also use an electric coolant pump to aid in additional cooling. This is known as the after-run coolant pump.

Radiator and cooling fan

A radiator cooling fan assembly provides auxiliary air flow through the radiator. The fan assembly is electrically operated and thermostatically controlled so that it runs only when extra air flow is required to maintain proper coolant temperature.

The radiator is a cross-flow design constructed of an aluminum core and plastic side tanks. A translucent expansion tank, or overflow reservoir, provides for the expansion of the coolant at higher temperatures, easy monitoring of the coolant level and a convenient location for adding coolant.

An electric radiator cooling fan assembly is controlled by a thermoswitch located in the side of the radiator. At higher coolant temperatures, the switch closes to start the cooling fans. Any time the coolant temperature rises to higher than normal levels, the fan will start and continue to run until coolant temperature returns to a normal range. On vehicles with air conditioning, rising refrigerant pressures will also activate the cooling fans.



WARNING —

The electric cooling fans can come on at any time, even if the key is out of the ignition. To avoid personal injury, use extreme caution when working at or near the cooling fan if the engine is hot. As a safety precaution, always disconnect the harness connector from the fan when working around the radiator, fans and associated components.

Coolant temperature/level warning lights

The Golf, Jetta and GTI are equipped with a conventional coolant temperature gauge. The needle in the gauge will indicate coolant temperature shortly after the ignition is switched on. When the ignition is switched on, the warning light will flash for a few seconds as a functional check.

When the engine is cold the coolant temperature gauge will read in the **a** zone as shown at left. Avoid high engine speeds and heavy throttle when the needle is at the lower end of the dial.

As the engine warms up the gauge will move into the **b** zone. If the engine is working hard at high outside temperatures, the needle may move toward the upper end of the scale. This is no cause for immediate concern as long as the coolant temperature warning light (**c**) does not start flashing. Turning off the air conditioner can help the engine run cooler if it appears to be overheating.

If the warning light (**c**) flashes when driving, first check the coolant temperature gauge. If the needle is in the normal range, add coolant at the next opportunity. If the needle is in the warning range (upper end of scale) the coolant temperature is too high and the vehicle should be stopped immediately and the engine shut off.

TROUBLESHOOTING

When investigating the cause of overheating or coolant loss, begin with a visual inspection of the system. Check the coolant level and inspect for evidence of coolant leaks.

The system becomes pressurized at normal operating temperatures. Leaks may prevent the system from becoming pressurized and allow the coolant to boil at a lower temperature. If visual evidence is inconclusive, a cooling system pressure test will determine whether the system leaks and may help to indicate the source.

Table a. Cooling system troubleshooting

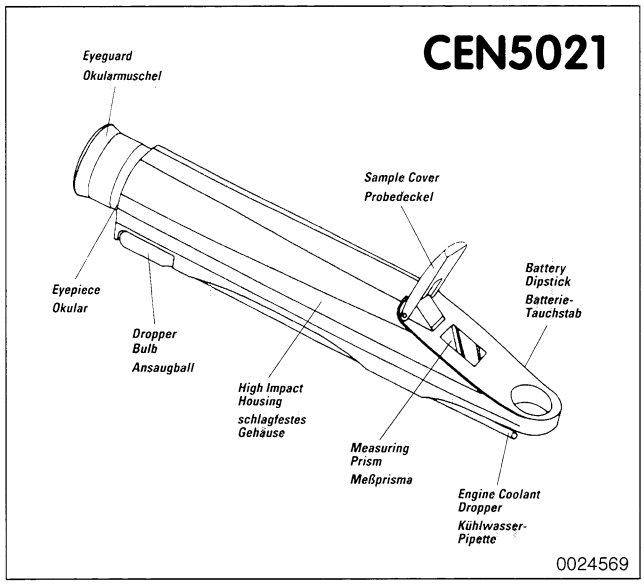
Symptom	Probable cause	Corrective action
1. Engine overheats	a. Low coolant level	a. Fill expansion tank to the MAX mark on a cold engine. Check cooling system for leaks with pressure tester.
	b. Incorrect coolant concentration	b. Adjust coolant concentration to a mix of 50% coolant additive and 50% distilled water.
	c. Poor air flow through radiator	c. Check for debris (leaves, bugs, etc.) buildup on front of radiator. Clean radiator exterior using compressed air.
	d. Radiator fan not switching on	d. Test thermoswitch and fan. Replace faulty parts.
	e. Faulty radiator cap	e. Pressure test radiator cap. Replace faulty cap.
	f. Faulty thermostat	f. Remove and test thermostat. Replace faulty thermostat.
	g. Coolant pump faulty	g. Remove and inspect for spun impeller or pulley hub.
	h. Radiator hose restricted (lower hose may collapse at high engine or highway speeds)	h. Check hoses for soft, spongy areas. Replace faulty hoses.
	i. Clogged radiator	i. Clean or replace faulty radiator.
	j. Internal engine mechanical fault	j. Check internal engine condition, see **15 Cylinder Head and Valvetrain**, for appropriate engine.
2. Temperature gauge reads low, poor heater output	a. Incorrect coolant concentration	a. Adjust coolant concentration to a mix of 50% coolant additive and 50% distilled water.
	b. Faulty thermostat	b. Remove and test thermostat. Replace faulty thermostat.
	c. Radiator fan not switching off	c. Test thermoswitch. Replace faulty parts.
3. Temperature gauge reads low, heater output normal	a. Faulty instrument cluster or coolant temperature sensor	a. Test instrument cluster and sensor. Replace parts as required.
4. Temperature gauge reads normal, poor heater output	a. Installed position of heater hoses reversed	a. Inspect routing of heater hoses, see **80 Heating and Ventilation**.
	b. Heater hose restriction	b. Inspect heater hoses for ply separation and clogging. Replace hoses as required.
	c. Heat core restricted or clogged	c. Clean or replace faulty heater core.
	d. Heater or A/C ventilation controls or flaps not operating correctly	d. Check operation and adjustment of controls, see **80 Heating and Ventilation** and/or **87 Air Conditioning**

If the cooling system holds pressure, the most probable causes of overheating are an electrical fault with the cooling fans, a faulty thermostat, or poor coolant circulation due to restrictions in the system.

Table a lists overheating and underheating symptoms, their probable causes, and suggested corrective actions. The bold type refers to areas outside of this repair group for suggested repairs.

NOTE —

- *Coolant also circulates through the heater core in the passenger compartment. For problems associated with the heater core and the heating system, see* **80 Heating and Ventilation** *and/or* **87 Air Conditioning**.
- *Overheating problems may also be caused by an engine fault that leaks hot combustion gases into the cooling system. See* **13 Crankshaft/Cylinder Block** *or* **15 Cylinder Head and Valvetrain** *for additional information concerning the cylinder block and head.*



Diagnostic checks

The following checks and tests should generally be performed prior to any major tear down or repair work. This will help insure that the full extent or nature of the problem is known beforehand and may prevent unneeded repair work.

Coolant/antifreeze concentration, testing

Using a refractometer (VW tools CEN5021, T10007, or equivalent), take a small amount of coolant and place it onto **measuring prism**. Close the **sample cover** and hold tester up to a light source.

- Look into the **eyepiece** and read the scale for ethylene glycol. The measure point is where the red and white come together. A 50/50 mixture is generally preferred and will provide freeze protection to -34°F (-37°C). See **Coolant, pump and thermostat** given earlier.
- Rinse the tester clean.
- Periodically check calibration by placing distilled water onto the prism and closing the cover. The measure point should be at 32°F (0°C) which is the freezing point for pure water. If this reading is not obtained, follow the instructions that came with tester for calibration and adjustment.

Cooling system, pressure testing

A pressure test uses a special tester in place of the cap on the expansion tank to pressurize the system and simulate normal operating conditions. If the system is unable to hold pressure, the engine will overheat more easily and fluid will be lost.

NOTE —
A pressure test also checks for internal leakage. Some of the common sources of internal leakage include a faulty cylinder head gasket, a cracked cylinder head, and a cracked cylinder block.

- With engine at normal operating temperature, pressure test the system using a cooling system pressure tester with suitable adapters.
- Observe the gauge reading. If the pressure drops, there is a leak in the system. A rapid drop may indicate a faulty cylinder head gasket if no external leaks can be found. Remove the spark plugs or glow plugs to inspect for coolant in the cylinders.
- Using the correct tester adapter, test coolant expansion tank cap opening pressure. Compare opening pressure to specification and replace the cap if opening pressure is outside of specification.

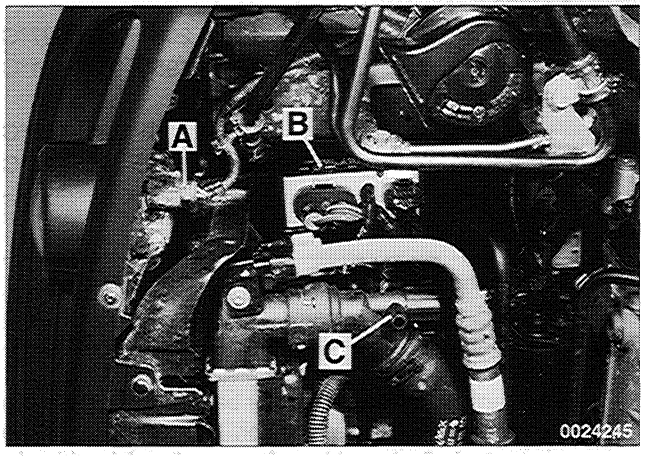
NOTE —
It is not unusual for opening pressure to be slightly above specification when pressure is first applied due to slight sticking of the internal valve. Subsequent pressure applications should open the valve within specification, otherwise, replace the cap.

Cooling system test pressures
- Testing pressure (max). . . . . 1.25 bar (18 psi)
- Cap opening pressure . . . . 1.4 - 1.6 bar (20 - 23 psi)

– Inspect gasket in expansion tank cap for cuts and damage.

Cooling fans and thermoswitch, testing

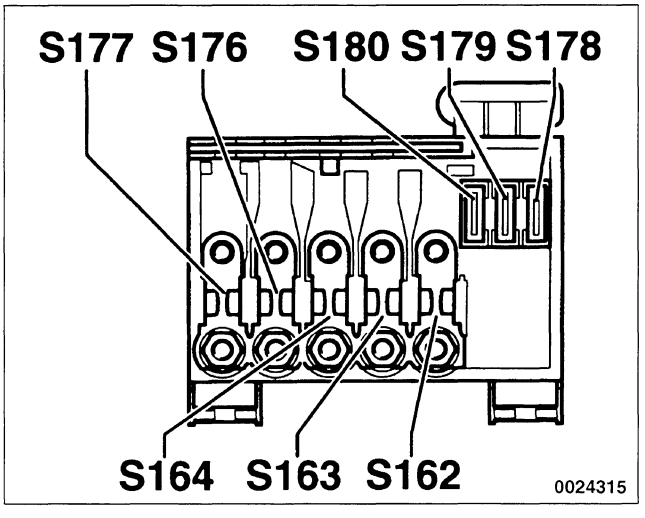
The Factory service information shows a procedure for testing the radiator (coolant) fans on 2.0L AEG, AVH, AZG, and 2.8L AFP coded engines only. However, since all engine types covered by this manual are similar, the procedures for testing on other engine codes will be similar.



Golfs, Jettas, and GTIs use a pair of 2 speed electric cooling fans (V7 and V35) to pull air across the radiator (and A/C condenser where equipped). A thermo-switch (**A**) and a fan control module (**B**) are used to control fan operation. The engine will overheat if the electric cooling fans are not operating properly, especially in traffic where speeds are low and there is insufficient natural air flow across the radiator. A/C operation will also be affected and damage to the system could result. In normal operation, the fans will switch on and off according to engine coolant temperature at radiator thermo-switch or whenever the A/C is on.

NOTE —
*The radiator drain connection (**C**) is also shown at left.*

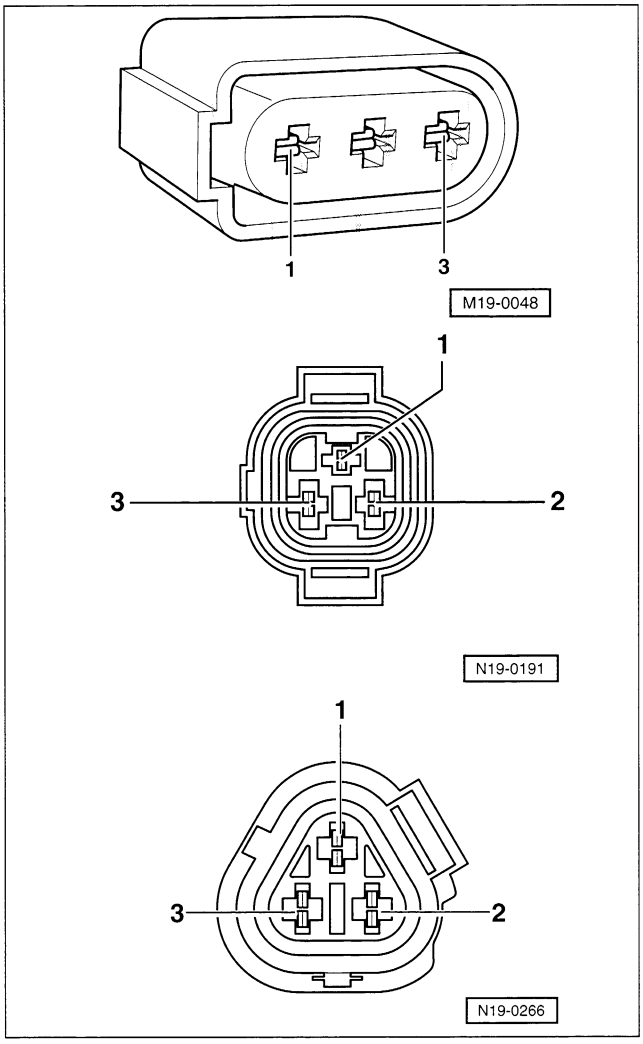
WARNING —
Use extreme care when working at or near the radiator cooling fans when the engine is hot. The fan can come on at any time, even if the ignition key is switched off.



NOTE —
If the cooling fans fail to operate normally use the following procedure to help determine where the problem lies.

Check fuse #16 (A/C clutch, after-run coolant pump; 10 amp) in the dash fuse box and thermo fuses in the holder on battery cover (**S164** through **S180**). Replace as necessary. **See 97 Wiring Diagrams, Fuses and Relays** for circuit information.

- **S164**: coolant fan control module/coolant fan
- **S180**: coolant fan



– Disconnect harness connector from radiator fan thermo-switch on lower left side of radiator.

➢ Using a fused jumper wire, bridge terminals 1 and 2 of radiator fan thermoswitch connector. Both fans should run on the first speed.

NOTE —
Radiator fan thermoswitch connectors from various model years are shown at left.

– Using a fused jumper wire, bridge terminals 2 and 3 of the radiator fan thermoswitch connector. Both fans should run on the second speed.

– If the fans run with the jumpers installed, this indicates the fans are functioning properly and the radiator thermo-switch may be faulty. Switch opening and closing specifications are given below for more accurate testing of the thermo-switch. Drain coolant before replacing a faulty switch.

Radiator fan thermo-switch operating temperatures

- Stage I
  switch on . . . . . .197° - 206°F (92° - 97°C)
  switch off . . . . . .183° - 195°F (84° - 91°C)
- Stage II
  switch on . . . . . .210° - 221°F (99° - 105°C)
  switch off . . . . . .195° - 208°F (91° - 98°C)

Tightening torque

- Thermo-switch to radiator . . . . . 35 Nm (26 ft-lb)

– If the fans do not run, check for battery voltage at the red wire in the harness connector. No voltage at harness connector indicates a blown fuse or a break in wiring from the fuse. See **97 Wiring Diagrams, Fuses and Relays**.

– If the fans do not run and voltage is present at the thermo-switch harness connector, reconnect jumper to terminals 1 and 2 of thermo-switch connector.

– Unplug left side fan motor and plug a suitable test light into terminals 1 and 2 of fan motor harness connector. The light should light.

– Unplug right side fan motor and plug a suitable test light into terminals 1 and 2 of fan motor harness connector. The light should light.

– If the test light does not come on during the previous two steps check for broken or shorted wiring between the fan control module and the thermo-switch or between the fan control module and the fans. See **97 Wiring Diagrams, Fuses and Relays**. If the wiring is in order, then the fan control module is faulty. If the test light comes on, this indicates that the radiator fan is faulty and should be replaced.

The above tests check first speed fan operation. The second speed can be checked by connecting the jumper to the red wire and red/yellow wire at the thermo-switch harness and a test light to terminals 1 and 3 of the fan harness connectors. As with the first speed, if the light does not come on for steps 8 and 9, check for broken or shorted wiring between the fan control module and the thermo-switch or between the fan control module and the fans. See **97 Wiring Diagrams, Fuses and Relays**. If the wiring is in order, than the fan control module is faulty. If the test light comes on, this indicates that the radiator fan is faulty and should be replaced.

Thermostat, testing

A thermostat that is stuck open will cause the engine to warm up slowly and generally run below normal operating temperature at highway speed. A thermostat that is stuck closed will restrict coolant flow to the radiator and cause overheating.

Accurate testing of the thermostat requires removal and observation while being warmed in a container of hot water. An accurate thermometer is used to note the temperatures at which it begins to open and at which it is fully open.

Specification

- Coolant thermostat operating parameters

Opening starts at approx.	85°C (185°F)
Fully open by approx.	105°C (221°F)
Valve travel, min.	7mm (0.28 in.)

To quickly check if the thermostat is opening and if coolant is circulating through the radiator, allow a cold engine to run at idle and warm up. As the temperature of the coolant rises, carefully feel the heater and expansion tank hoses. They will get hot. Feel the radiator hoses, particularly the lower hose. They will stay relatively cool to the touch. When the thermostat opens, the radiator hoses will quickly get hot and the radiator fan should cycle on shortly thereafter.

> ***CAUTION —***
> *If the engine runs long enough for the warning light in the instrument cluster to indicate an overheat condition, shut down the engine immediately.*

Check the radiator hoses. If they are not hot, then the thermostat has not opened or the radiator is clogged. If the hoses are hot, but the radiator fan did not come on, troubleshoot the radiator fans as per instructions given earlier in this section.

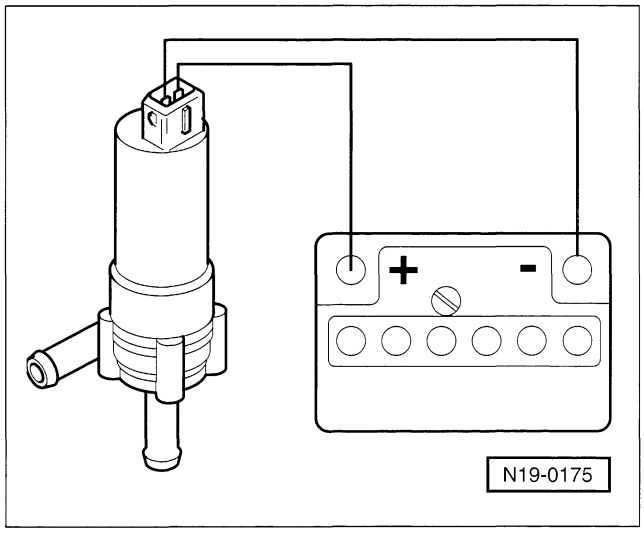
After-run coolant pump, checking

The 2.8L and some 1.8L engines covered in this manual use and after-run coolant pump (V51) for continued circulation of the coolant after the engine is turned off.

– Using the **Electrical Wiring Diagrams** in the back of this manual check to make sure the fuse for the after-run coolant pump is OK.

– Remove lower sound absorber panel (belly pan).

– Remove 2-pin harness connector from after-run coolant pump. See **Cooling system components** for pump location.

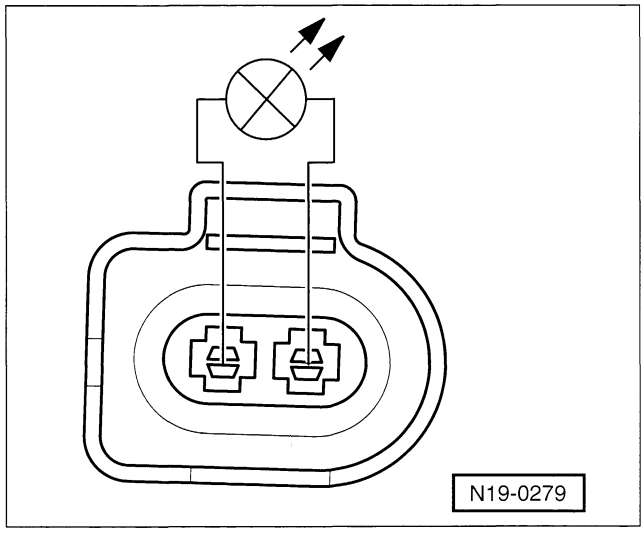


➢ Use electrical test leads to connect after-run coolant pump to battery.

– Confirm that pump runs.

– If pump does not run, replace pump.

– If pump does run, continue with checking activation as described below.



➢ Connect diode test lamp, VAG 1527 B, or equivalent to after-run coolant pump harness connector using adapter cables from VAG 1594 A, or equivalent.

– Switch ignition on and off.

– Confirm that LED lights up.

NOTE —
This check must be performed within 5-10 minutes after switching ignition off.

– If LED does not light up, locate and eliminate open circuit using the **Electrical Wiring Diagrams** in the back of this manual.

COOLING SYSTEM, DRAINING AND FILLING

> ***CAUTION —***
> *Always use a mixture of genuine Volkswagen coolant/anti-freeze and distilled water to avoid the formation of harmful deposits in the cooling system. Use of coolant/anti-freeze with phosphate compounds or tap water can be harmful to the cooling system.*

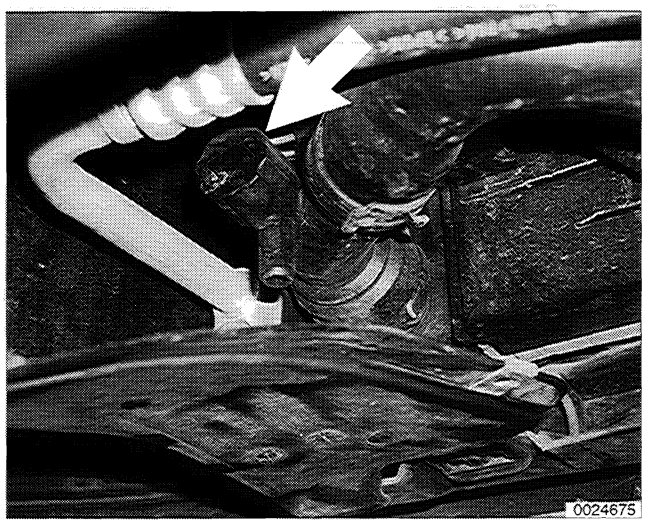
When refilling the engine coolant, keep in mind the following points:

- Use only Volkswagen G12 or equivalent phosphate and silicate free coolant/anti-freeze identified by the red or purple color.
- Under no circumstances should G12 be mixed with any other type of coolant/anti-freeze. If the fluid in the expansion tank is brown, mixing with other types has occurred and the system must be flushed and the coolant/antifreeze changed.
- Under no circumstances should straight coolant/anti-freeze or straight water be used. A 50/50 mix of coolant/anti-freeze to water provides freeze protection to -34°F (-35°C) and boiling protection to 226°F (108°C). The coolant/anti-freeze percentage should always be a minimum of 40% and a maximum of 60%.
- Hoses are secured with spring clamps. If replacement is needed, always replace with spring clamps due to their ability to expand with engine heat and remain tight.
- Most hoses have alignment marks to ensure correct positioning on the appropriate fitting; always line up the marks to ensure stress free installation.

– Remove lower sound absorber panel (belly pan).

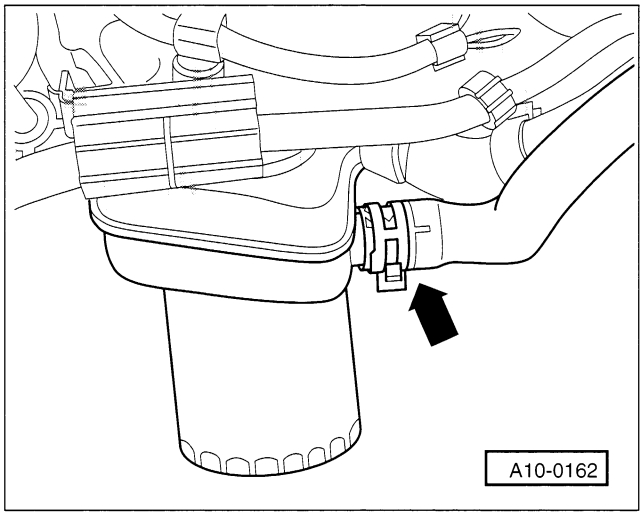
– With engine fully cold, remove cap from the coolant expansion tank.

– Position a drain pan under left front part of the radiator.

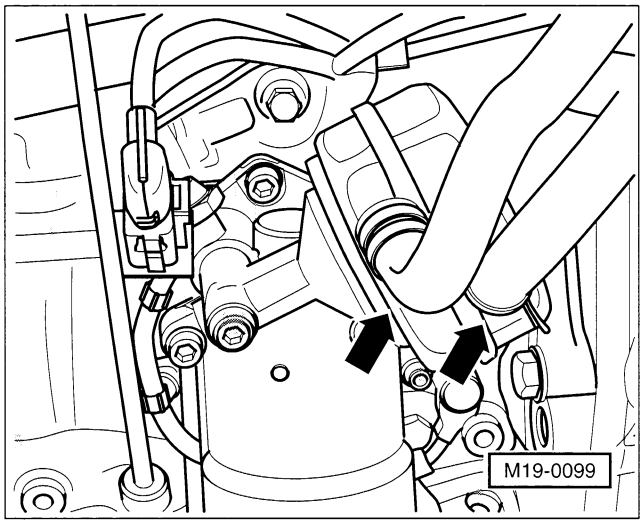


◀ If equipped, unscrew drain plug (**arrow**) at lower radiator hose fitting and allow coolant to drain.

> ***NOTE —***
> - *On vehicles without coolant drain plug (i.e. 2.8L, code: BDF), disconnect lower coolant hose from radiator to drain coolant.*
> - *Coolant hoses on newer models use a quick release retaining spring that must be pulled out before removing coolant hose.*
> - *Dispose of used coolant properly.*



➢ On 4-cylinder engines, remove lower oil cooler hose to completely drain coolant from engine block.



➢ On 6-cylinder engines, remove both hoses from oil cooler to completely drain coolant.

– Close drain plug on lower radiator hose fitting, as applicable.

– Reconnect the lower oil cooler hose.

– Slowly fill expansion tank with the appropriate mixture of coolant/anti-freeze while allowing the air to escape.

Cooling system capacity

- 1.8L engine . . . . . 5.3 quarts (5.0 liters)
- 1.9L engine . . . . . 6.3 quarts (6.0 liters)
- 2.0L engine . . . . . 5.3 quarts (5.0 liters)
- 2.8L engine . . . . . 9.5 quarts (9.0 liters)

NOTE —

If a cooling system pressure tester is available, connect it to the expansion tank and pressurize the system. This will force the coolant/anti-freeze past the thermostat and into many of the hoses that drained and will speed up the entire process.

– Install expansion tank cap, start engine and allow to run until the radiator fans cycle at least once.

NOTE —

*If the expansion tank empties completely during warm-up, shut off the engine, carefully remove the expansion tank cap and refill to the **max** marks on the side. Restart the engine and continue until the fans cycle.*



– Recheck the level in the expansion tank when the engine has cooled.

➢ On early production vehicles, the coolant/anti-freeze level should be at the **max** mark with engine at operating temperature and between the **min** and **max** marks when cold. The final level is best checked when cooling system is fully cold.



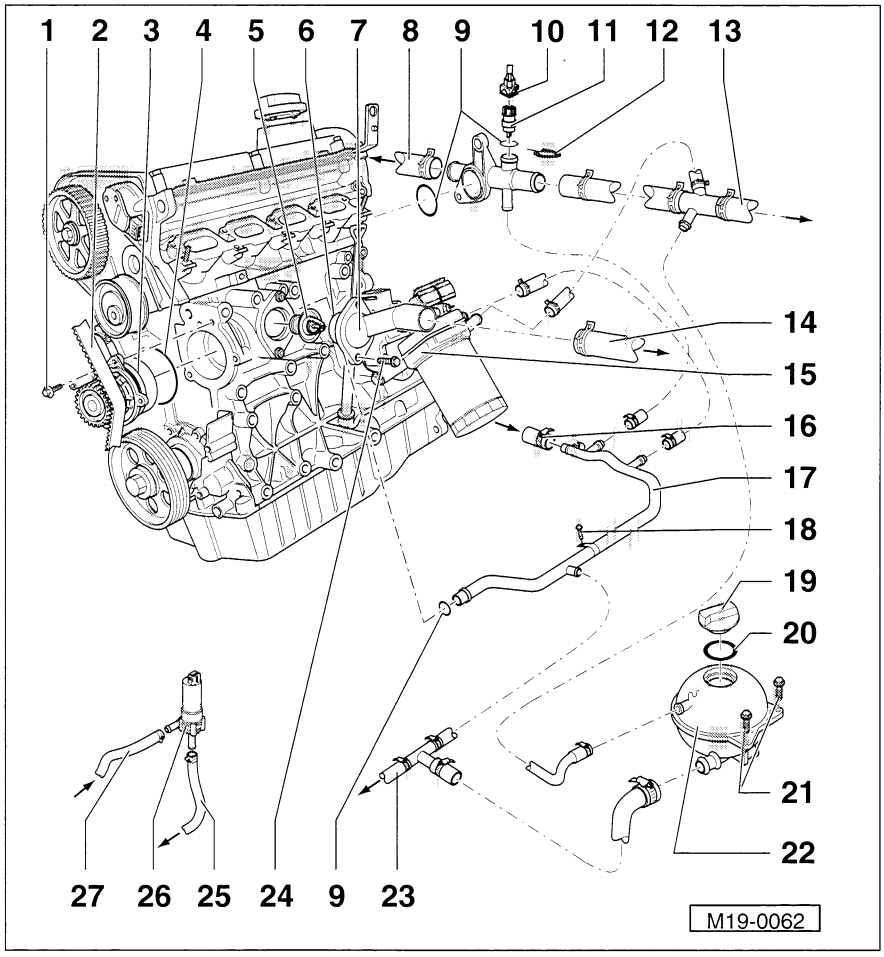
➢ On later production vehicles, the coolant expansion tank has only a shaded area on the side. The top of this shaded area is the "max" level.

NOTE —

Experience has shown that G12 "shrinks" or contracts considerably when temperatures drop to very low levels. This may cause the low coolant level warning light to illuminate. Be sure that there is sufficient coolant in the expansion tank when temperatures are very low.

COOLING SYSTEM, COMPONENTS

Cooling system, components (1.8L engine)



1. **Bolt**
   - Tighten to 15 Nm (11 ft-lb)
2. **Toothed belt**
   - Mark direction of rotation before removing
   - Check for wear
   - Do not kink
3. **Coolant pump**
   - Check pulley for ease of movement
   - If damaged or leaking replace complete assembly
   - Note installation position
4. **O-ring**
   - Always replace
5. **Coolant thermostat**
   - Checking: heat-up thermostat in water
   - Opening starts at approx. 189°F (87°C)
   - Opening ends at approx. 216°F (102°C)
   - Opening lift: 7 mm minimum
6. **O-ring**
   - Replace if damaged
7. **Outlet flange**
8. **Hose to heater core**
   - For passenger compartment heat
9. **O-ring**
   - Always replace
10. **4-pin harness connector**
    - Wiring cavities 2 and 4 for engine coolant temperature gauge (G2)
    - Wiring cavities 1 and 3 for engine coolant temperature (ECM) sensor (G62)
    - Gold-plated contacts on pins 1 and 3 for G62
11. **Engine coolant temperature sender (G62)**
    - For engine control module
    - With engine coolant temperature warning light sensor (G2)
    - If necessary, release cooling system pressure before removing
12. **Retaining clip**
    - Ensure clip is securely seated
13. **Upper coolant hose**
    - Secured to radiator with retaining clip
14. **Lower coolant hose**
    - From bottom of radiator
    - Secured to radiator with retaining clips
15. **Oil cooler**
16. **Hose from heater core**
17. **Lower coolant pipe**
    - Multiple connections
18. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
19. **Expansion tank cap**
    - Test pressure: 1.4-1.6 bar (20.3-23.2 psi)
20. **Seal**
    - Replace if damaged
21. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
22. **Expansion tank**
23. **To turbocharger**
24. **Bolt**
    - Tighten to 15 Nm (11 ft-lb)
25. **To upper coolant hose**
    - Only engine code AWP with 5-speed automatic transmission
26. **After-run coolant pump (V51)**
    - Only engine code AWP with 5-speed automatic transmission
27. **From turbocharger**
    - Only engine code AWP with 5-speed automatic transmission

NOTE —

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Coolant pump, replacing (1.8L engine)

– Drain coolant as previously described.

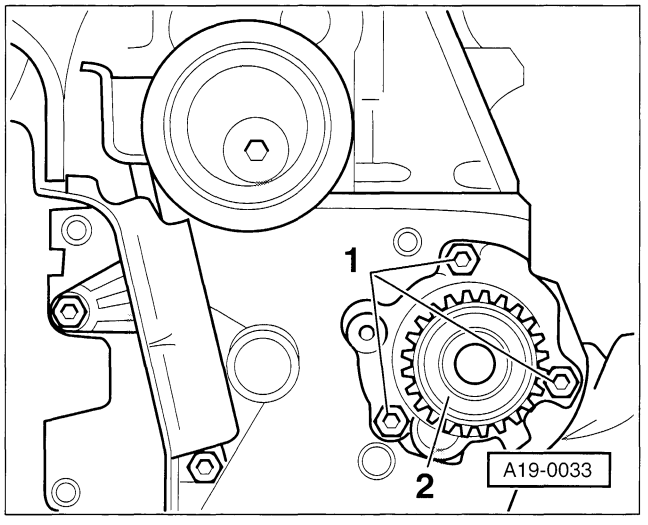
– Remove ribbed V-belt and tensioner, see **0 Maintenance**.

– Remove upper and center toothed belt guards.

– Turn the crankshaft to TDC for cylinder 1 and release the toothed belt tensioning roller, see **15a Cylinder Head and Valvetrain (1.8L engine)**. The toothed belt should be left in position on the crankshaft sprocket.

– Slide toothed belt off coolant pump sprocket.

– Cover toothed belt with a cloth to prevent contamination from coolant.



➤ .Remove coolant pump mounting bolts (**1**) and remove coolant pump (**2**)Installation is reverse of removal, noting the following:

- Clean pump mating surface on cylinder block.
- Always use new O-rings and hardware as indicated.
- Lubricate O-rings with coolant before installing.

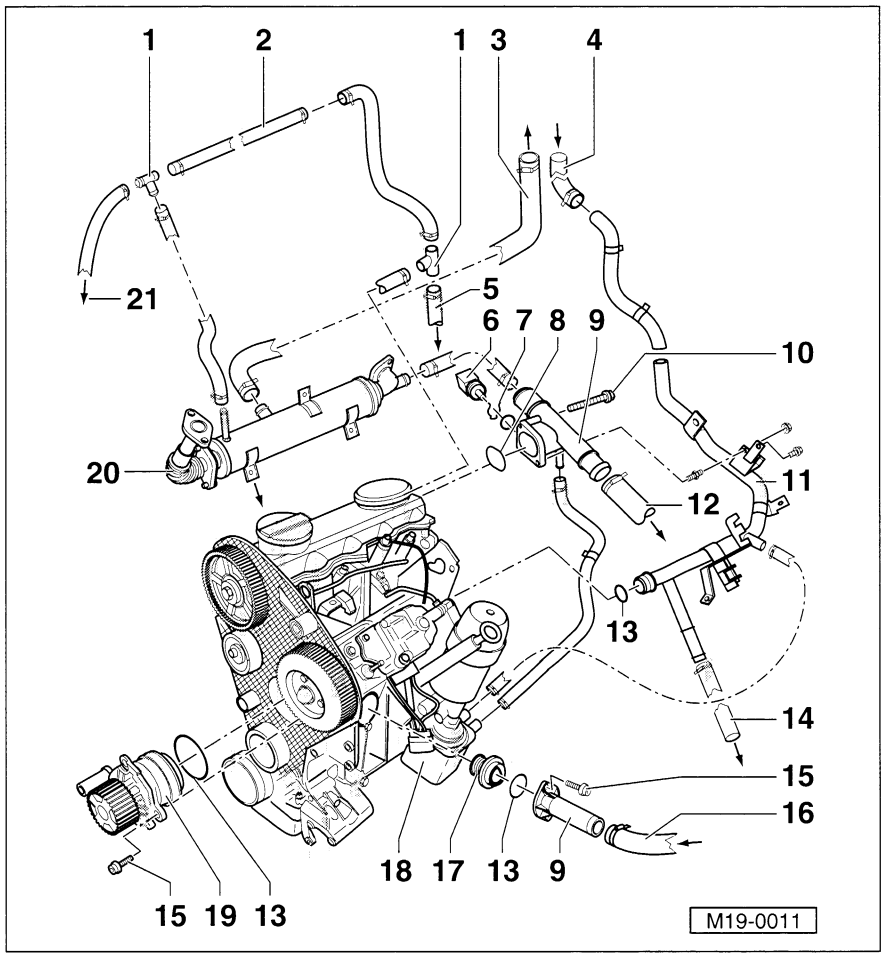
Tightening torque

- Coolant pump to cylinder block . . . . 15 Nm (11 ft-lb)

– Fill cooling system as described previously.

– Start engine and check for leaks.

Cooling system components (1.9L engine)



1. **Connector "T"**
2. **Coolant hose, upper**
3. **Hose to heater core**
   - For passenger compartment heat
4. **Hose from heater core**
5. **Hose to upper coolant "T" connector**
6. **Engine coolant temperature sensor (G62)**
   - For engine control module
   - With engine coolant temperature warning light sensor (G2)
   - If necessary, release cooling system pressure before removing
7. **Retaining clip**
   - Check for secure installation
8. **O-ring**
   - Always replace
9. **Outlet flange**
10. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
11. **Coolant pipe**
    - Multiple connections
12. **Hose**
    - To top of radiator
13. **O-ring**
    - Always replace
14. **Hose**
    - To expansion tank, lower
15. **Bolt**
    - Tighten to 15 Nm (11 ft-lb)
16. **Hose**
    - From bottom of radiator
17. **Coolant thermostat**
    - Checking: heat-up thermostat in water
      Opening starts at approx. 185°F (85°C)
      Opening ends at approx. 221°F (105°C)
      Opening lift: 7 mm minimum
18. **Oil cooler**
19. **Coolant pump**
    - Check pulley for ease of movement
    - If damaged or leaking replace complete assembly
    - Note installation position
20. **EGR cooler**
21. **Hose**
    - To expansion tank, upper fitting

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Coolant pump, replacing (1.9L engine)

– Drain coolant as previously described.

– Remove ribbed V-belt and tensioner, see **0 Maintenance**.

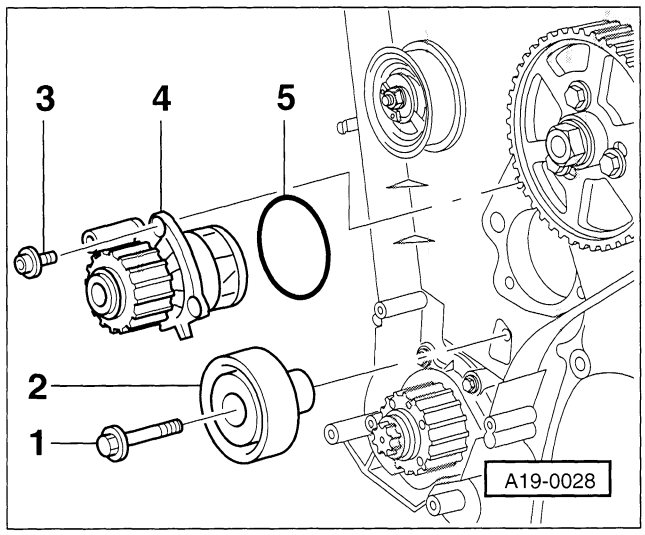
– Disconnect fuel supply and return lines at fuel filter.

– Remove connecting pipe between intercooler and intake manifold.

– Remove fuel filter and mounting bracket.

– Remove upper and center toothed belt guards.

– Turn crankshaft to TDC for cylinder 1 and release toothed belt tensioning roller, see **15b Cylinder Head and Valvetrain (1.9L engine)**. Slide toothed belt off camshaft, injection pump and coolant pump sprockets, but leave it in position on crankshaft sprocket.



➤ Remove bolt (**1**) from idler pulley (**2**) and work the pulley free from cylinder block. Discard bolt.

1. Bolt
- Tighten to 40 Nm (30 ft-lb) plus ¼ turn (90°)
- Always replace

2. Idler pulley

3. Bolt
- Tighten to 15 Nm (11 ft-lb)

4. Coolant pump
- Installation position: plug in housing points downward

5. O-ring seal
- Always replace

– Cover toothed belt with a cloth to prevent contamination from coolant.

– Remove coolant pump mounting bolts and carefully lift coolant pump from cylinder block between engine mount support and rear toothed belt guard.

– Installation is reverse of removal, noting the following:
- Clean pump mating surface on cylinder block.
- Always use new O-rings and hardware as indicated.
- Lubricate O-rings with coolant before installing.

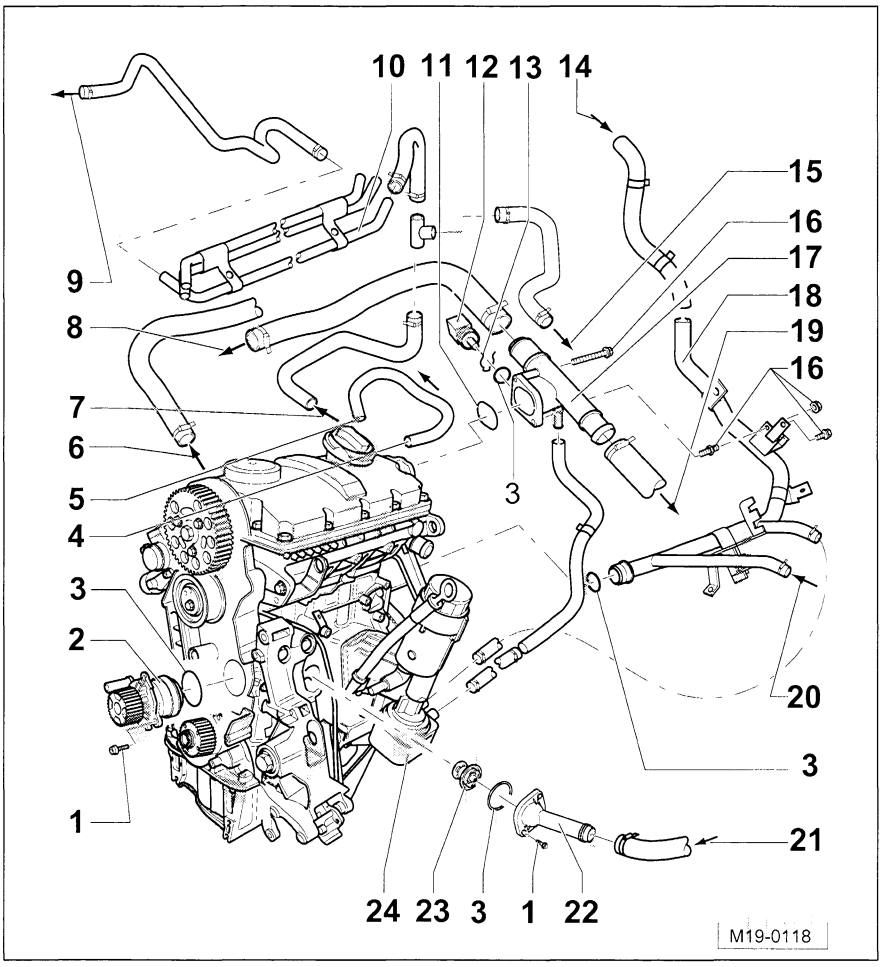
Tightening torque

- Rear toothed belt guard to cylinder block (M8) . . . . . 20 Nm (15 ft-lb)

– Fill cooling system as described previously.

– Start engine and check for leaks.

Cooling system components (1.9L PD engine)



1. **Bolt**
   - Tighten to 15 Nm (11 ft-lb)
2. **Coolant pump**
   - Check pulley for ease of movement
   - If damaged or leaking replace complete assembly
   - Note installation position
3. **O-ring**
   - Always replace
4. **Coolant flow**
   - From cylinder head
5. **Hose**
   - To bypass flap on EGR cooler
6. **Hose**
   - From EGR cooler
   - To heater core
7. **Hose**
   - From bypass flap on EGR cooler
8. **Hose**
   - To EGR cooler
9. **Hose**
   - To expansion tank, upper fitting
10. **Pipe, upper coolant**
    - Bolted to cylinder head (valve) cover
    - Complete assembly includes fuel lines
11. **O-ring**
    - Always replace
12. **Engine coolant temperature sensor (G62)**
    - For engine control module
    - With engine coolant temperature warning light sensor (G2)
    - If necessary, release cooling system pressure before removing
13. **Retaining clip**
    - Check for secure installation
14. **Hose from heater core**
15. **Hose**
    - To top of radiator
16. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
17. **Connector**
18. **Pipe**
    - Multiple connections
    - To coolant pump
19. **Hose**
    - To top of radiator
20. **Coolant flow**
    - From bottom of expansion tank
21. **Hose**
    - From bottom of radiator
22. **Outlet flange**
23. **Coolant thermostat**
    - Checking: heat-up thermostat in water
      Opening starts at approx. 185°F (85°C)
      Opening ends at approx. 221°F (105°C)
      Opening lift: 7 mm minimum
24. **Oil cooler**

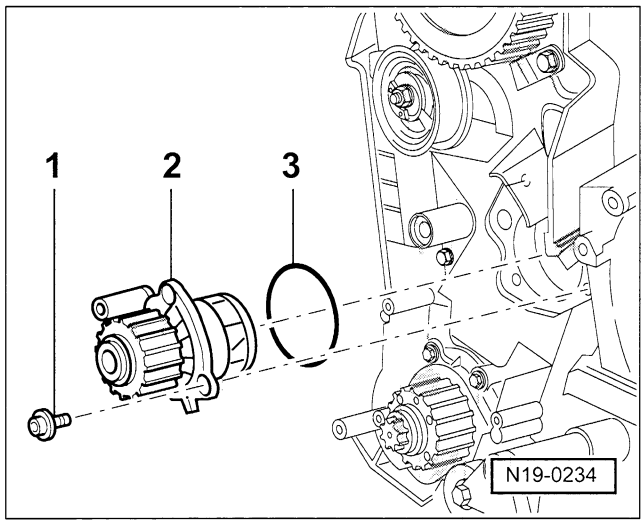
NOTE —

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Coolant pump, replacing (1.9L PD engine)

– Remove toothed belt, see **15e Cylinder Head and Valvetrain (1.9L PD Engine)**.

– Drain coolant as previously described.



➢ Remove securing bolts (**1**) and carefully remove coolant pump (**2**) from cylinder block.

– Installation is reverse of removal, noting the following:

- Clean pump mating surface on cylinder block.
- Always use new O-rings and hardware as indicated.
- Lubricate O-rings with coolant before installing.

– Install new O-ring (**3**) into pump housing and lubricate with coolant.

– Insert pump into cylinder block and tighten bolts.

Tightening torque

- Coolant pump to cylinder block (M7) . . 15 Nm (11 ft-lb)

NOTE —

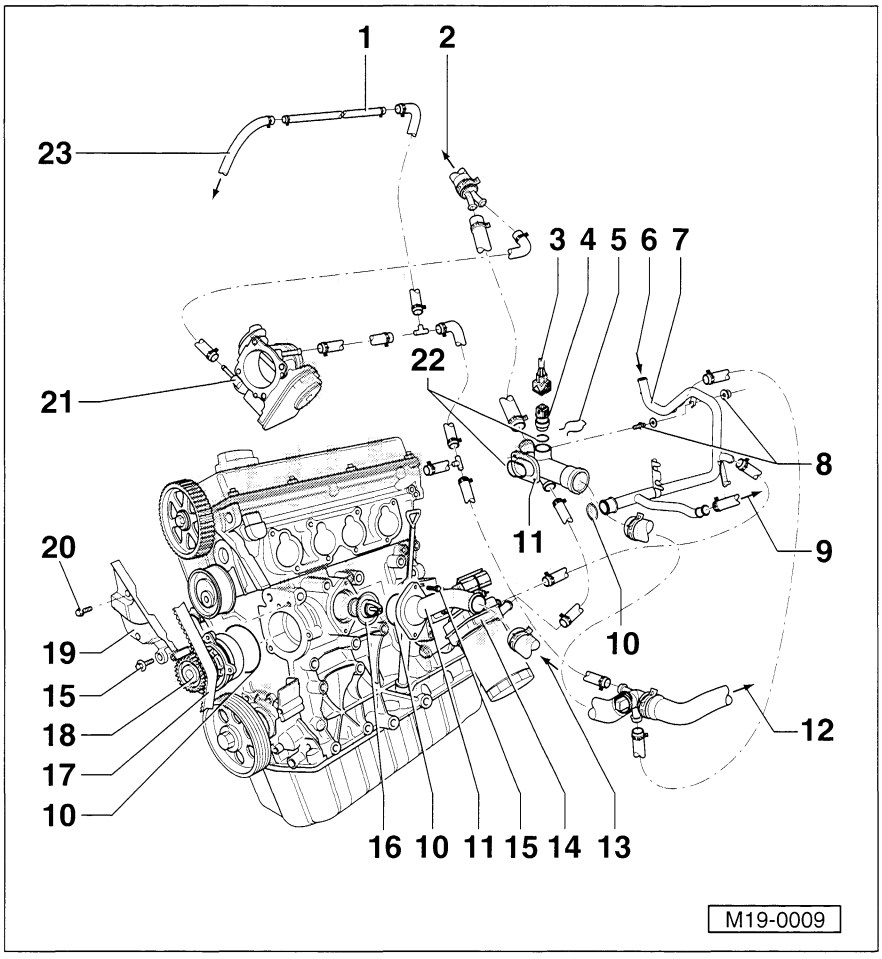
Coolant pump sealing plug faces downwards.

– Install toothed belt and tension.

– Refill cooling system with G12.

– Start engine and check for leaks.

Cooling system components (2.0L AEG engine, early)

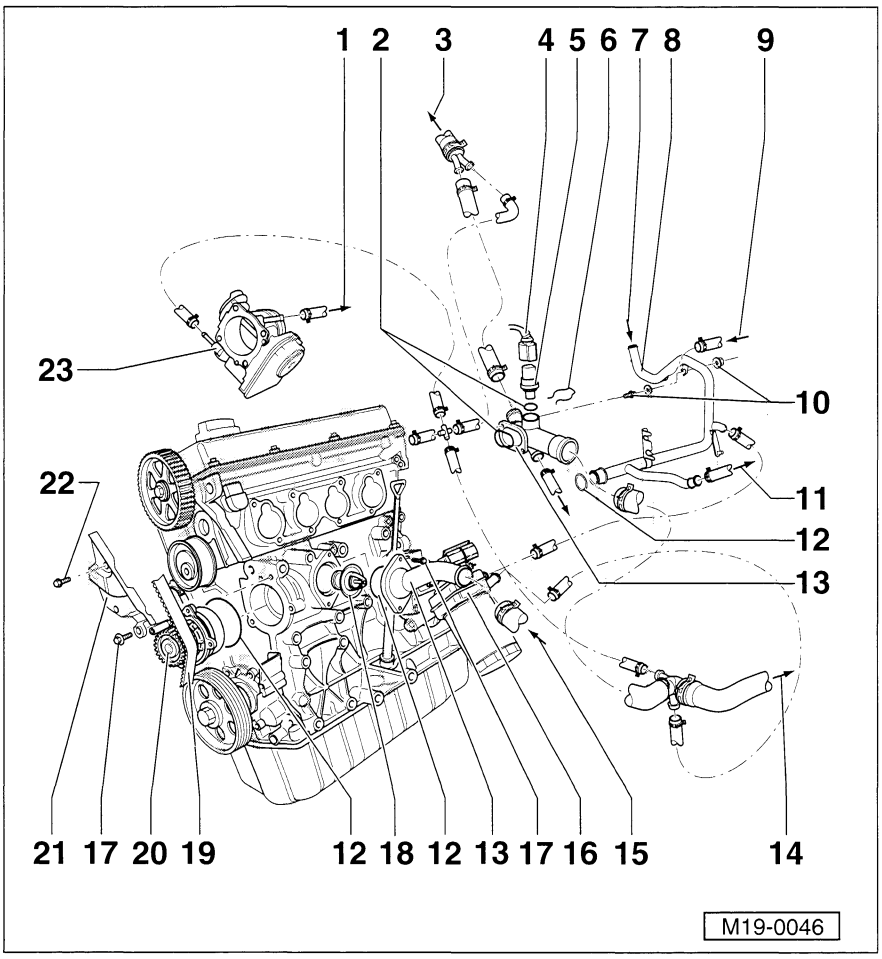


1. **Pipe, upper coolant**
   - Clipped to engine bulkhead
2. **Hose to heater core**
   - For passenger compartment heat
3. **4-pin harness connector**
   - Wiring cavities 2 and 4 for engine coolant temperature gauge (G2)
   - Wiring cavities 1 and 3 for engine coolant temperature (ECM) sensor (G62)
   - Gold-plated contacts on pins 1 and 3 for G62
4. **Engine coolant temperature sensor (G62)**
   - For engine control module
   - With engine coolant temperature warning light sensor (G2)
   - If necessary, release cooling system pressure before removing
5. **Retaining clip**
   - Ensure clip is securely seated
6. **Hose from heater core**
7. **Coolant pipe**
   - Multiple connections
   - To coolant pump
8. **Stud (stepped) and nut**
   - Tighten to 10 Nm (7 ft-lb)
9. **Hose**
   - From bottom of expansion tank
10. **O-ring**
    - Always replace
11. **Outlet flange**
12. **Hose**
    - To top of radiator
13. **Hose**
    - From bottom of radiator
14. **Oil cooler**
15. **Bolt**
    - Tighten to 15 Nm (11 ft-lb)
16. **Coolant thermostat**
    - Checking: heat-up thermostat in water
      Opening starts at approx. 187°F (86°C)
      Opening ends at approx. 216°F (102°C)
      Opening lift: 7 mm (0.28 in.) minimum
17. **Toothed belt**
    - Mark engine direction of rotation before removing
    - Check for wear
    - Do not kink
18. **Coolant pump**
    - Check pulley for ease of movement
    - If damaged and leaking replace complete assembly
    - Note installation position
19. **Toothed belt guard, rear**
20. **Bolt**
    - 20 Nm (15 ft-lb)
21. **Throttle Valve control module**
    - Heated by engine coolant
22. **O-ring**
    - Replace if damaged
23. **Hose**
    - To expansion tank, upper fitting

NOTE —

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Cooling system components (2.0L AEG engine, late AVH, AZG engine)

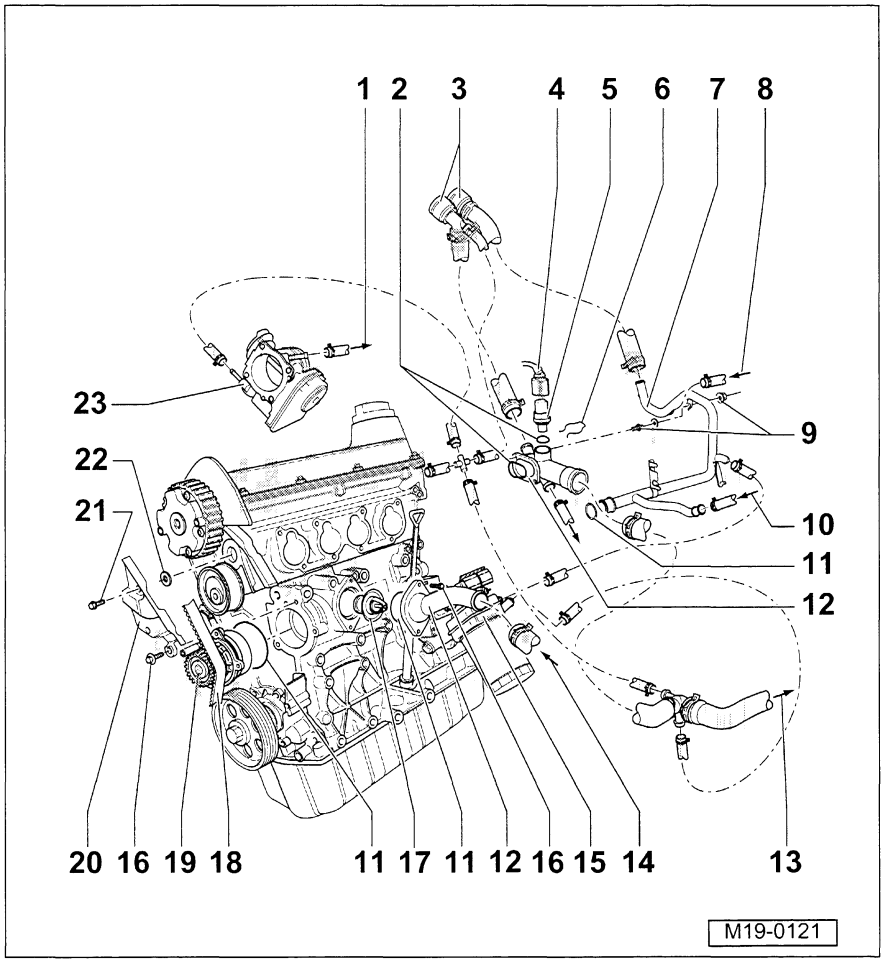


1. **Hose**
   - To expansion tank, upper fitting
2. **O-ring**
   - Always replace
3. **Hose to heater core**
   - For passenger compartment heat
4. **4-pin harness connector**
   - Wiring cavities 2 and 4 for engine coolant temperature gauge (G2)
   - Wiring cavities 1 and 3 for engine coolant temperature (ECM) sensor (G62)
   - Gold-plated contacts on pins 1 and 3 for G62
5. **Engine coolant temperature sensor (G62)**
   - For engine control module
   - With engine coolant temperature warning light sensor (G2)
   - Release cooling system pressure before removing
6. **Retaining clip**
   - Ensure clip is properly seated
7. **Hose from heater core**
8. **Pipe**
   - Multiple connections
   - To coolant pump
9. **Hose**
   - From transmission ATF cooler
   - Only for vehicles with automatic transmission
10. **Stud (stepped) and nut**
    - Tighten to 10 Nm (7 ft-lb)
11. **Hose**
    - From bottom of expansion tank
12. **O-ring**
    - Always replace
13. **Outlet flange**
14. **Hose**
    - To top of radiator
15. **Hose**
    - From bottom of radiator
16. **Oil cooler**
17. **Bolt**
    - Tighten to 15 Nm (11 ft-lb)
18. **Coolant thermostat**
    - Checking: heat-up thermostat in water
      Opening starts at approx. 187°F (86°C)
      Opening ends at approx. 216°F (102°C)
      Opening lift: 7 mm (0.28 in.) minimum
19. **Toothed belt**
    - Mark engine direction of rotation before removing
    - Check for wear
    - Do not kink
20. **Coolant pump**
    - Check pulley for ease of movement
    - If damaged and leaking replace complete assembly
21. **Toothed belt guard, rear**
22. **Bolt**
    - 20 Nm (15 ft-lb)
23. **Throttle Valve control module**
    - With cable: Motronic M5.9
    - Without cable: Motronic ME7 E-gas drive-by-wire system
    - Heated by engine coolant

NOTE —

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Cooling system components (2.0L BBW, BEV engine)



1. **Hose**
   - To expansion tank, upper fitting
2. **O-ring**
   - Always replace
3. **Quick release couplings**
   - Hose connections to/from heater core
   - For passenger compartment heat
4. **4-pin harness connector**
   - Wiring cavities 2 and 4 for engine coolant temperature gauge (G2)
   - Wiring cavities 1 and 3 for engine coolant temperature (ECM) sensor (G62)
   - Gold-plated contacts on pins 1 and 3 for G62
5. **Engine coolant temperature sensor (G62)**
   - For engine control module
   - With engine coolant temperature warning light sensor (G2)
   - Release cooling system pressure before removing
6. **Retaining clip**
   - Ensure clip is properly seated
7. **Pipe**
   - Multiple connections
   - To coolant pump
8. **Hose**
   - To transmission cooler
   - Only for vehicles with automatic transmission
9. **Stud (stepped) and nut**
   - Tighten to 10 Nm (7 ft-lb)
10. **Hose**
    - From bottom of expansion tank
11. **O-ring**
    - Always replace
12. **Outlet flange**
13. **Hose**
    - To top of radiator
14. **Hose**
    - From bottom of radiator
15. **Oil cooler**
16. **Bolt**
    - Tighten to 15 Nm (11 ft-lb)
17. **Coolant thermostat**
    - Checking: heat-up thermostat in water
      Opening starts at approx. 187°F (86°C)
      Opening ends at approx. 216°F (102°C)
      Opening lift: 7 mm (0.28 in.) minimum
18. **Toothed belt**
    - Mark engine direction of rotation before removing
    - Check for wear
    - Do not kink
19. **Coolant pump**
    - Check pulley for ease of movement
    - If damaged and leaking replace complete assembly
20. **Toothed belt guard, rear**
21. **Bolt**
    - 20 Nm (15 ft-lb)
22. **Washer/spacer**
    - Note part number/markings
23. **Throttle Valve control module**
    - Without cable: Motronic ME7 E-gas drive-by-wire system
    - Heated by engine coolant

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Coolant pump, replacing (2.0L engine)

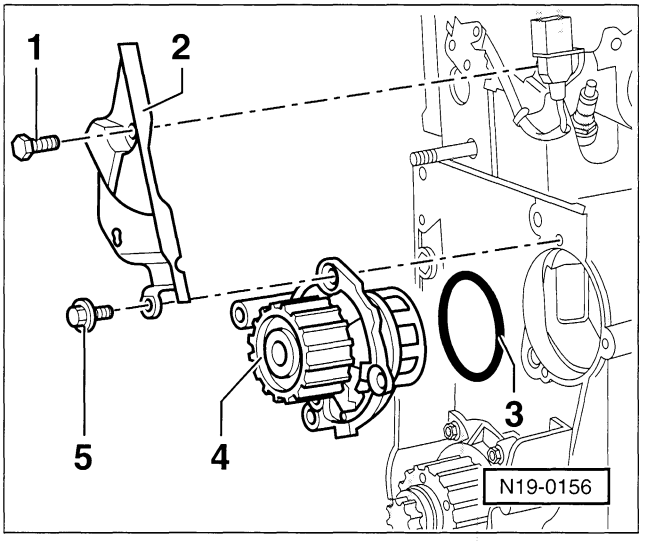
– Drain coolant as previously described.

– Remove ribbed V-belt and tensioner, see **0 Maintenance**.

– Remove upper and center toothed belt guards.

– Turn crankshaft to TDC for cylinder 1 and release toothed belt tensioning roller, see **15c Cylinder Head and Valvetrain (2.0L engine)**. Toothed belt should be left in position on crankshaft sprocket.

– Slide toothed belt off coolant pump sprocket.

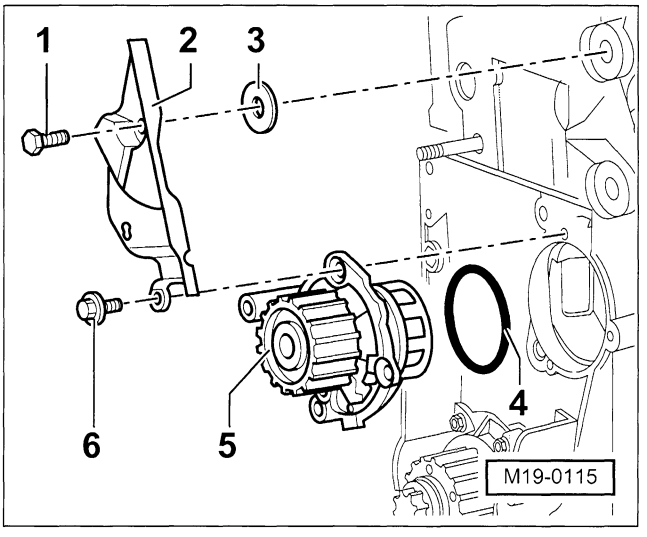


➢ For engine codes AEG, AVJ, AZG, BEV; remove mounting bolts (**1** and **5**) from rear toothed belt guard (**2**).

1. Bolt
- Tighten to 20 Nm (15 ft-lb)

2. Rear toothed belt guard
3. O-ring seal
4. Coolant pump
- Installed position: plug in housing points downward

5. Bolt
- Tighten to 15 Nm (11 ft-lb)



➢ For engine code BBW; remove mounting bolts (**1** and **6**) from rear toothed belt guard (**2**) taking care to capture washer/spacer (**3**) at cylinder head.

1. Bolt
- Tighten to 20 Nm (15 ft-lb)

2. Rear toothed belt guard
3. Washer/spacer
4. O-ring seal
5. Coolant pump
- Installed position: plug in housing points downward

6. Bolt
- Tighten to 15 Nm (11 ft-lb)

Continued for all engines

– Cover toothed belt with cloth to prevent damage from coolant.

– Carefully remove coolant pump from cylinder block.

– When installing new pump, note the following:
- Clean pump mating surface on cylinder block.
- Always use new O-rings and hardware as indicated.
- Lubricate O-rings with coolant before installing.

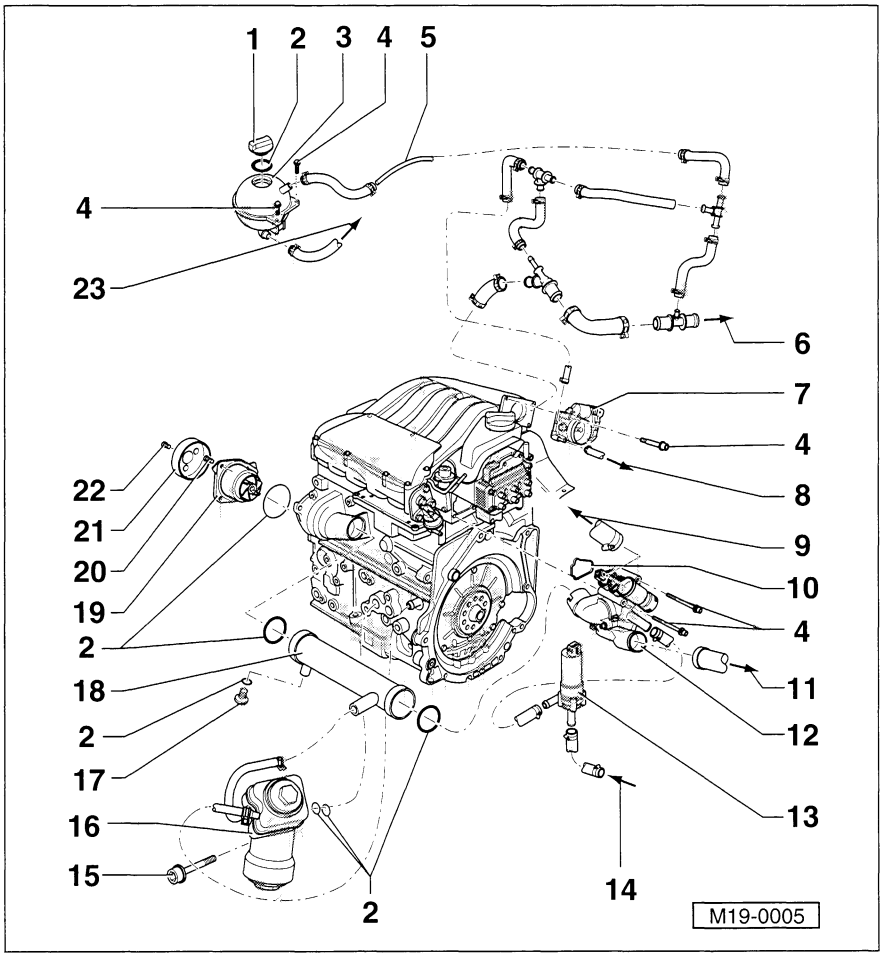
Tightening torque
- Coolant pump to cylinder block . . . . 15 Nm (11 ft-lb)
- Rear toothed belt guard to cylinder block . . . . . 20 Nm (15 ft-lb)

– Balance of installation is reverse of removal.

– Fill cooling system as described previously.

– Start engine and check for leaks.

Cooling system components (2.8L AFP engine)

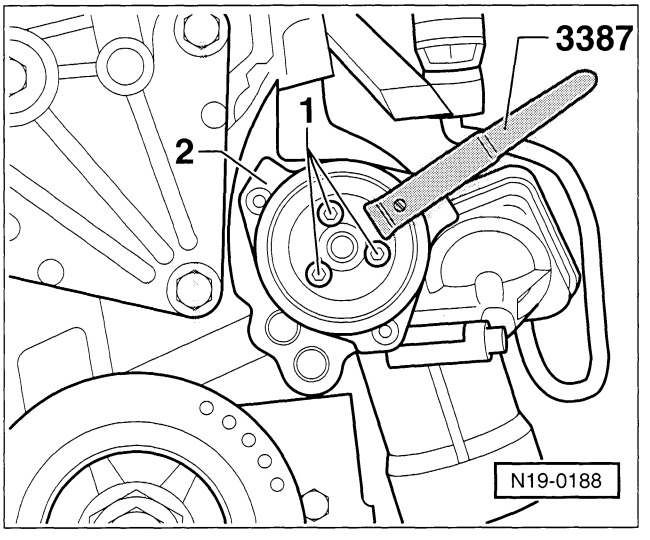


1. **Expansion tank cap**
   - Test pressure: 1.4-1.6 bar (20.3-23.2 psi)
2. **O-ring**
   - Replace if damaged
3. **Expansion tank**
4. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
5. **Pipe, upper coolant**
   - Clipped into bulkhead
6. **Coolant flow**
   - To heater core
7. **Throttle Valve control module (J338)**
   - Heated by coolant
8. **Coolant flow**
   - To "T" connection in upper radiator hose
9. **Hose**
   - To upper radiator (inlet) connection
10. **Gasket**
    - Always replace
11. **Hose**
    - To lower radiator (outlet) connection
12. **Thermostat housing**
    - Multiple connections
13. **After-run coolant pump (V51)**
14. **Coolant flow**
    - From heater core
15. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
16. **Oil cooler**
    - Coat all contact surfaces outside the gasket with AMV 188 001 02
    - When installing, do not allow cooler to come into contact with surrounding components
17. **Screw plug**
    - Tighten to 2 Nm (18 in-lb)
18. **Coolant pipe**
    - Multiple connections
19. **Coolant pump**
    - Observe installation position
    - Check for smooth running
    - Replace complete unit if damaged or leaking
20. **Bolt**
    - Tighten to 15 Nm (11 ft-lb)
21. **Pulley**
    - For coolant pump
22. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
23. **Coolant flow**
    - To "T" connection in hose for heater core/coolant after-run pump (V51)

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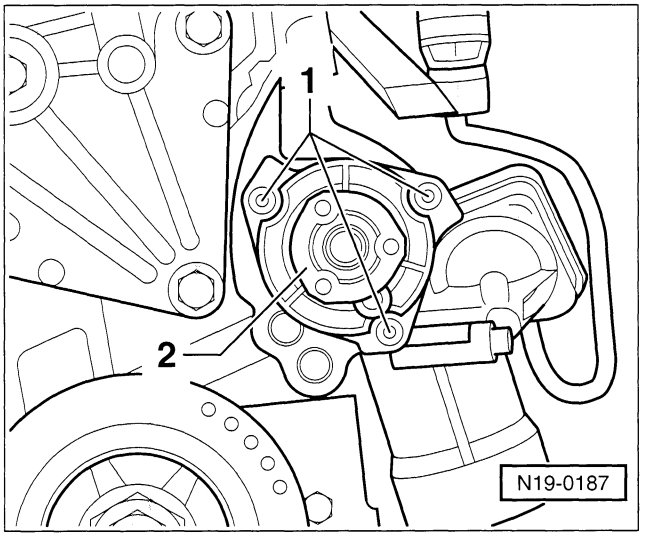
Coolant pump, replacing (2.8L AFP engine)



– Drain coolant as previously described.

– Remove ribbed V-belt and tensioner, see **0 Maintenance**.

➤ Use a spanner wrench 3387 (shown), VAG 1590 or equivalent to counterhold coolant pump pulley. Loosen 3 pulley retaining bolts (**1**) and remove pulley from pump (**2**).



➤ Remove coolant pump mounting bolts (**1**) and slide coolant pump (**2**) out of cylinder block.

– Assemble in reverse order of removal noting the following points:

- Clean pump mating surface on cylinder block.
- Moisten new O-ring with coolant.
- Insert coolant pump into engine block and tighten retaining screws.

Tightening torque

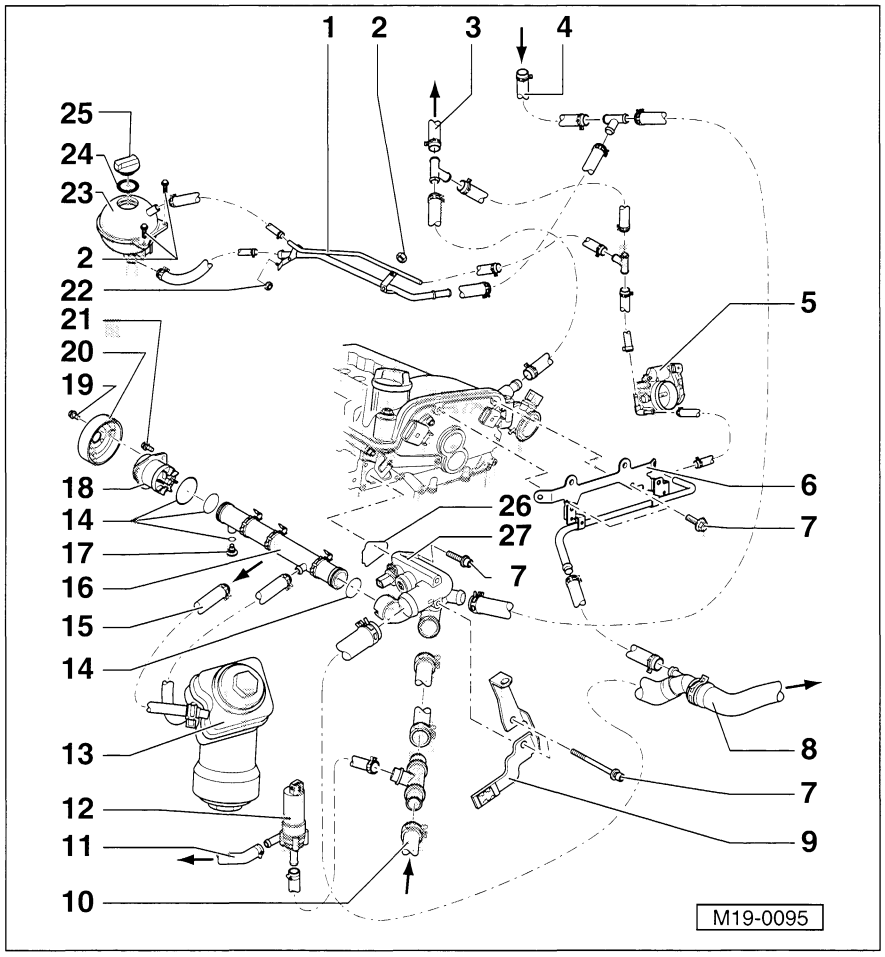
- Coolant pump pulley bolts . . . . . 25 Nm (18 ft-lb)
- Coolant pump retaining bolts . . . . . 15 Nm (11 ft-lb)

– Balance of installation is reverse of removal.

– Fill cooling system as described previously.

– Start engine and check for leaks.

Cooling system components (2.8L BDF engine)



1. **Coolant pipe**
   - Secured to exhaust manifold with heat shield
2. **Nut**
   - Tighten to 10 Nm (7 ft-lb)
3. **Hose**
   - To heater core
4. **Hose**
   - From heater core
5. **Throttle Valve control module (J338)**
   - Heated by coolant
6. **Cable guide/support**
   - For hoses and wiring harness
7. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
8. **Hose**
   - To upper radiator (inlet) connection
9. **Bracket**
   - For wiring harness
10. **Hose**
    - To lower radiator (outlet) connection
11. **Hose**
    - To cylinder block
12. **After-run coolant pump (V51)**
    - Secured to cylinder block with a bracket
13. **Oil cooler**
    - Coat all contact surfaces outside the gasket with AMV 188 001 02
    - When installing, do not allow cooler to come into contact with surrounding components
14. **O-ring**
    - Replace if damaged
15. **Hose**
    - From cylinder block
16. **Coolant pipe**
    - Multiple connections
17. **Screw plug**
    - Tighten to 2 Nm (18 in-lb)
18. **Coolant pump**
    - Observe installation position
    - Check for smooth running
    - Replace complete unit if damaged or leaking
19. **Bolt**
    - Tighten to 20 Nm (15 ft-lb)
20. **Pulley**
    - For coolant pump
21. **Bolt**
    - Tighten to 20 Nm (15 ft-lb)
22. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
23. **Expansion tank**
24. **O-ring**
    - Replace if damaged
25. **Expansion tank cap**
    - Test pressure: 1.4-1.6 bar (20.3-23.2 psi)
26. **O-ring**
    - Replace if damaged
27. **Thermostat housing**
    - Multiple connections

NOTE —

Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*

Coolant pump, replacing (2.8L BDF engine)

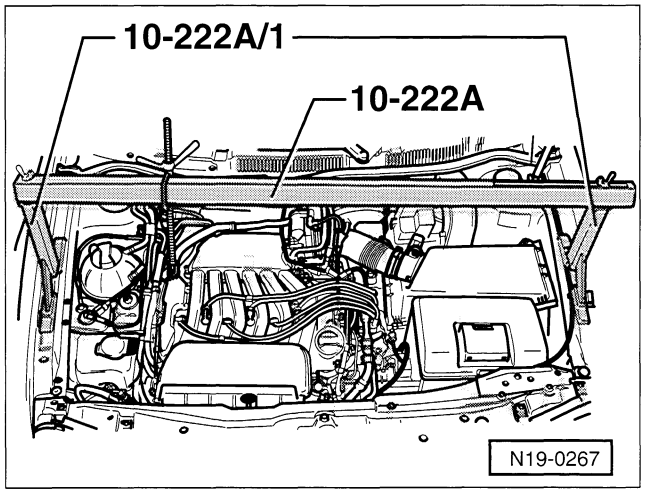
– Remove engine cover and center and right-side lower insulation trays (belly pans), see **Maintenance**.

– Remove ribbed V-belt and tensioner, see **0 Maintenance**.

– Pull off crankcase breather connection hose between cylinder head cover and intake hose.

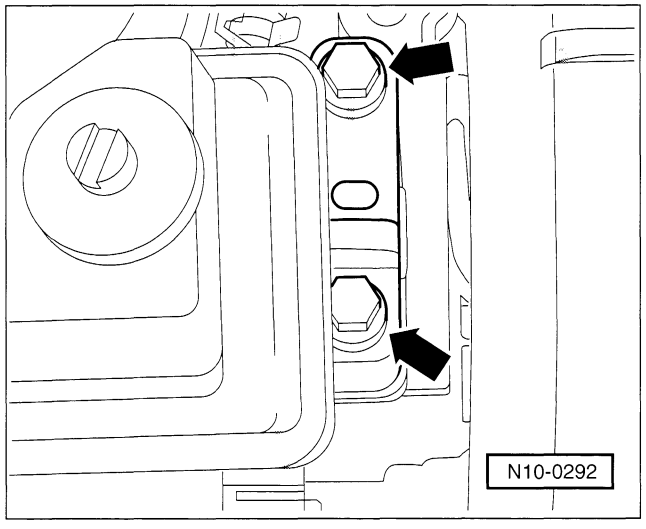
NOTE —
Press release tabs on hose couplings to remove connecting hoses

– Drain coolant as previously described.



➢ Install engine support bracket 10-222A with legs 10-222A/1 or similar to support and lower engine enough to remove coolant pump.

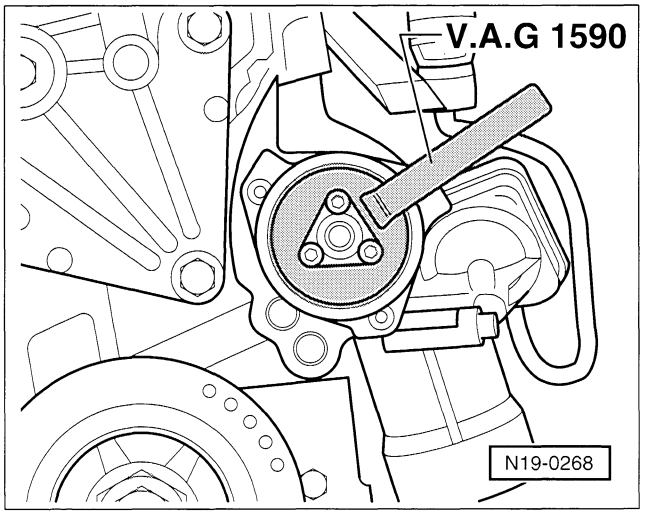
– Insert securing hook of supporting device in right lifting eye of cylinder block and take up tension so engine weight is supported.



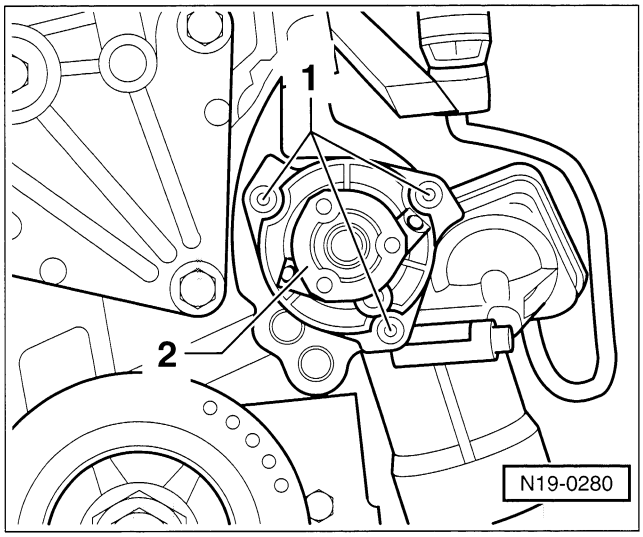
➢ Unbolt engine side mount bolts (**arrows**) from top of engine bracket.

NOTE —
To remove securing bolts while vehicle is supported on a lift, use Volkswagen special tool VAS 5085 (a ladder) or equivalent.

– Lower engine with supporting device as far as necessary to access coolant pump.



➢ Use water pump wrench VAG 1590, or equivalent, to counter-hold belt pulley while removing pulley mounting bolts. Remove belt pulley.



➤ Remove coolant pump mounting bolts (**1**) and slide coolant pump (**2**) out of cylinder block. It may be necessary to use lever to move the engine toward one side enough to remove coolant pump.

– Assemble in reverse order of removal noting the following points:

- Clean pump mating surface on cylinder block.
- Moisten new O-ring with coolant.
- Insert coolant pump into engine block and tighten retaining screws.
- Align engine mount and torque bolts to proper specification, see **10 Engine-Removing and Installing**.

Tightening torque

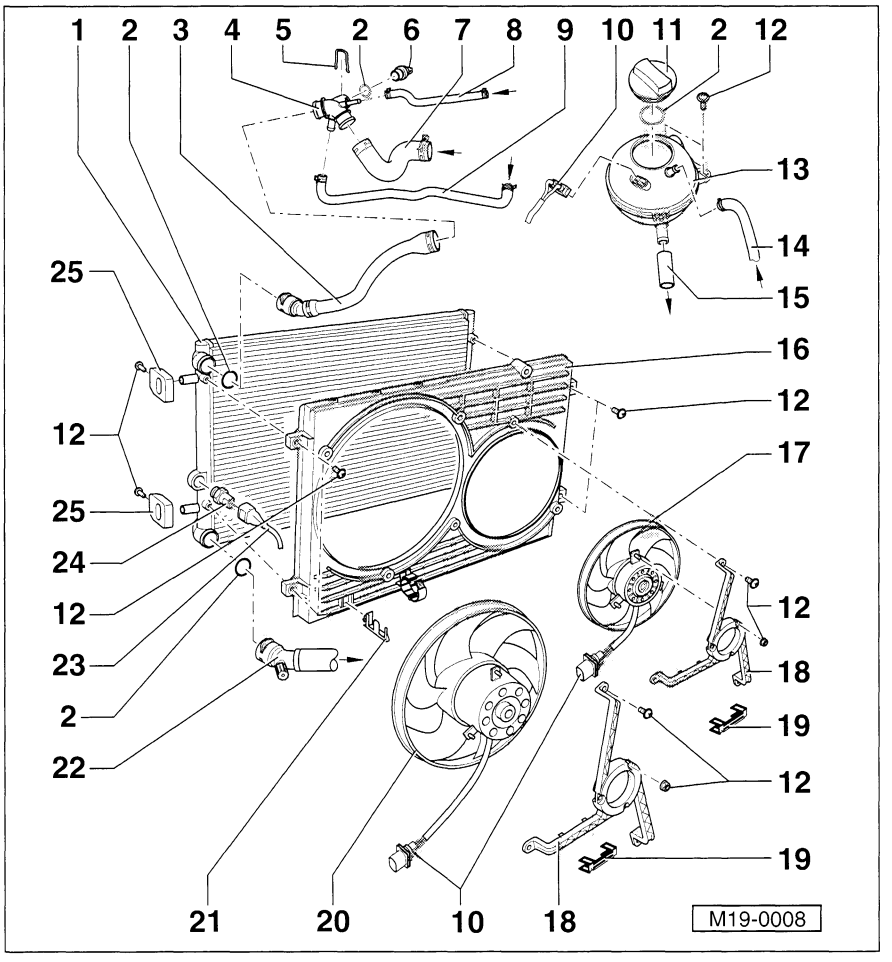
- Coolant pump belt pulley to coolant pump . . . . . 20 Nm (15 ft-lb)
- Coolant pump to engine block . . . . . 20 Nm (15 ft-lb)

– Balance of installation is reverse of removal.

– Fill cooling system as described previously.

– Start engine and check for leaks.

Radiator and cooling fans (1.9L and 2.0L engine)

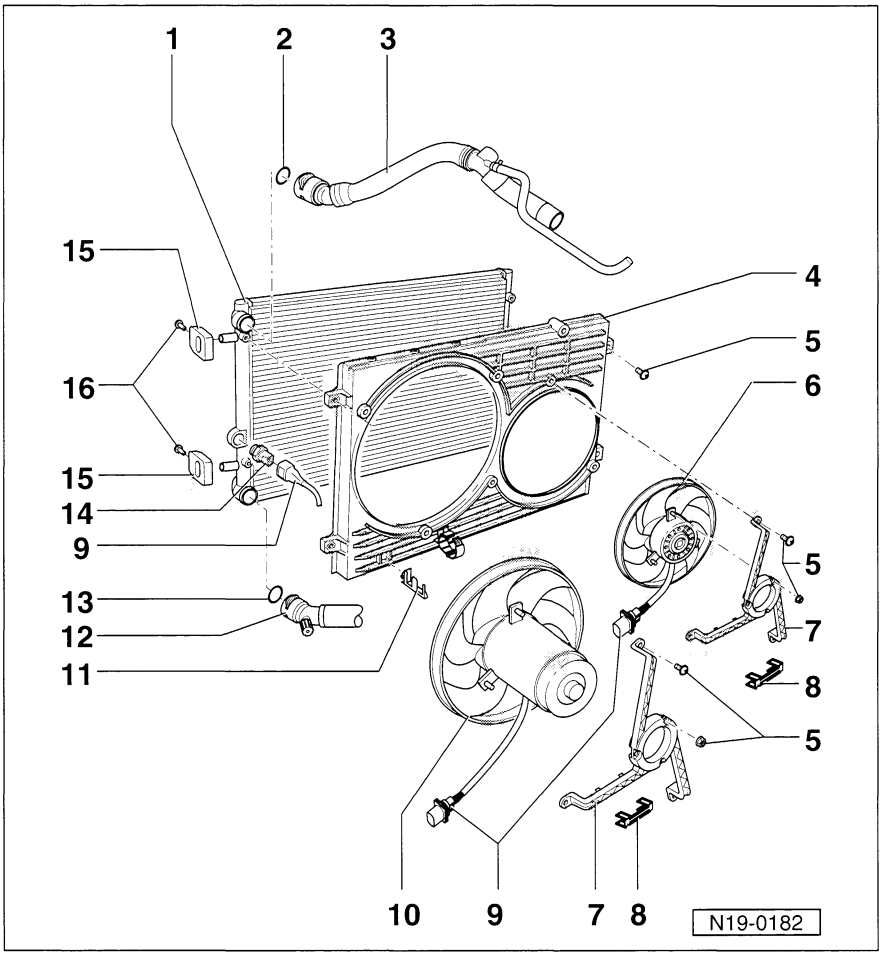


1. **Radiator**
   - If replaced, flush cooling system and use new coolant
2. **O-ring**
   - Always replace
3. **Coolant hose, upper**
   - Attached to radiator with retaining clip
4. **Coolant distribution connector**
   - Multiple connections
5. **Retaining clip**
   - Ensure clip is properly seated
6. **A/C thermal cut-off switch (F163)**
   - Vehicles with A/C only
7. **Hose**
   - From outlet flange on cylinder head
8. **Hose**
   - From outlet flange on cylinder head
9. **Hose**
   - From ATF cooler where applicable
   - From oil cooler where applicable
   - From coolant pipe on lower cylinder block where applicable
10. **Connector**
    - At expansion tank: for Engine Coolant Level (ECL) sensor (G32), 2-pin
    - At radiator fans: 3-pin
11. **Expansion tank pressure cap**
    - Also referred to as the "radiator cap"
    - Test pressure: 1.4-1.6 bar (20.3-23.2 psi)
12. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
13. **Expansion tank**
14. **Hose**
    - Gas engines: from throttle valve control module
    - Diesel engines: from "T" connector near left side of EGR cooler
15. **Hose**
    - To coolant pipe
16. **Air ducting/fan shrouding**
17. **Radiator fan (V35), right side**
18. **Fan support bracket**
19. **Retaining clip**
    - Check for secure installation
20. **Radiator fan (V7), left side**
21. **Bracket**
    - For radiator fan connector
22. **Hose**
    - Bottom of radiator to lower outlet flange
    - Attached to radiator with retaining clip
23. **Connector**
    - For Coolant Fan Control (FC) thermal switch (F18)
    - Multiple configurations
    - 3-pin
24. **Coolant Fan Control (FC) thermal switch (F18)**
    - Tighten to 35 Nm (26 ft-lb)
    - For coolant fans
    - Multiple fan speeds
25. **Bracket**
    - For radiator mounting
    - Note installation position
    - Upper and lower parts are different

NOTE —

Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*

Radiator and cooling fans (1.8L and 2.8L AFP engine)



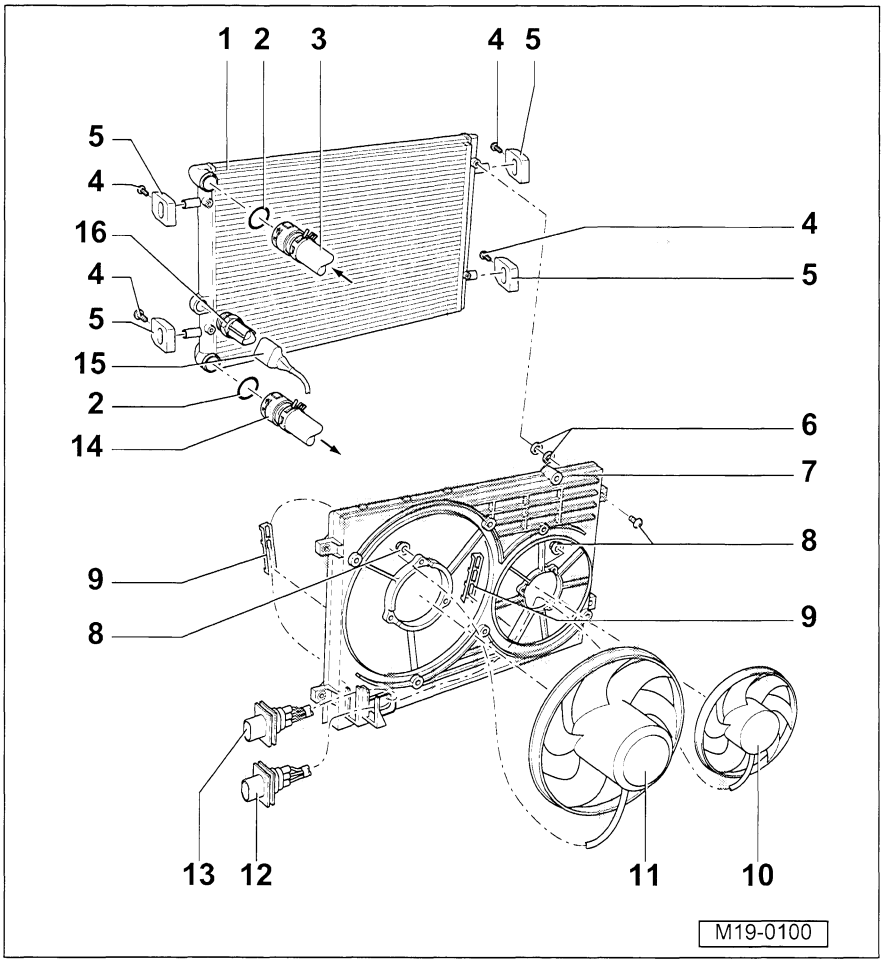
1. **Radiator**
   - If replaced, flush cooling system and use new coolant
2. **O-ring**
   - Always replace
3. **Coolant hose, upper**
   - Attached to radiator with retaining clip
   - Ensure retaining clip is properly seated
4. **Air ducting/fan shrouding**
5. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
6. **Radiator fan (V35), right side**
7. **Fan support bracket**
8. **Retaining clip**
   - Check for secure installation
9. **Connector**
   - At radiator fans: 3-pin
   - At Coolant Fan Control (FC) thermal switch: 3-pin
10. **Radiator fan (V7), left side**
11. **Bracket**
    - For radiator fan connector
12. **Hose**
    - Bottom of radiator to lower outlet flange or thermostat housing
    - Attached to radiator with retaining clip
13. **O-ring**
    - Always replace
14. **Coolant Fan Control (FC) thermal switch (F18)**
    - Tighten to 35 Nm (26 ft-lb)
    - For coolant fans
    - Multiple fan speeds
15. **Bracket**
    - For radiator mounting
    - Note installation position
    - Upper and lower parts may be different
16. **Bolt**
    - Tighten to 15 Nm (11 ft-lb)

NOTE —

Some vehicles with VR6 engines are equipped with an auxiliary radiator mounted behind the right side lower front valence panel. The auxiliary radiator effectively increases the size of the heat radiating area/surface for improved cooling. See **Auxiliary radiator (2.8L engine) removing and installing.**

Radiator and cooling fans (2.8L BDP engine)

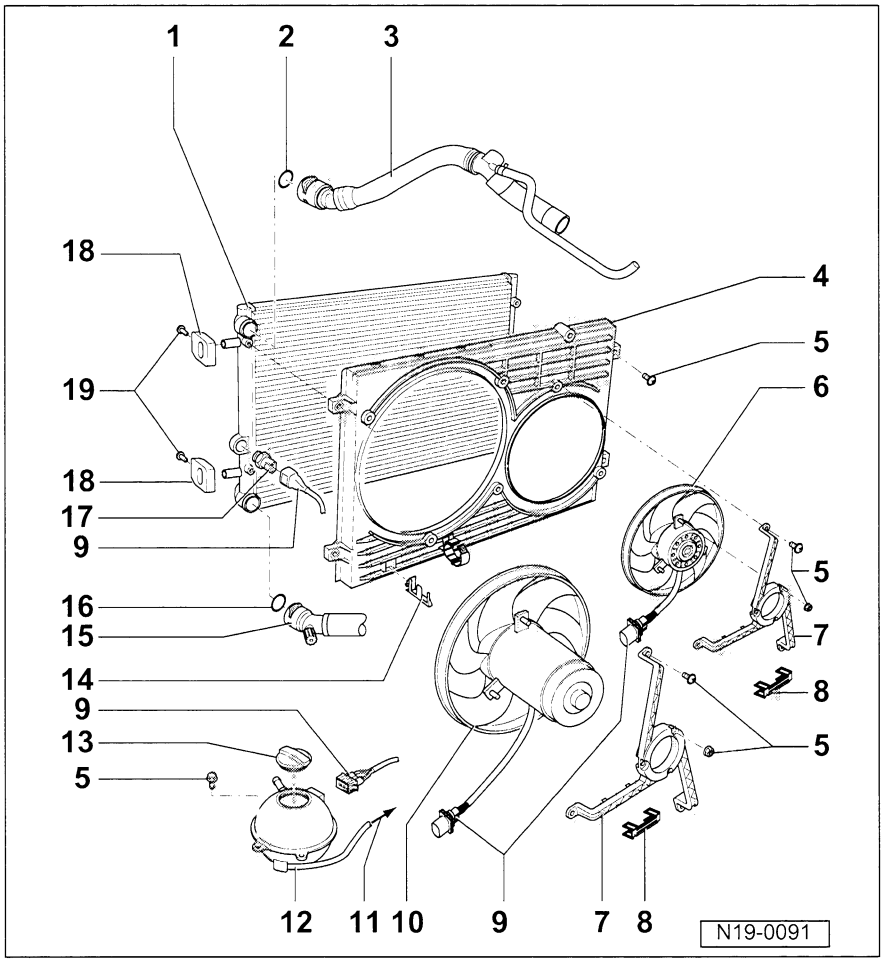
1. **Radiator**
   - If replaced, flush cooling system and use new coolant
2. **O-ring**
   - Always replace
3. **Coolant hose, upper**
   - Attached to radiator with retaining clip
   - Ensure retaining clip is properly seated
4. **Bolts**
   - Tighten to 15 Nm (11 ft-lb)
5. **Bracket**
   - For radiator mounting
   - Note installation position
   - Upper and lower parts may be different
6. **Washers**
7. **Air ducting/fan shrouding**
8. **Nuts**
   - Tighten to 5 Nm (44 in-lb)
9. **Retaining clip**
   - Check for secure installation
10. **Radiator fan (V35), right side**
11. **Radiator fan (V7), left side**
12. **Connector**
    - For radiator fan V35: 3-pin
13. **Connector**
    - For radiator fan V7: 3-pin
14. **Hose**
    - Bottom of radiator to lower outlet flange or thermostat housing
    - Attached to radiator with retaining clip
15. **Connector**
    - At radiator fans: 3-pin
    - At Coolant Fan Control (FC) thermal switch: 3-pin
16. **Coolant Fan Control (FC) thermal switch (F18)**
    - Tighten to 35 Nm (26 ft-lb)
    - For coolant fans
    - Multiple fan speeds



NOTE —

- *Some vehicles with VR6 engines are equipped with an auxiliary radiator mounted behind the right side lower front valence panel. The auxiliary radiator effectively increases the size of the heat radiating area/surface for improved cooling. See* **Auxiliary radiator (2.8L engine) removing and installing.**
- *Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See* **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*

Radiator and cooling fans (1.9L PD engine)



1. **Radiator**
   - If replaced, flush cooling system and use new coolant
2. **O-ring**
   - Always replace
3. **Coolant hose, upper**
   - Attached to radiator with retaining clip
   - Ensure retaining clip is properly seated
4. **Air ducting/fan shrouding**
5. **Screws**
   - Tighten to 5 Nm (44 in-lb)
6. **Radiator fan (V35), right side**
7. **Fan support bracket**
8. **Retaining clip**
   - Check for secure installation
9. **Connectors**
   - At radiator fans: 3-pin
   - At Coolant Fan Control (FC) thermal switch: 3-pin
10. **Radiator fan (V7), left side**
11. **Hose**
    - From expansion tank to upper coolant pipe
12. **Expansion tank**
13. **Expansion tank pressure cap**
    - Also referred to as the "radiator cap"
    - Test pressure: 1.4-1.6 bar (20.3-23.2 psi)
14. **Bracket**
    - For radiator fan connector
15. **Hose**
    - Bottom of radiator to lower outlet flange
    - Attached to radiator with retaining clip
16. **O-ring**
    - Always replace
17. **Coolant Fan Control (FC) thermal switch (F18)**
    - Tighten to 35 Nm (26 ft-lb)
    - For coolant fans
    - Multiple fan speeds
18. **Bracket**
    - For radiator mounting
    - Note installation position
    - Upper and lower parts may be different
19. **Screws**
    - Tighten to 5 Nm (44 in-lb)

NOTE —

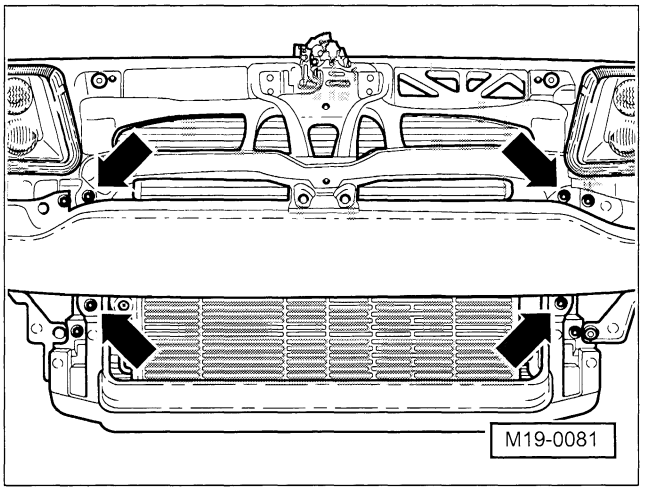
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Radiator and cooling fans, removing and installing

The cooling fans provide additional air flow through the radiator. A faulty cooling fan motor or thermoswitch may be the cause of insufficient air flow and overheating.

The Volkswagen Golf, Jetta and GTI models covered by this manual are equipped with dual two-speed radiator fans.

> ***WARNING —***
> *The electric cooling fans can come on at any time, even if the key is out of the ignition. To avoid personal injury, use extreme caution when working at or near the cooling fan if the engine is hot. As a safety precaution, always disconnect the harness connector from the fan when working around the radiator, fans and associated components.*



– Drain coolant as previously described.

– Disconnect coolant hoses from radiator. Remove retaining clip where equipped.

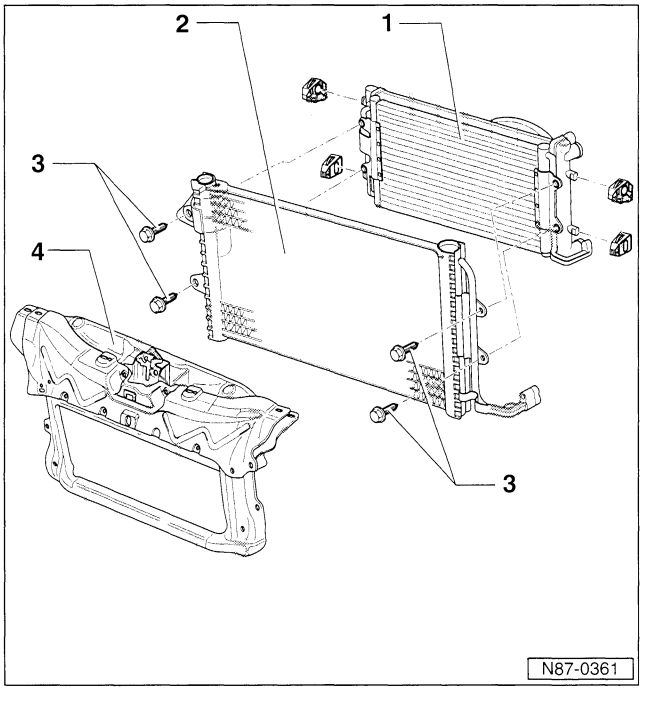
– Remove front body section and move lock carrier to service position, see **50 Body-Front**.

– Disconnect thermo-switch and fan harness connectors.

– Remove retaining clamps from A/C hoses near condenser. Do not open refrigerant system.

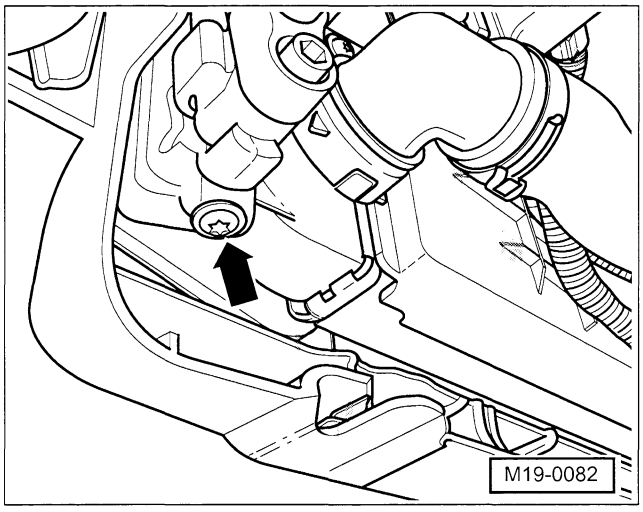
➤ Unbolt A/C condenser from radiator (**arrows**) and support condenser with wire or heavy duty tie wraps.

> ***NOTE —***
> *Do not discharge the A/C refrigerant. Support the A/C condenser with wire and avoid stretching or kinking the hoses.*



➤ Radiator mounting bolts (**3**) as noted above. Some vehicles may be equipped with an additional bolt as noted in the following illustration. When all bolts have been removed from sides and bottom, slide radiator (**1**) slightly to rear and remove radiator and fans together from below.

1. Radiator
2. Condenser
3. Mounting bolts
4. Lock carrier



- Remove bolt (**arrow**) on left of radiator for condenser bracket where equipped.
- Installation is reverse of removal.

NOTE —

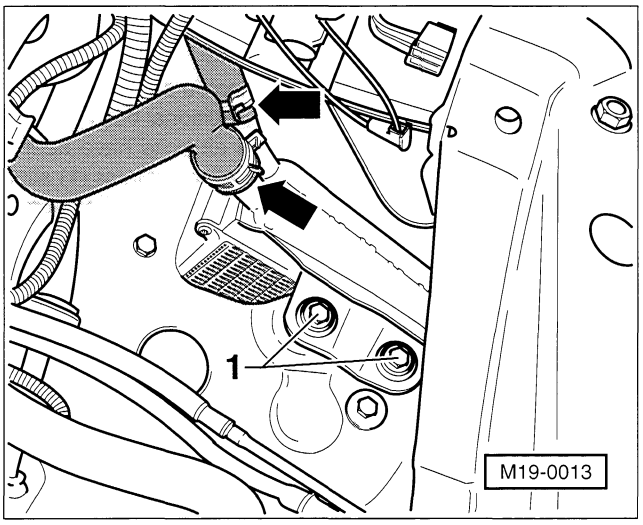
Tightening torques vary between the different engine types. Check **Radiator and cooling fans** *earlier in this section for the appropriate engine group for the correct torque specifications.*

- Fill cooling system as described previously.
- Start engine and check for leaks.

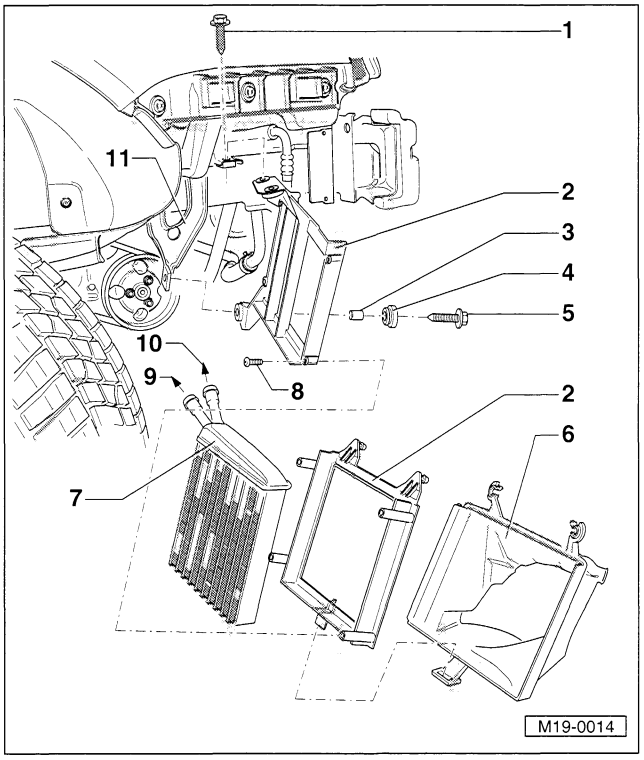
Auxiliary radiator (2.8L engine), removing and installing

Vehicles with the 2.8L (VR6) engine may be equipped with an auxiliary radiator for additional cooling in hot climates.

- Drain coolant as described earlier.
- Remove lower right front sound absorption panel, see **50 Body–Front**.
- Remove right front wheel housing liner, see **66 Body–Exterior Equipment**.
- Remove auxiliary radiator air scoop, see item 6 in illustration M19-0014 below.
- Remove windshield washer reservoir, see **92 Wipers and Washers**.



- Pull coolant hoses (**arrows**) off auxiliary radiator using pliers (VAG 1921 or equivalent). Remove auxiliary radiator upper retaining screws (**1**) located below right headlight.



Remove the lower mounting bolt (**5**) in the front wheel housing from mounting bracket.

1. **Upper mounting bolts**
   - Tighten to 10 Nm (7 ft-lb)
2. **Retaining frame**
3. **Spacer sleeve**
4. **Rubber insulator**
5. **Lower mounting bolt**
   - Tighten to 10 Nm (7 ft-lb)
6. **Air scoop**
   - Clipped onto retaining frame
7. **Auxiliary radiator**
   - Refill with fresh coolant after replacement
   - If replaced, flush cooling system and use new coolant
8. **Retaining screws**
   - Tighten to 5 Nm (44 in-lb)
9. **To "T" in upper radiator hose**
10. **To "T" in lower radiator hose**
11. **Mounting bracket**

– Carefully remove the auxiliary radiator (**7**) with its attachments from below.

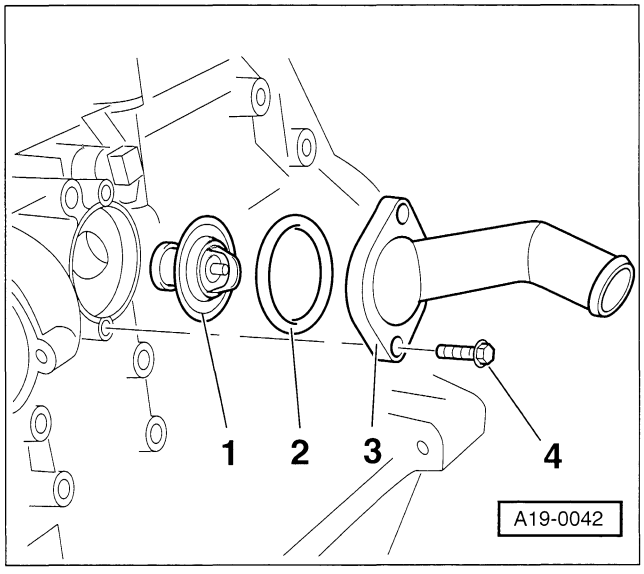
– Installation is the reverse of removal.

Tightening torque

- Auxiliary radiator mounting bolts . . . . 10 Nm (7 ft-lb)

– Fill the cooling system as described previously. Start engine and check for leaks.

Thermostat, replacing (4-cylinder)



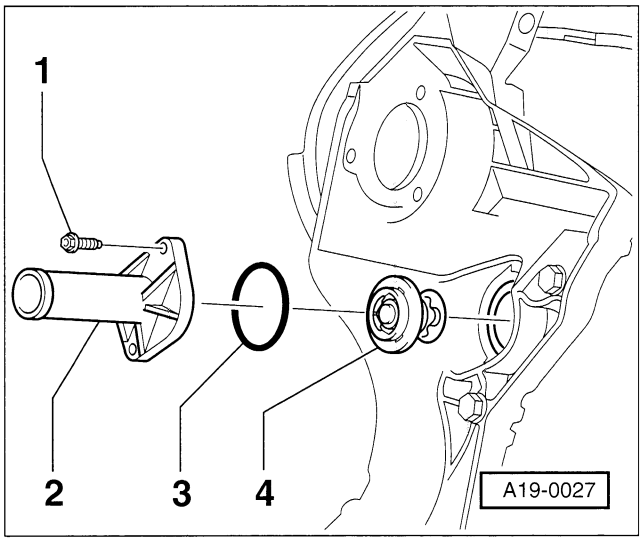
A thermostat mounted in the cylinder block provides primary control of coolant temperature by regulating the flow of coolant to the radiator. The thermostat remains closed when coolant is below the specified temperature allowing the engine to reach operating temperature quickly and providing immediate heat to the passenger compartment. Thermostats for all the 4-cylinder engines covered by this manual operate within the same temperature ranges, but are not interchangeable.

– Drain coolant as previously described.

– Disconnect lower radiator hose from outlet flange on cylinder block.

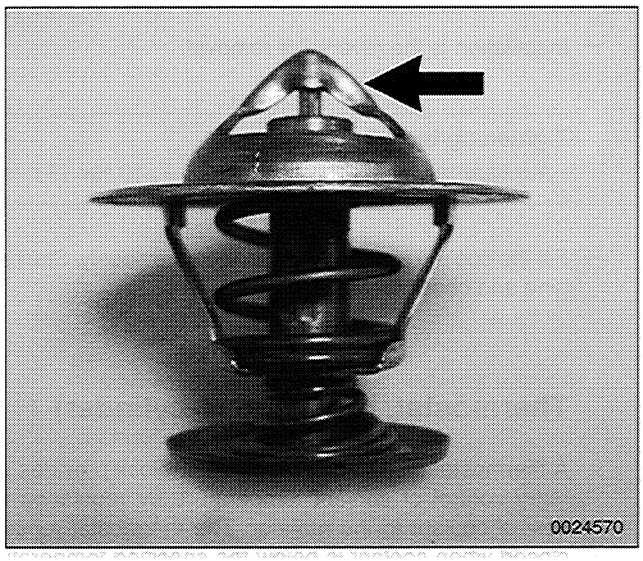
– Remove the outlet flange mounting bolts and remove the flange and O-ring seal.

To remove the thermostat on 2.0L engines, carefully pull the thermostat out.



➤ To remove the thermostat on 1.8L and 1.9L engines, rotate the thermostat ¼ turn, (90°), counterclockwise and pull out.

– Before installing thermostat into cylinder note the following points:
  - Clean mating surface on cylinder block and outlet flange before installing.
  - Always install new O-rings moistened with coolant.



➤ Install thermostat into cylinder block. In all engines, the thermostat must be installed so that the outer support brace (**arrow**) is as close to vertical as possible:
  - 2.0L engines, fit thermostat into cylinder block.
  - 1.8L and 1.9L engines, fit thermostat into cylinder block and rotate ¼ turn (90°) clockwise.

– Installation is reverse of removal.

– Fill cooling system as described previously.

– Start engine and check for leaks.

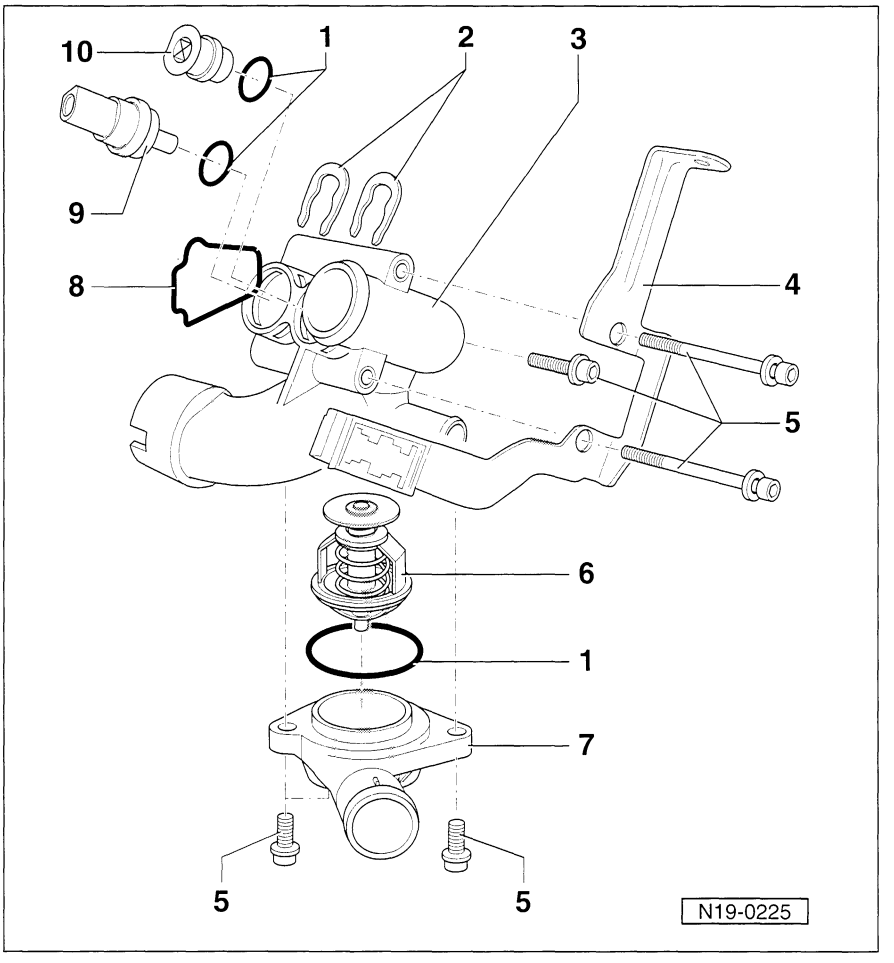
Tightening torque

- Thermostat flange to engine block (4-cylinder engines) . . . . . 15 Nm (11 ft-lb)

Thermostat assembly (2.8L engine)

NOTE —
BDF engine shown, AFP engine is similar.

1. **O-ring**
   - Always replace
2. **Retaining clip**
   - Ensure clip is properly seated
3. **Thermostat housing**
   - Multiple connections
4. **Bracket**
   - Not installed on all engines
5. **Bolts**
   - Some engines may only have 2 mounting bolts
   - AFP engines: Tighten to 10 Nm (7 ft-lb)
   - BDF engines: Tighten to 8 Nm (6 ft-lb)
6. **Thermostat**
   - Install with large plate downward
   - Checking: heat thermostat in water bath
     Opening starts at approx. 80°C (176°F)
     Opening ends at approx. 105°C (221°F)
     Travel at least 7 mm
7. **Outlet flange**
8. **Gasket/seal**
   - Always replace
   - If seal is not on ECT sensor when sensor is removed, check thermostat housing to be sure that seal is not stuck in housing
9. **Engine Coolant Temperature (ECT) sensor (G62)**
   - With coolant temperature gauge sensor (G2)
   - For engine control module (ECM)
   - Release pressure from cooling system before removing
   - Always check with an Authorized Volkswagen Parts Department or aftermarket Parts Specialized for the latest ECT version.
10. **Sealing plug**
    - Number of sealing plugs and location will vary depending on vehicle equipment



NOTE —
Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*

2 Fuel, Ignition, and Exhaust Systems

GENERAL 2-1

FUEL SUPPLY 2-1

FUEL INJECTION 2-1
Motronic 5.9 engine management 2-1
Motronic 5.9 overview 2-2
Diesel Turbo Direct Injection (TDI) 2-3
Diesel Turbo Direct Injection, overview 2-4
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GENERAL

This general information group covers application information and system descriptions for the repair groups listed under **2 Fuel, Ignition and Exhaust Systems**.

NOTE —

- *For general information on the battery, starter and alternator, see* **27 Engine Electrical Systems**.
- *For emission control system application information, see* **26 Exhaust System and Emission Controls**.

FUEL SUPPLY

The plastic fuel tank is mounted beneath the rear of the vehicle. On gasoline engines, an electric fuel pump with integral level sensor is submersed in the tank. On diesel engines, only the fuel the level sensor is mounted in the tank, as the engine-mounted diesel injection pump handles fuel delivery to the engine.

This gasoline fuel pump/fuel level sensor assembly is called the fuel delivery unit. An inlet strainer provides course filtration and prevents dirt and debris from entering the fuel system. Built into the fuel delivery unit is a check valve and a relief valve. The check valve is on the outlet side of the pump and holds pressure in the system after the engine is shut off. The relief valve prevents high pressure from damaging the system. The check valve and relief valve are not replaceable.

The fuel tank is designed to prevent overfilling and allow for fuel expansion. The fuel cap contains a valve to prevent a vacuum from forming in the tank.

On all engines, fuel is supplied to the engine and excess fuel is returned to the tank through special plastic fuel lines. In addition, diesel engines with automatic transmissions use a fuel cooler on the supply line to the pump.

FUEL INJECTION

The various types of engine management systems used on the engines covered by this manual are listed below.

Engine Codes

- AWD, AWW, AWP . . . . . 1.8L 4-cylinder gasoline Motronic ME 7.5
- ALH . . . . . 1.9L 4-cylinder turbo diesel TDI Diesel Direct Fuel Injection EDC/DFI
- BEW . . . . . 1.9L 4-cylinder turbo diesel TDI/PD Diesel Direct Fuel Injection EDC 16
- AEG . . . . . 2.0L 4-cylinder gasoline Motronic 5.9
- AVH, AZG, BBW, BEV . . . . . 2.0L 4-cylinder gasoline Motronic ME 7.5
- AFP, BDF . . . . . 2.8L 6-cylinder gasoline Motronic ME 7.1

Motronic 5.9 engine management

The AEG (2.0 liter) engine is equipped with an enhanced version of the sophisticated Bosch Motronic engine management system. See Fig. 1. This version (5.9) complies with the federal and state government mandated On-Board Diagnostic (OBD) II standards.

Basic fuel metering is determined by engine speed and engine load. The Engine Control Module (ECM) receives engine speed and crankshaft position information from the engine speed and reference sensor, and engine load information from the Mass Air Flow sensor (MAF). The ECM then meters fuel to the engine by sequentially triggering the fuel injectors at a rate proportional to engine speed and load. The length of time the injectors remain open determines fuel quantity.

Motronic 5.9 overview

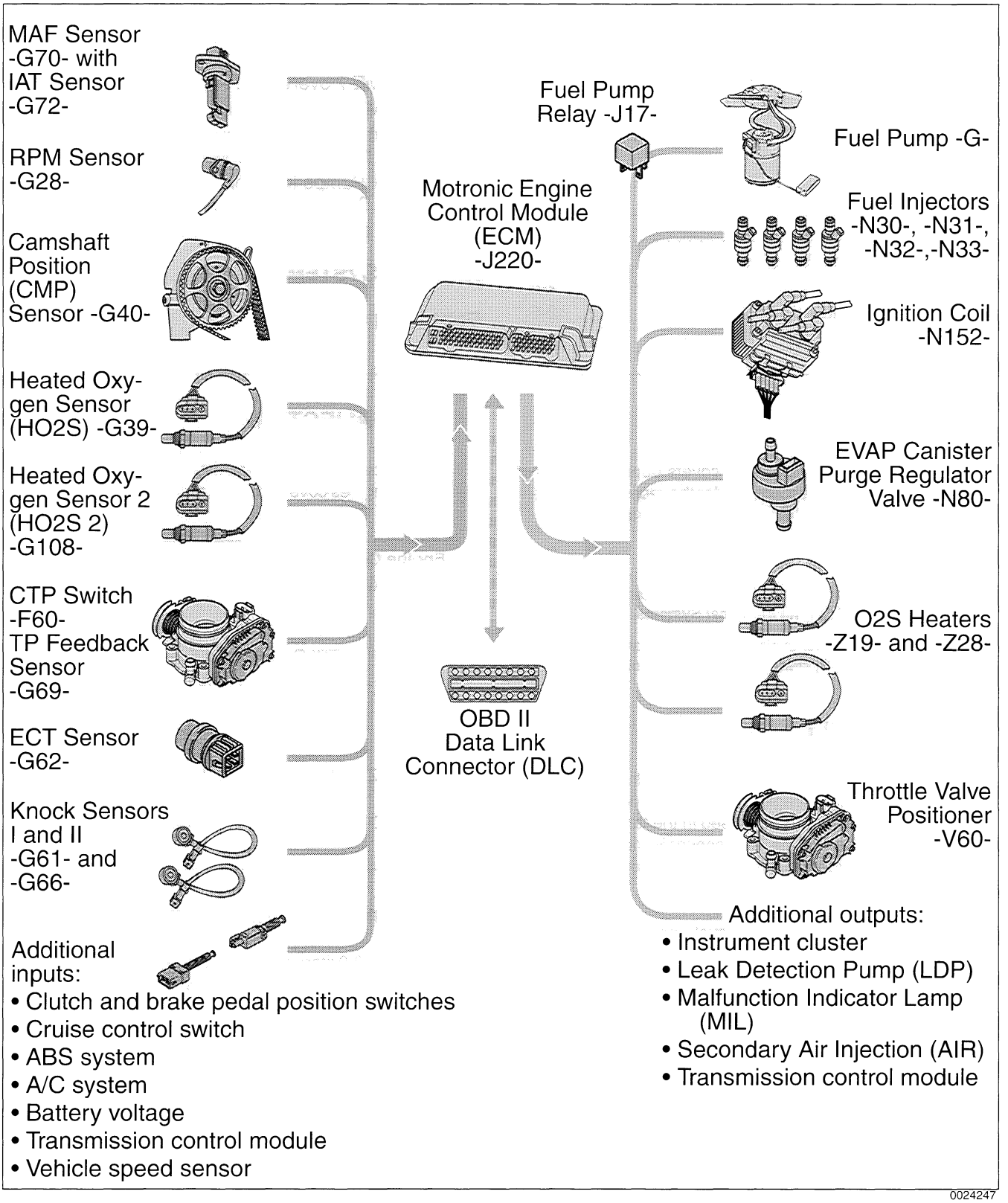


Fig. 1. Bosch Motronic 5.9 engine management system. Inputs (**left**) to the ECM are used to control and adapt output signals (**right**) to the individual components. Volkswagen component codes are indicated within dashes (–).

The ECM uses the same information to determine the correct ignition firing point. A small output signal is generated and sent to the Power Output Stages built into the Ignition Coils. The Camshaft Position Sensor (CMP), identifies cylinder number 1 firing position for cylinder-selective injection and ignition knock control. The Engine Coolant Temperature sensor (ECT), supplies engine temperature information to the ECM.

The Throttle Actuator Control Module (TACM), combines 4 functions. Three are used on the input side: the Throttle Position Sensor (TPS), which signals throttle angle; the Closed Throttle Position switch (CTP), which signals fully closed throttle plate; and the Throttle Position Feedback sensor, which signals position of the electric motor used for idle stabilization and cruise control function.

The Pre-Catalyst Heated Oxygen Sensor (HO2S), signals combustion efficiency, and the Post-Catalyst Heated Oxygen Sensor (HO2S), monitors efficiency of the Three-Way Catalytic Converter (TWC).

The Knock Sensors (KS1 and KS2), supply engine knock information for ignition timing regulation and the Intake Air Temperature sensor (IAT), is used for idle stabilization and as a correction factor for ignition timing.

Based on all of the input signals, the ECM precisely controls the following output components:

- Fuel Injectors
- Power Output Stage and Ignition Coil
- Throttle Position Actuator
- Evaporative Canister Purge Valve (EVAP)
- Fuel Pump and Relay

In addition, certain versions have additional outputs controlled by the ECM:

- Secondary Air Pump Relay (AIR); Air Injection Solenoid Control Valve and Secondary Air Injection Pump
- Leak Diagnosis Pump (LDP); and Control Relay

The ECM also controls cruise control functions.

A warning light known as a Malfunction Indicator Lamp (MIL), is located in the instrument cluster and signals the vehicle operator when certain systems have failed. In some instances, it will come on if relatively small malfunctions have been recorded, such as running very low on fuel or leaving off the gas cap. Most malfunctions that occur will cause the light to stay on steadily, but certain very serious situations such as an overheating catalytic converter may cause it to blink.

Because of complexity of the Motronic 5.9 system, proper diagnosis and repair requires the use of specialized scan tools such as the Volkswagen VAG 1551 or 1552, or the VAS 5051 or 5052. Aftermarket scan tools can also access the Motronic 5.9 system diagnostic trouble codes (known as P-codes). A table is provided at the back of this manual that identifies the various scan tool codes. See **ST Scan Tool Codes**.

In addition to diagnostics, Motronic 5.9 systems include the ability to record proper operation of as many as 8 monitored functions. These functional checks are called readiness codes and are set when the proper operating parameters are reached at least one time. These codes are important because some areas with emissions testing check these codes first. If the readiness code is NOT set, the vehicle will not pass the specialized test. Readiness codes may be erased if the battery is disconnected or runs low, if the ECM is disconnected, or if faults or DTCs are erased with a scan tool. Generally speaking, the readiness codes in Volkswagen systems will reset themselves after the vehicle has been started and driven under varying conditions several times. They can also be reset using the scan tool.

Diesel Turbo Direct Injection (TDI)

The 1.9 liter diesel engine is equipped with one of two different Diesel Turbo Direct Injection System. Both systems feature engine controls that closely resemble those of a gasoline engine. The early system, is known simply as TDI, and combines sophisticated computer control of fuel management and emissions with system monitoring and diagnostics. See Fig. 2. For the later system, see **TDI Diesel Engine with Pump Injection (PD**)

An exhaust driven turbocharger and an intercooler work with a specially designed combustion chamber and cylinder head to produce more efficient combustion and lower fuel consumption. This also results in reduced engine noise and increased power.

In addition, the accelerator pedal is directly connected to the Engine Control Module (ECM) via a potentiometer. This eliminates the need for an accelerator cable and is known as "drive by wire". The ECM also controls all glow plug functions, auxiliary coolant glow plug functions and cruise control.

Basic fuel metering is determined by engine speed and engine load. When the key is switched on and the engine is started, the fuel cut-off valve opens and fuel flows into the injection pump. The ECM receives engine RPM from the engine speed sensor and engine load information from the Throttle Position Sensor (TPS). These signals are modified by the Engine Coolant Temperature sensor (ECT), the Mass Air Flow Sensor (MAF), and the Fuel Temperature Sensor. The ECM then signals the quantity adjuster which allows the proper quantity of fuel to be metered sequentially to the mechanical injectors. The ECM also uses the same information to determine the correct moment of injection which is the ignition firing point. An output signal is generated and sent to the cold start valve at the correct time.

The ECM monitors the operation of the quantity adjuster via a signal received from the modulating piston displacement sensor and makes corrections to the fuel quantity as required.

The ECM monitors operation of the cold start valve via a signal received from the needle lift sensor attached to injector number 3 and again makes corrections as required.

Diesel Turbo Direct Injection, overview

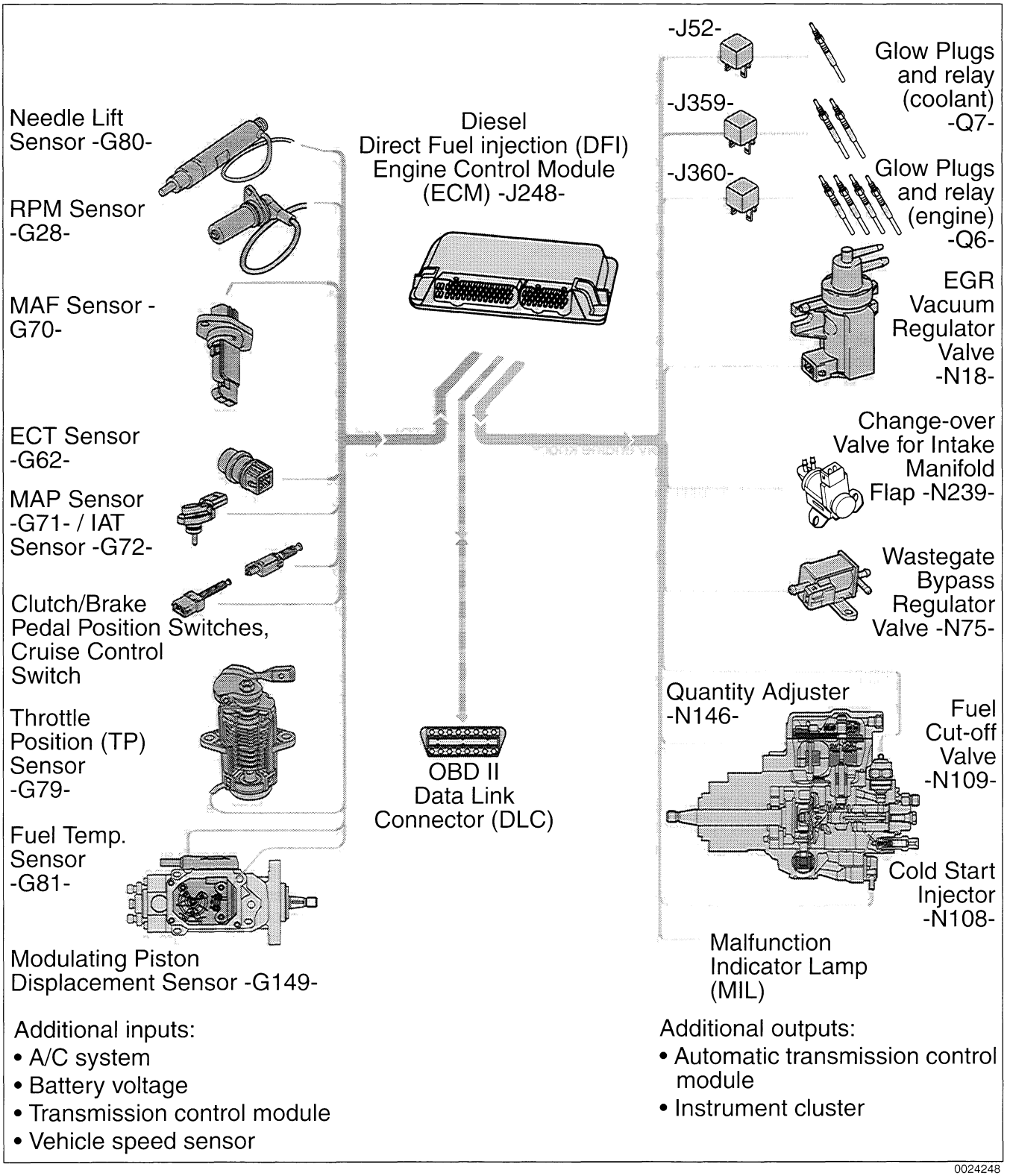


Fig. 2. Diesel Turbo Direct Injection engine management system. Inputs (**left**) to the ECM are used to control and adapt output signals (**right**) to the individual components. Volkswagen component codes are indicated within dashes (–).

Turbocharger boost pressure is regulated by the ECM based on a signal from the Intake Air Temperature sensor (IAT), the Mass Air Flow (MAF) sensor, and an ambient pressure signal from an internal Barometric Pressure Sensor (BARO). The wastegate bypass regulator valve receives output from the ECM and controls a vacuum signal sent to the turbocharger wastegate.

In order to prevent possible damage from simultaneous application of the brake, clutch and accelerator pedals, the brake pedal switch, brake light switch, and clutch pedal switch signal their respective positions to the ECM. These signals are also used by the ECM during in cruise control mode.

Based on all of the input signals, the ECM precisely controls the following output components:

- Quantity Adjuster
- Cold Start Injector
- Fuel Cut-off Valve
- Wastegate Bypass Regulator Valve
- EGR Vacuum Regulator Valve
- Intake Manifold Change-over Valve

In addition, the ECM uses various sensors to control these additional outputs:

- Glow Plugs
- Glow Plug Relay
- Auxiliary Heater Coolant Glow Plugs
- Coolant Glow Plug Relay

When the ECM receives the signal to shut down, a signal is sent to a flap valve mounted in the intake tract. This valve, known as the intake manifold change-over valve, closes and blocks the flow of air to the still-turning engine. Blocking the flow of air during the shut-down cycle reduces the abruptness associated with stopping a diesel engine.

Tailpipe emissions are further reduced by a two-way oxidation-type catalytic converter.

TDI equipped New Beetles have two warning lights in the instrument cluster to advise of system status. The glow plug indicator light operates when the key is first turned on to indicate the need to wait for the glow plugs to preheat the combustion chambers. The Malfunction Indicator Lamp (MIL), lights if a failure of a monitored component occurs. In some serious failure modes, both warning indicators can be lit.

Owing to the complex nature, most diagnosis and repair of the TDI system requires the use of specialized scan tools such as Volkswagen special tool VAG 1551 or VAG 1552. Aftermarket scan tools can also access the diagnostic trouble codes (known as P-codes). A table is provided at the back of this manual that identifies the various scan tool codes. See **ST Scan Tool Codes**.

Motronic ME 7 engine management

The 2.8 liter, 1.8 liter, and the AVH, AZG, BBW, and BEV 2.0L engines are equipped with versions of the torque-based Bosch Motronic ME7 engine management systems. See Fig. 3. This system fully complies with the federal and state government mandated On-Board Diagnostic (OBD) II standards.

In previous engine management systems, demands for torque and efficiency are handled by separate sub-systems. The interaction between all of the different subsystems has become increasingly complicated as new demands are placed on the engine management system. These demands can include control of transmission, traction control and vehicle dynamics in addition to enhanced links with existing subsystems.

The Bosch Motronic ME 7 engine management system uses a new internal circuit design to calculate engine torque. The Engine Control Module (ECM) receives all of the relevant signal data from the input sensors and various other sources and computes the required amount of engine torque needed based on pre-established priorities. All torque and efficiency demands are defined as mathematical variables.

The ECM is then able to obtain the calculated engine torque through precise coordination of the following output components:

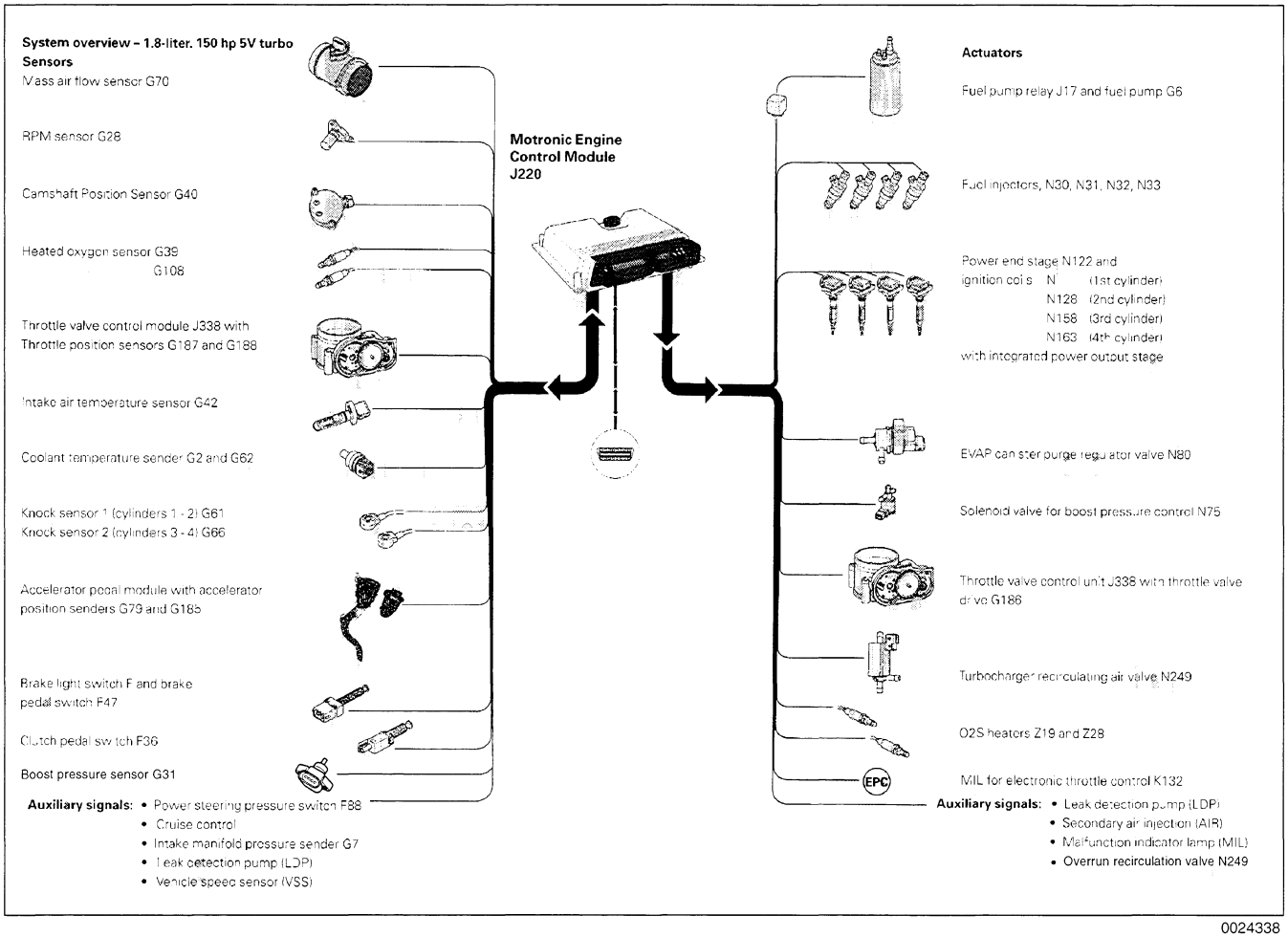
- Throttle Valve Control Module (throttle angle)
- Wastegate Regulator Solenoid Valve (boost control)
- Fuel Injectors (injection time and fuel cut-off)
- Power Output Stages with Ignition Coils (ignition timing)

Main sensor inputs to the ME 7 ECM (J220) include:

- Mass air flow sensor (G70)
- Speed/reference sensor (G28)
- Camshaft position sensor (G40)
- Pre-Catalyst heated oxygen sensor (G39)
- Post-Catalyst heated oxygen sensor (G108)
- Throttle valve control module (J338) with position sensors (G187) and (G188)
- Intake air temperature sensor (G42)
- Coolant temperature sensors (G2) and (G62)
- Knock sensor, cylinders 1-2, (G61)
- Knock sensor, cylinders 3-4, (G66)
- Accelerator pedal position sensors (G79) and (G185)
- Boost pressure sensor (G31)
- Brake light (F) and pedal switches (F47)
- Clutch pedal switch (F36)
- Leak Detection Pump (V144)

Additional inputs are received from the cruise control switches, transmission control module, vehicle speed sensor, instrument cluster, anti-lock brake system control module, fan control module, airbag control module and air conditioning system.

Motronic ME 7 overview



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Fig. 3. Bosch Motronic ME 7 engine management system components. Inputs (**left**) to the ECM are used to calculate the required torque. Outputs (**right**) convert demands to torque. Volkswagen component codes are indicated within dashes (–).

Based on the calculations of the torque demand coordinator in the central processor of the ECM, signals are sent to the torque conversion processor for activation of the outputs required to achieve the requested torque.

The primary outputs used to achieve the ECM-requested torque are:

- Throttle valve control module (J338) with throttle valve drive motor (G186)
- Fuel Injectors (N30, N31, N 32, N33)
- Ignition Coil Packs with Power Output Stages (N70, N127, N291, N292)
- Wastegate Regulator Solenoid Valve (N75)

Additional outputs controlled by the ECM include:

- Fuel Pump Relay (J17)
- Evaporative Canister Purge Valve (N80)
- Secondary Air Injection Pump Relay (J299)
- Secondary Air Injection Solenoid Valve (N112)
- Leak Detection Pump (V144)
- Overrun Recirculation Valve (N249)
- Oxygen Sensor Heaters

Motronic ME 7 system structure

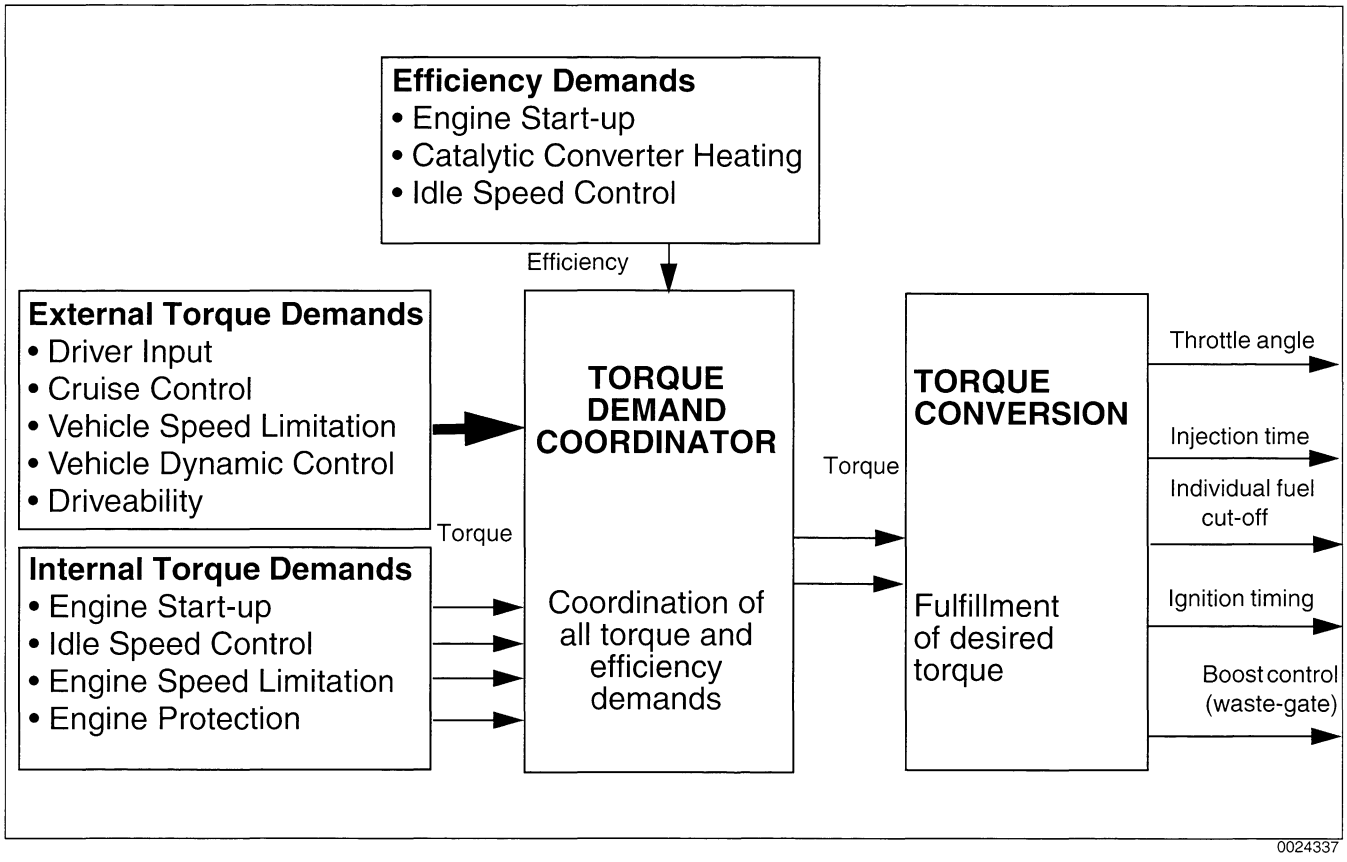


Fig. 4. Schematic representation of Motronic ME 7 torque generation.

A Malfunction Indicator Lamp (MIL), is located in the instrument cluster and signals the vehicle operator when certain emissions-related systems have in some way malfunctioned. In some instances, it will come on if relatively small malfunctions have been recorded, such as running very low on fuel or leaving off the gas cap. Most malfunctions that occur will cause the light to stay on steadily, but certain very serious situations such as an overheating catalytic converter may cause it to blink. An EPC indicator light also located in the instrument cluster will signal the vehicle operator of certain malfunctions within the electronic accelerator pedal system.

Due to the complex nature of the Motronic ME 7 system, proper diagnosis and repair requires the use of a specialized scan tools such as Volkswagen scan tools VAG 1551, VAG 1552 or VAS 5051. Aftermarket scan tools can also access the ME 7 system diagnostic trouble codes (known as P-codes). A table is provided at the back of this manual that identifies the various scan tool codes. See **ST Scan Tool Codes**.

Previous Motronic versions modified basic fuel and ignition maps as required to match the air flow of the mechanical throttle valve. ME 7 systems integrate a mechanically de-coupled accelerator pedal and throttle valve (drive-by-wire) system to allow the ECM processor complete control of engine torque generation as a response to external, internal and efficiency demands. See Fig. 4. Simply stated, the ECM controls all three main combustion requirements: fuel, spark and air, whereas previous systems only controlled fuel and spark.

In addition to diagnostics, Motronic ME 7 systems include the ability to record proper operation of as many as 8 monitored functions. These functional checks are called readiness codes and are set when the proper operating parameters are reached at least one time. These codes are important because some areas with emissions testing check these codes first. If the readiness code is NOT set, the vehicle will not pass the specialized test. Readiness codes may be erased if the battery is disconnected or runs low, if the ECM is disconnected, or if faults or DTCs are erased with a scan tool. Generally speaking, the readiness codes in Volkswagen systems will reset themselves after the vehicle has been started and driven under varying conditions several times. They can also be reset using the scan tool.

Diesel Turbo Direct Injection, Pump Injection (Pumpe Düse, PD), overview

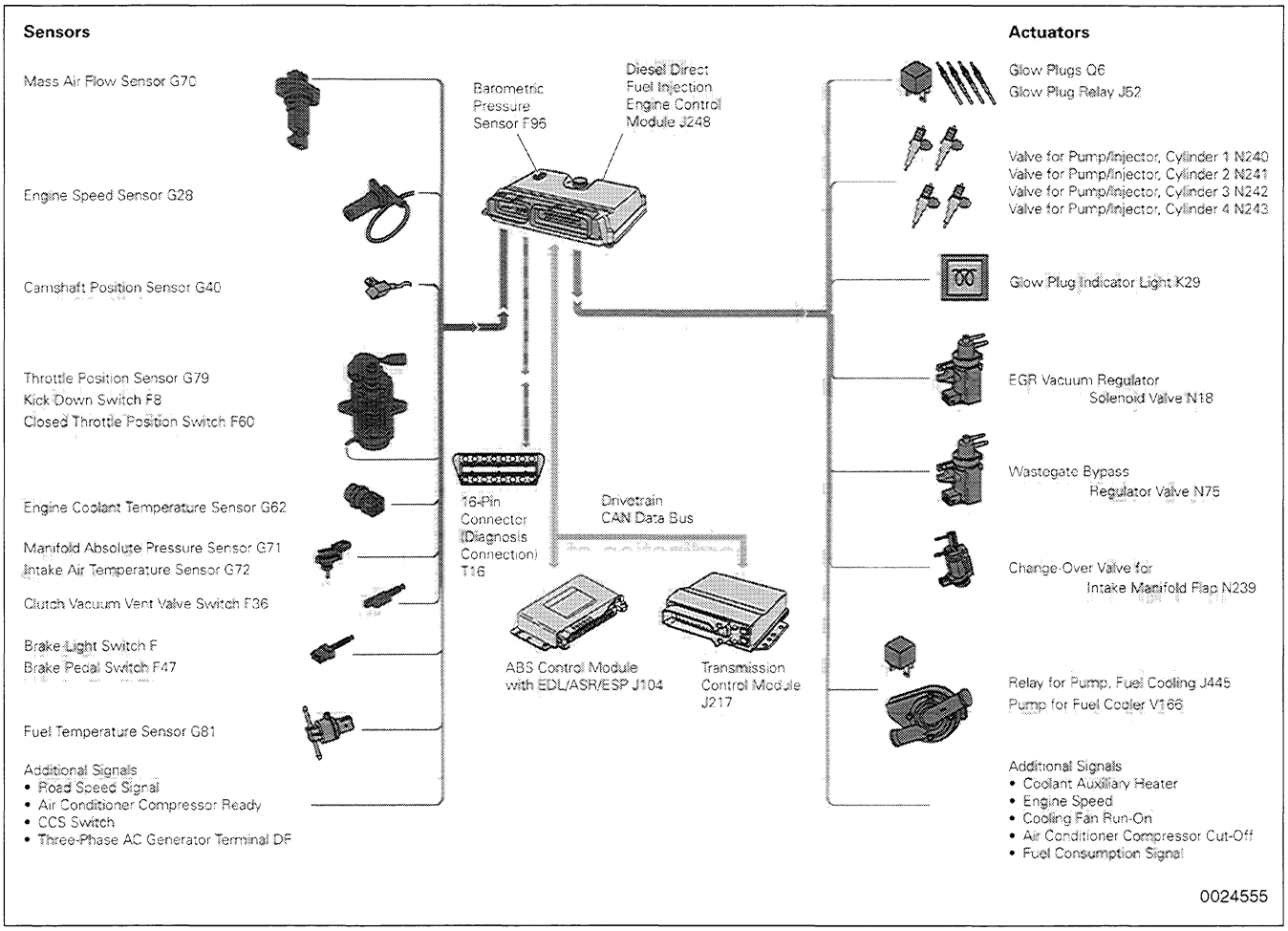


Fig. 5. Volkswagen TDI-PD engine management system components. Inputs (**left**) to the ECM are used to calculate the required torque. Outputs (**right**) convert demands to torque. Volkswagen component codes are indicated within dashes (–).

Diesel TDI Pump Injection (Pumpe Düse, PD)

The 4-cylinder, 2 valve per cylinder, 1.9 liter PD (Pumpe Düse, or Pump Injection) diesel engine is also a Turbo Direct Inject (TDI) engine. This engine is installed in Golf, Jetta, and New Beetles starting with the 2004 model year. A 2.0 liter version with very similar characteristics is also available in the B5 series Passats starting with model year 2004.

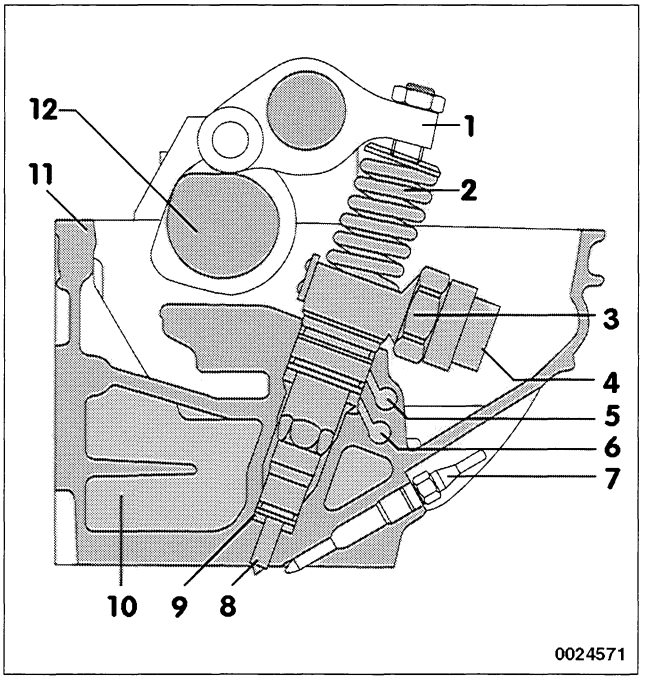
While both 1.9L Diesel engine versions share some common characteristics, numerous substantive differences exist between the this version of the 1.9L engine and the earlier ALH diesel engine. For engine management system differences, See Fig. 5.

A pump/injector (PD) is, as the name implies, a pressure-generating pump combined with a solenoid valve control unit. The engine is equipped with four pressure generating pumps with solenoid valve control units, N240, N241, N242, and N243 driven by separate lobes on the camshaft. Each unit has an integral injector.

This means that there is no longer any need for high-pressure lines, a distributor-type injection pump, or separate injectors. All functions are combined into a single unit installed directly into the cylinder head.

Just like the earlier system with a distributor-type injection pump and separate injectors, the new pump injection (PD) system must:

- Generate the high injection pressures required (up to 1920 bar or 27,846 psi).
- Inject fuel into the cylinders in the correct quantity and at the correct point in time.

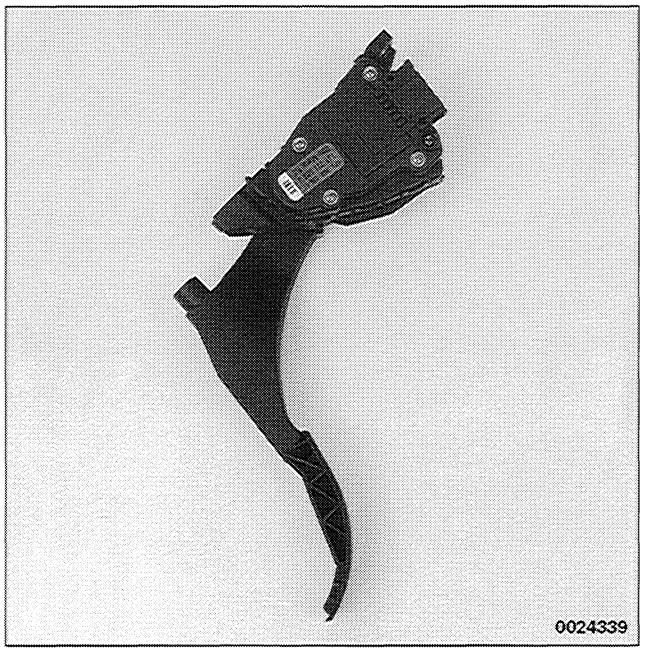


Detail view of major components of the pump/injector as installed in cylinder head.

1. **Roller-type rocker arm**
2. **Pump piston and spring**
3. **Solenoid needle valve**
4. **Pump injector solenoid valve**
5. **Fuel return line**
6. **Fuel supply line**
7. **Glow plug**
8. **Injector needle (discharge end)**
9. **Heat insulating seal**
10. **Coolant passage in cylinder head**
11. **Cylinder head casting**
12. **Injection lobe on camshaft**

Fuel is drawn from the fuel tank and supplied to the pump/injector units via a tandem pump on the end of the cylinder head. A second section of this pump supplies vacuum for vehicle needs.

For additional information, see **1 Engine - General**.



Electronic power control (EPC)

The ME 7 and TDI engine management systems use electronic controls to operate the throttle valve rather than the usual bowden cable. Pedal resistance and operation matches cable designs so that the operator is unlikely to differentiate. In the event of a failure with either one of the accelerator pedal position sensors (G79 or G185), the other sensor signal would be used in a limited capacity with functions such as cruise control deactivated. If both sensors malfunction, the ECM will limit engine speed to approximately 1200 rpm.

IGNITION SYSTEM

The ignition function is handled through the fuel injection/engine management system on all engines.

On gasoline engines, the Motronic ECM computes ignition timing based on inputs from the various sensors. Crankshaft position and speed are the main inputs to the ECM used for starting. The other sensors are used to adapt the basic timing map for varying operating conditions. Motronic engines incorporate adaptive knock control to adjust the ignition timing for individual cylinders. See **28a Ignition System–Gasoline** for the appropriate engine for more information.

On diesel engines, the ECM uses the same information that was used to compute the fuel quantity to determine the correct moment of injection. When the fuel is injected into the combustion chamber, heat generated by the high compression ratio causes the fuel to spontaneously burn. This is the ignition firing point. There is no separate ignition system as such. In spite of this high compression ratio, cold engines do not have sufficient heat to burn the fuel. For this reason, glow plugs are used to provide supplementary heat. See **28b Ignition System–Diesel** for more information.

EMISSION CONTROLS

Gas and diesel engines use different emission controls. Most functions are integral with the engine management systems and are monitored by the On-Board Diagnostic (OBD) system. Most of these functions cannot be isolated. For additional information on those functions, see **26 Exhaust System and Emission Controls,** or **ST Scan Tool Codes** at the back of this manual.

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GENERAL

This repair group covers the fuel supply portion of the fuel system. For gasoline engines, this includes the components that store and supply fuel under pressure to the fuel injection section of the engine management system. For diesel engines, this includes the components that store and supply fuel to the diesel injection pump. For general system descriptions and overviews, see **2 General Information**.

NOTE —

Fuel filter replacement for most engines is covered in **0 Maintenance**. *Due to the location of the filter on vehicles with the 2.0L BBW engine, replacement is covered in this section. A detail view of the 1.9L engine is also shown in this section.*

Engine Codes

- AWD, AWW, AWP . . . 1.8L 4-cylinder turbo gasoline
- ALH . . . . . 1.9L 4-cylinder turbo diesel
- BEW . . . . . 1.9L 4-cylinder PD turbo diesel
- AEG, AVH, AZG, BBW, BEV . . . 2.0L 4-cylinder gasoline
- AFP, BDF . . . . . 2.8L 6-cylinder gasoline

Safety Precautions

Please read and be familiar with the following warnings and cautions before working on the fuel pump, fuel tank or fuel lines.

WARNING —

- *Always disconnect the negative (-) battery cable and cover the terminal with an insulated material whenever working on any fuel related component.*
- *Gasoline and diesel fuel are dangerous to your health. Wear suitable hand and skin protection when working on the fuel system. Do not breath fuel vapors. Always work in a well-ventilated area.*
- *Fuel and fuel vapors will be present during many of the operations described in this repair group. Do not smoke or create sparks. Be aware of pilot lights in gas operated equipment (heating systems, water heaters, etc.). Have an approved fire extinguisher handy.*
- *Gasoline fuel supply systems are designed to maintain pressure in the system after the engine is turned off. Fuel will be expelled under pressure as fuel lines are disconnected. This can be a fire hazard, especially if the engine is warm. Always wrap a clean shop rag around any fuel line fitting before loosening or disconnecting it.*
- *The fuel and the fuel lines in the PD fuel system can become very hot as a result of heat generated by the extremely high operating pressures. Use caution; there is danger from scalding!*
- *Exercise extreme caution when using spray-type cleaners on a warm engine. Observe all manufacturer recommendations.*
- *Cleanliness is essential when working on any part of the fuel system. Thoroughly clean fuel line unions and hose fittings before disconnecting them. Use only clean tools.*
- *Use only spring-type clamps on fuel hoses. Do not use screw-type hose clamps, they do not expand and contract with engine heat and will leak*
- *Keep removed components clean. Seal or cover them with plastic or paper, especially if the repair cannot be completed immediately. Seal open fuel supply and return lines to prevent contamination.*
- *When replacing parts, install only new, clean components. Always replace seals and O-rings.*

FUEL PUMP TROUBLESHOOTING (GASOLINE ENGINES)

The fuel supply system is an integral part of the operation of the fuel injection system. Problems such as a no-start condition, hesitation, or stalling may be due to poor fuel delivery. The fuel pump itself is not directly monitored as part of the OBD II system, however, the fuel pump relay is monitored and several Diagnostic Trouble Codes (DTCs) are associated with it. In addition, the fuel injection system will try to adjust for poor fuel delivery and the resultant lean running condition may exceed the system's ability to compensate. This will store DTCs in the system memory. Suspected fuel pump problems should first be investigated with an appropriate scan tool such as the Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program. Use of these specialized tools must be in accordance with instructions with the tool by the manufacturer and are outside the scope of this service manual.

Models with an airbag are equipped with a crash fuel shut-off system. It reduces the danger of a fire in a crash by switching the fuel pump off via the fuel pump relay. At the same time this system improves starting of the engine. When the door is opened the fuel pump is activated for 2 seconds to build up pressure in the fuel system.

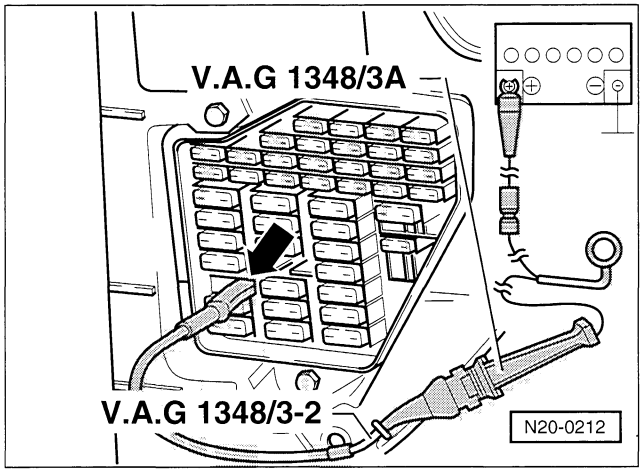
There are some preliminary tests that can be used to determine if the fuel pump or its electrical circuits are causing problems. Some of the tests described below require special test equipment such as a fuel pressure gauge and fittings.

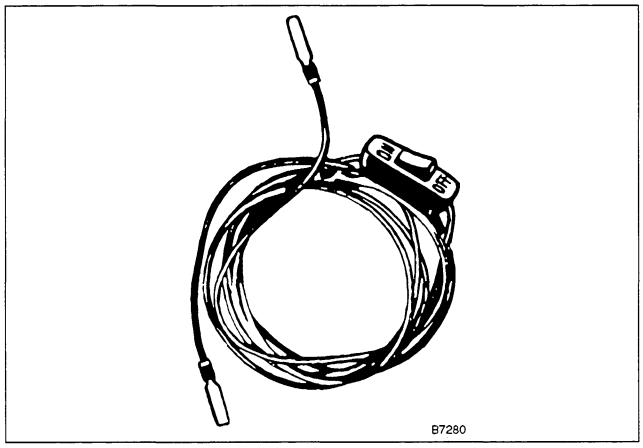
The electrical current that operates the fuel pump is controlled by a relay and protected by a 15-amp fuse. This helps to handle the high current load of the pump and also ensures that the pump will not continue to run in the event of an accident or if the engine stalls. If, for any reason, electric power to run the pump is interrupted, the engine will not run.

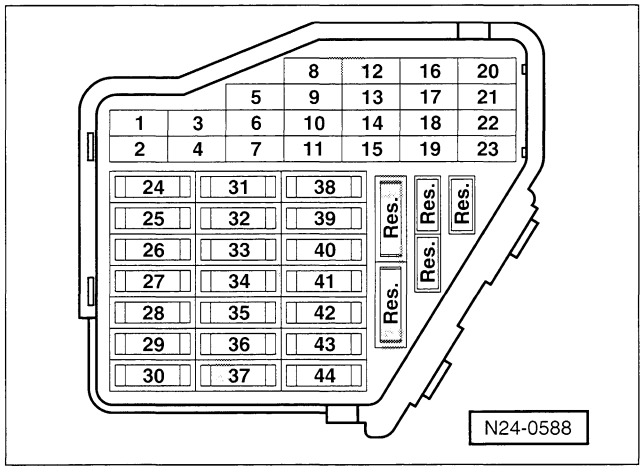
Begin troubleshooting with a simple check of the fuel pump electrical circuit. The pump should run while cranking the engine with the starter. If necessary, remove the floor cover and access plate in the luggage compartment and listen or feel to verify that the fuel pump is running. If the pump does not run, see **Fuel pump, checking electrical circuit**.

> ***WARNING —***
> *In cold weather, water in the fuel may freeze in the pump causing the circuit to overload and the fuse to fail. Be sure to check the fuel pump fuse in the dashboard fuse/relay panel. See* **97 Wiring Diagrams, Fuses and Relays** *for fuse locations.*

If the fuel pump runs, begin troubleshooting with a check of the fuel pump delivery rate as described later in this section. The test will indicate whether further tests are necessary. This is especially important on higher mileage cars, where normal pump wear may decrease delivery volume. Also check for correct pump installation and for a clogged or restricted pump inlet screen.







The electric fuel pump operates only when the car is running or being started. Because many of the fuel pump and fuel injection tests require that the pump be operated with the engine off, the fuel pump relay can be temporarily bypassed during testing.

All tests assume that there is sufficient fuel in the tank. If there is any doubt regarding fuel quantity, add more. The fuel gauge may not indicate true fuel level. Avoid running the fuel pump when the tank is empty.

Fuel pump, operating for testing

The procedure below uses a temporary wiring connection to bypass the fuel pump fuse and run the pump directly from the battery by way of the fuse panel connection.

➤ The preferred method is to use a remote switch such as Volkswagen special tools VAG 1348/3A and VAG 1348/3-2.

➤ You can also accomplish the same thing with a homemade fused jumper wire with flat blade terminals and an in-line switch.

NOTE —

- *A homemade jumper wire with a switch should be at least 1.5mm metric wire size (14 gauge AWG) and, for safety, include a 15-amp in-line fuse.*
- *To avoid damaging the fuse panel sockets, the ends of the jumper wires should be flat-blade connectors that are the same size as the fuse blades.*
- *Connect and disconnect the remote switch or jumper wire only with switch in the off position.*

➤ Remove fuse from position 28 of dashboard fuse panel.

– With the ignition switched off, connect one lead of the fused jumper wire (as shown on previous page) to the rear terminal of the fuse holder number 28.

– Connect the other lead of the fused jumper to the positive terminal of the battery.

– Turn the jumper wire switch on to run the pump.

- If the pump does not run, remove the jumper lead from the rear terminal of fuse holder number 28 and put it in the front terminal.
- If the pump still does not run, the problem is most likely in the wiring to the pump or the pump itself is faulty. See **Fuel pump, checking electrical circuit**.
- If the pump runs only with the jumper connected, the relay, the engine control module (ECM), the circuit wiring or fuse 28 is faulty. See **97 Wiring Diagrams, Fuses and Relays**.

Fuel pump, checking electrical circuit

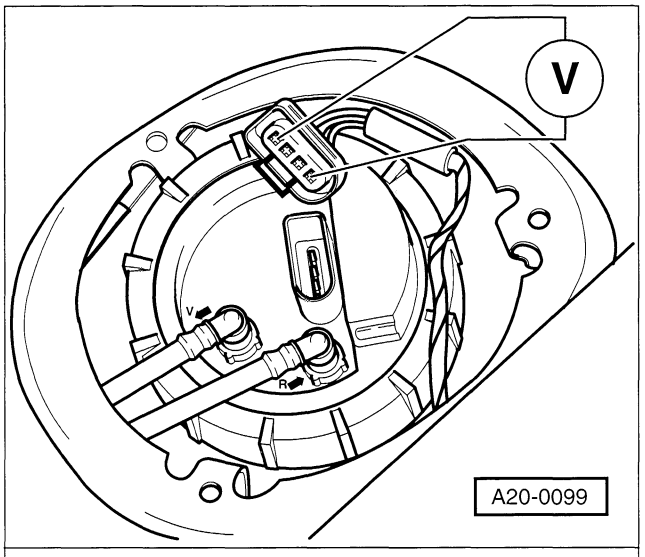
The fuel pump receives power from the fuel pump relay which is energized by the engine control module (ECM). The test given below checks for power at the fuel pump.

– Check that the battery is fully charged and that fuse 28 is good.

– Fold down rear seat, pull back floor cover and remove the access plate to the fuel delivery unit.

– While a helper listens at the fuel pump, turn the ignition key on. The pump may run briefly. If not, turn the key to the start position and crank the engine. If the pump runs, the circuit is probably operating correctly. If the pump does not run, proceed as described below.

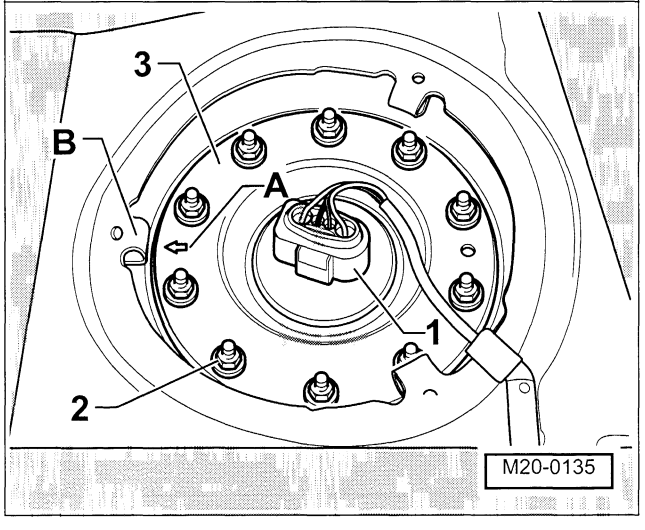
NOTE —
Listen carefully for the pump to run, in operation it is barely audible.



– Remove the fuel pump fuse and run the fuel pump as described in **Fuel pump, operating for testing**.
  - If the pump runs only with the jumper connected, the relay, the engine control module (ECM), the circuit wiring or fuse 28 is faulty. See **97 Wiring Diagrams, Fuses and Relays**.
  - If the pump does not run, leave the jumper connected and continue steps below.

– Disconnect the 4 pin harness connector from the fuel delivery unit.

➤ Check for voltage at the pump harness connector with voltmeter across terminals 1 and 4 (the two outermost terminals). Early and late fuel tank versions are pictured and both are tested in the same way. Disregard callout numbers in lower illustration at this time.



– If voltage is not present at connector, check wiring between dashboard fuse panel and fuel pump harness connector. See **97 Wiring Diagrams, Fuses and Relays**.

– If voltage is present, remove fuel pump and check for open circuits and internal grounds in the delivery unit. If no faults can be found, the fuel pump is probably faulty.

Specification

- Voltage available at fuel pump . . . . . battery voltage minus 2 volts maximum
- Fuel pump amperage (current) draw with engine at idle (all engines except 2.0L BBW) . . . . . .8 amps maximum
- Fuel pump amperage (current) draw with engine at idle (2.0L BBW) . . . . . .9 amps maximum

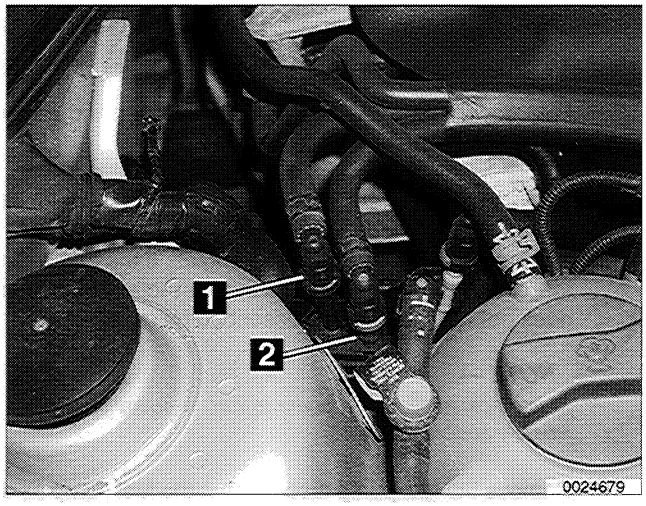
Fuel pump, checking delivery rate

The tests given below are applicable to all 1.8L, 2.0L, and 2.8L, except engine code BBW (see **Fuel pump, checking delivery rate, 2.0L BBW**). All tests require an accurate fuel pressure gauge with a shutoff valve and a range of 0-6 bar (approximately 0-100 psi). Volkswagen special tool VAG 1318 (commonly used with CIS/CIS-E fuel systems) with appropriate adapters, or equivalent, can be used to check fuel delivery rate.

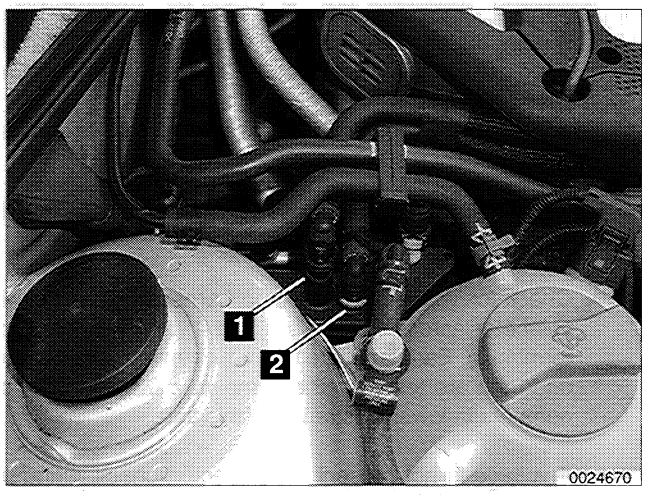
– Connect jumper wire with switch to fuel pump circuit as described earlier in **Fuel pump, operating for testing**.

– Remove the fuel filler cap from the fuel tank.

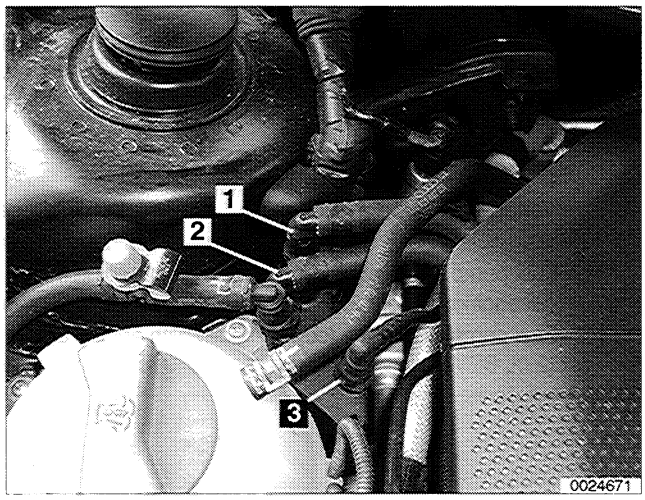
– Working in the engine compartment, disconnect the fuel supply hose from the supply pipe.



For **2.0L** engines (except BBW), separate fuel supply line (**1**) from supply pipe. Fuel may be under pressure; cover connections with a clean shop cloth before disconnecting hoses. Connection (**2**) is fuel return (marked with blue).

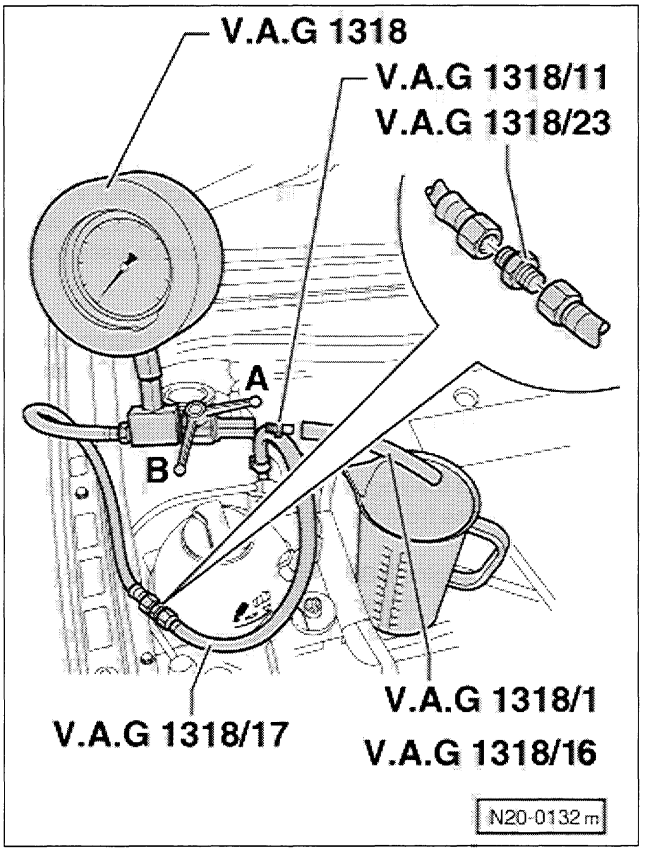


For **1.8L** and **2.8L AFP** engines, separate fuel supply line (**1**) from supply pipe. Fuel may be under pressure; cover connections with a clean shop cloth before disconnecting hoses. Connection (**2**) is fuel return (marked with blue).



For **2.8L BDF** engines, disconnect fuel supply line (**1**) from supply pipe. Press release tabs on hose couplings to remove connecting hoses. Fuel may be under pressure; cover connections with a clean shop cloth before disconnecting hoses. Connection (**2**) is fuel return and connection (**3**) runs to the throttle hosing.

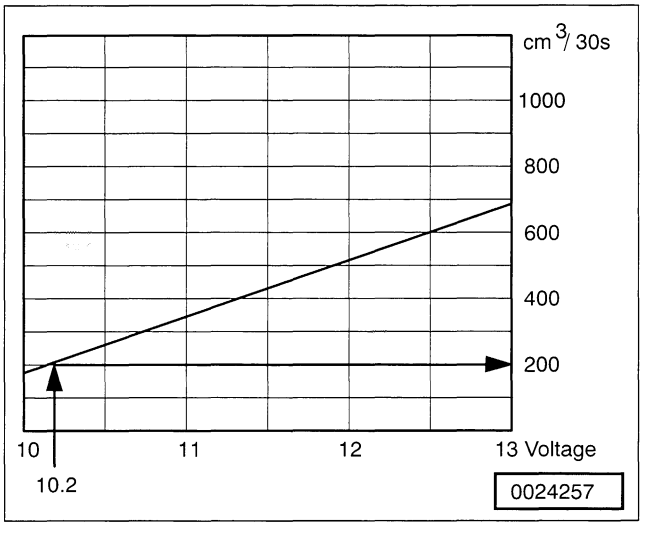
> ***WARNING —***
> *Fire Hazard! Fuel will be expelled under pressure when fuel lines are disconnected. Do not smoke or work near heaters or other fire hazards. Keep a fire extinguisher handy. Cover fuel connections with cloth before disconnecting to prevent excess leakage,*



- Connect fuel pressure gauge (VAG 1318 shown) to supply pipe with appropriate adapters.
- Connect one end of a length of hose to valve side of gauge and place other end into a clean, fuel resistant measurement container with at least 1 liter capacity.
- Open the pressure gauge valve.
- Operate the fuel pump with the jumper wire switch while slowly closing the valve on the gauge until the pressure reads 3 bar (44 psi).
- Without moving the valve, shut off fuel pump and empty the measuring container back into the tank.
- Connect a voltmeter to the battery and record reading.

NOTE —
Fuel pump delivery volume is dependent on the voltage available at pump. For purposes of this test, the factory assumes a 2 volt drop between the battery and pump.

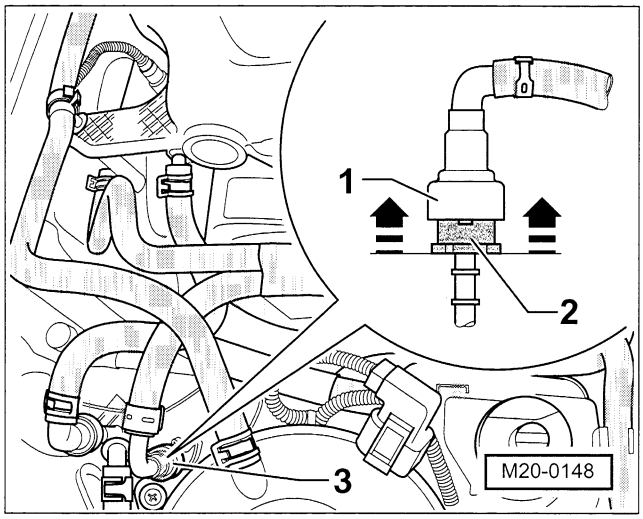
- Operate the fuel pump with the jumper wire switch for 30 seconds and note the voltage reading on the meter.



- Subtract 2 volts from the voltage reading at battery and compare the measured fuel quantity with the graph shown.

NOTE —
The line in the graph in illustration at left represents the minimum quantity of fuel at a given voltage. For example, at battery voltage of 12.2 volts the measured volume was 300 cubic centimeters (cm^3) after 30 seconds. Subtract 2 volts to get 10.2 volts, locate 10.2 volts on the graph and note that the minimum volume for that voltage is approximately 200 cm^3. 300 cm^3 is greater than 200 cm^3 and is therefore within specification.

- If fuel delivery is below specification, check for kinks, blockage or other restrictions in the lines, a blocked or restricted fuel filter or tank strainer, or fuel leakage. If no faults are found, the fuel pump/fuel delivery unit is probably worn or otherwise faulty and should be replaced.
- When testing is completed, empty measuring container back into tank. Remove pressure gauge and jumper wire switch, connect all fuel lines and check for leaks.



Fuel pump, checking delivery rate (2.0L BBW)

The tests given below are applicable to the 2.0L engine code BBW. All tests require an accurate fuel pressure gauge with a shutoff valve and a range of 0-6 bar (approximately 0-100 psi). Volkswagen special tool VAG 1318 (commonly used with CIS/CIS-E fuel systems) with appropriate adapters, or equivalent, can be used to check fuel delivery rate.

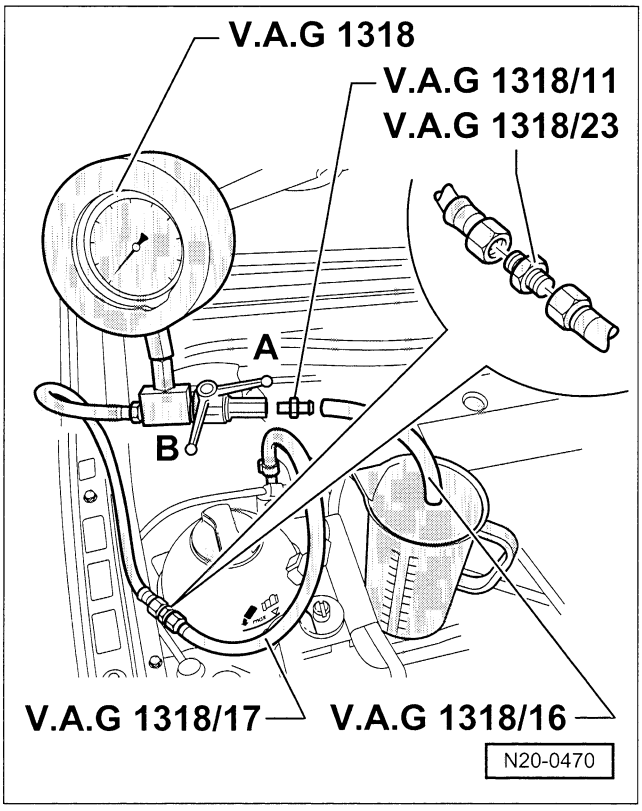
– Connect jumper wire with switch to fuel pump circuit as described earlier in **Fuel pump, operating for testing**.

– Remove the fuel filler cap from the fuel tank.

– Working in the engine compartment, disconnect the fuel supply hose from the supply pipe.

➢ For **2.0L** engine **BBW**, separate fuel supply line (**3**) from supply pipe. To remove, slide locking ring (**2**) into (**arrows**) union (**1**). Fuel may be under pressure; cover connections with a clean shop cloth before disconnecting hoses.

> ***WARNING —***
> *Fire Hazard! Fuel will be expelled under pressure when fuel lines are disconnected. Do not smoke or work near heaters or other fire hazards. Keep a fire extinguisher handy. Cover fuel connections with cloth before disconnecting to prevent excess leakage,*



➢ Connect fuel pressure gauge (VAG 1318 shown) to supply pipe with appropriate adapters.

– Connect one end of a length of hose to valve side of gauge and place other end into a clean, fuel resistant measurement container with at least 1 liter capacity.

– Open the pressure gauge valve.

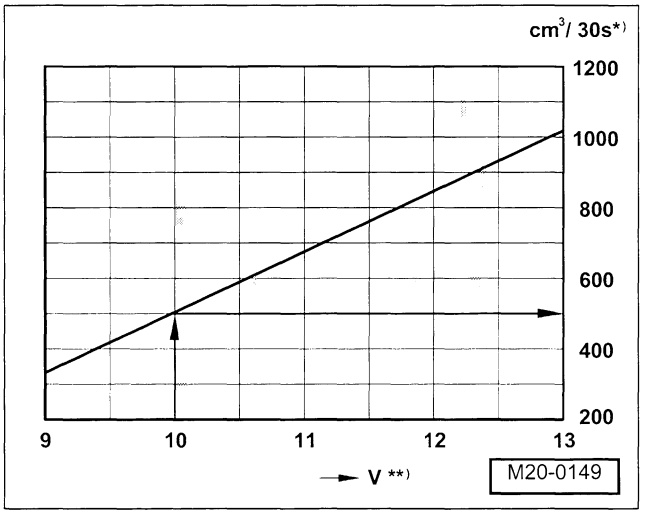
– Operate the fuel pump with the jumper wire switch while slowly closing the valve on the gauge until the pressure reads 3 bar (44 psi).

– Without moving the valve, shut off fuel pump and empty the measuring container back into the tank.

– Connect a voltmeter to the battery and record reading.

> ***NOTE —***
> *Fuel pump delivery volume is dependent on the voltage available at pump. For purposes of this test, the factory assumes a 2 volt drop between the battery and pump.*

– Operate the fuel pump with the jumper wire switch for 30 seconds and note the voltage reading on the meter.



➤ Subtract 2 volts from the voltage reading at battery and compare the measured fuel quantity with the graph shown.

NOTE —

The line in the graph in illustration at left represents the minimum quantity of fuel at a given voltage. For example, at battery voltage of 12.0 volts the measured volume was 500 cubic centimeters (cm^3) after 30 seconds. Subtract 2 volts to get 10.0 volts, locate 10.0 volts on the graph and note that the minimum volume for that voltage is approximately 500 cm^3. 500 cm^3 is the minimum and any quantity greater than 500 cm^3 (as shown) is therefore within specification.

** - centimeters per 30 seconds*

*** - Voltage*

– If fuel delivery is below specification, check fuel pressure regulator. If fuel pressure regulator is OK, check fuel filter and supply lines for kinks, blockage or other restrictions.

NOTE —

Most fuel system components for 2.0L BBW engine are inside the fuel tank. This includes the fuel pump assembly, fuel filter, and the fuel pressure regulator.

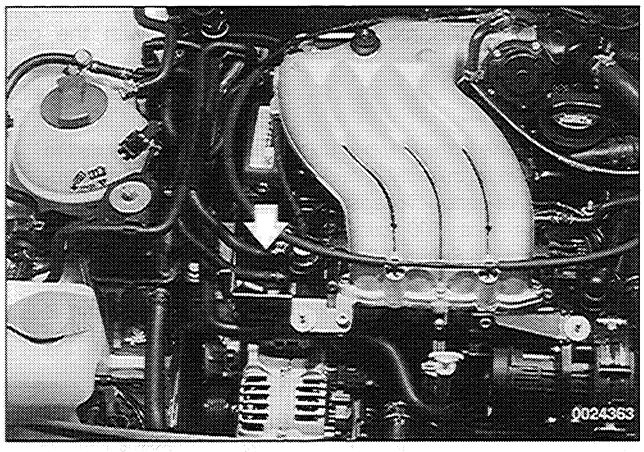
– When testing is completed, empty measuring container back into tank. Remove pressure gauge and jumper wire switch, connect all fuel lines and check for leaks.

Fuel pump, checking system pressures

The tests given below are applicable to all 1.8L, 2.0L, and 2.8L, except engine codes BBW, BEV (see **Fuel pump, checking system pressure, 2.0L BBW, BEV**).

Checking fuel pressure is a fundamental part of troubleshooting and diagnosing the Motronic Engine Management System. Fuel pressure has a direct effect on fuel mixture and driveability. Low fuel pressure may set oxygen sensor-related Diagnostic Trouble Codes (DTC) in the Engine Control Module (ECM) as the system attempts to compensate for low pressure. This test will also check the fuel pressure regulator, the fuel pump check valve and the fuel injectors for internal leaks.

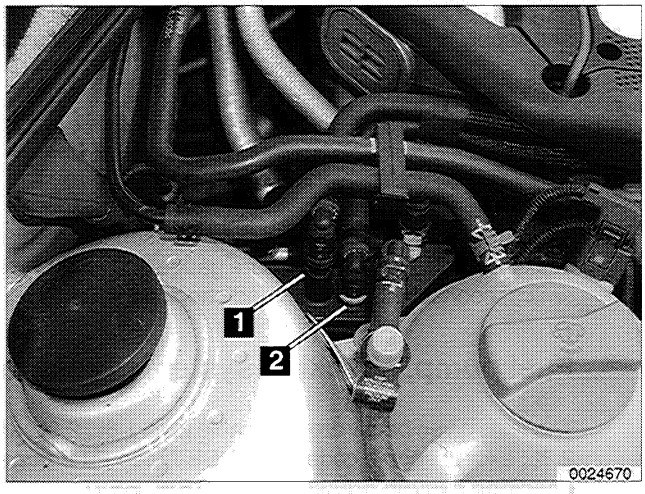
Before making the tests described below, make sure the fuel pump is operating correctly and that the fuel pump delivery rate is within specification as given earlier in this section. The tests given below require an accurate fuel pressure gauge with a range of 0-6 bar (approximately 0-100 psi). Volkswagen special tool VAG 1318 with appropriate adapters, or equivalent, can be used to measure fuel pressure.



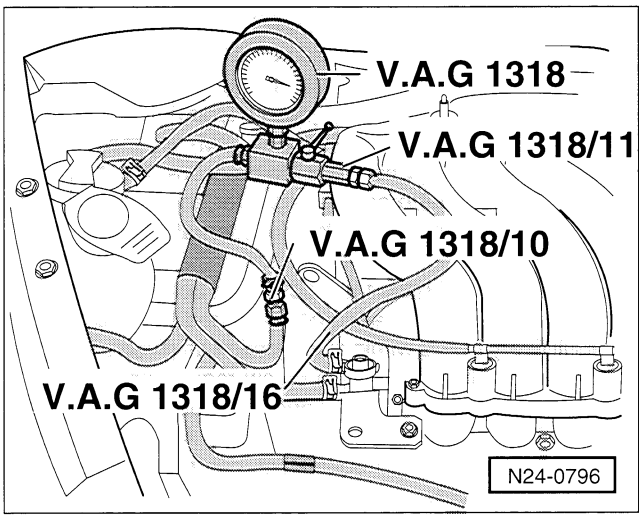
WARNING —
Fire Hazard! Fuel will be expelled under pressure when fuel lines are disconnected. Do not smoke or work near heaters or other fire hazards. Keep a fire extinguisher handy.

– Working in the engine compartment, disconnect the fuel supply hose and catch any leaking fuel with a cloth.

➤ For **2.0L** engine (except BBW), disconnect fuel supply hose (**arrow**).



➤ For **1.8L** or **2.8L** engine, disconnect fuel supply hose (**1**). Connection (**2**) is fuel return (marked with blue).



➤ Connect the fuel pressure gauge (VAG 1318 shown on 2.0L engine) between the fuel line and the fuel rail. Make sure that if the gauge is equipped with a valve, it is in the open position.

– Start the engine, let it run at idle speed and make sure that there are no leaks.

NOTE —
If engine does not start, operate fuel pump with a jumper wire with switch as given earlier in **Fuel pump, operating for testing**.

– Observe fuel pressure on gauge with the engine at idle:

- If system pressure is too high, check for a blocked or restricted fuel line from the fuel pressure regulator. Check the vacuum line to the fuel pressure regulator. If the fuel line has no restrictions and the vacuum line is properly connected, the fuel pressure regulator is probably faulty and should be replaced.
- If system pressure is too low, check for leaks in the fuel supply lines. Also check for restrictions in the fuel supply lines or a clogged fuel filter. If there are no leaks or restrictions, the fuel pressure regulator is probably faulty and should be replaced.

– If fuel pressure is OK, disconnect and plug the small vacuum hose on the fuel pressure regulator and check that the fuel pressure increases as specified.

– If fuel pressure does not increase, check the vacuum hose for kinks, restrictions and proper connections.

Specification

- Fuel pressure at idle. . . . . approx. 2.5 bar (36 psi)
- Fuel pressure (regulator hose disconnected). . . . . approx. 3.0 bar (44 psi)
- Residual pressure (complete system), after 10 minutes . . . . . minimum 2.0 bar (29 psi)

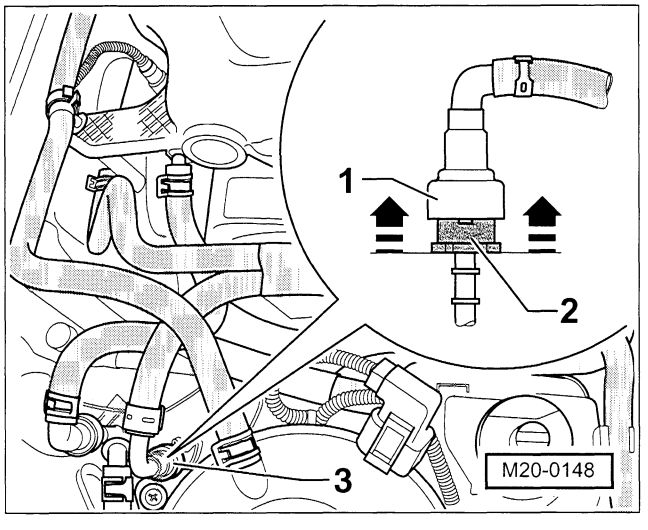
– Switch off engine.

– Check for leaks and residual pressure by observing pressure drop on gauge after 10 minutes.

– If pressure drops below specification, restart engine and let idle. While simultaneously closing valve on the pressure gauge, switch off engine.

– Observe pressure gauge.

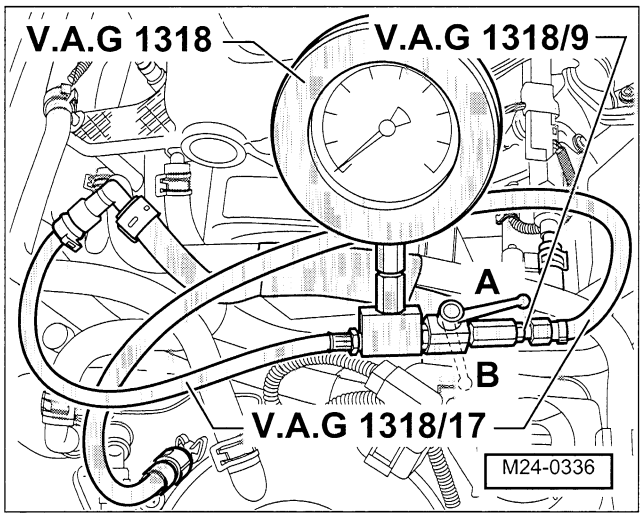
- If pressure drops below 2.5 bar (36 psi), check for leaks in the fuel lines between the gauge and the fuel pump. If no leaks are found, the fuel pump check valve is probably faulty and should be replaced. The check valve is part of the fuel delivery unit which is replaced as a complete unit, see **Fuel delivery unit, removing and installing**.
- If pressure does not drop, clamp off the return fuel line just past the fuel pressure regulator with a suitable clamp and open the valve. If the pressure drops, check for leaks in the fuel injector rail. If no leaks are found, the fuel injectors are probably leaking. Remove the injector rail and inspect the injectors.
- If the pressure does not drop when the valve is opened, remove the clamp from the return line and observe the pressure gauge. If it drops, the check valve in the fuel pressure regulator is faulty and the fuel pressure regulator must be replaced.



Fuel pump, checking system pressures (2.0L BBW, BEV)

For **2.0L** engines **BBW** and **BEV**, separate fuel supply line (**3**) from supply pipe. To remove, slide locking ring (**2**) into (arrows) union (**1**). Fuel may be under pressure; cover connections with a clean shop cloth before disconnecting hoses.

WARNING —
Fire Hazard! Fuel will be expelled under pressure when fuel lines are disconnected. Do not smoke or work near heaters or other fire hazards. Keep a fire extinguisher handy. Cover fuel connections with cloth before disconnecting to prevent excess leakage,



➢ Connect fuel pressure gauge (VAG 1318 shown) in supply line with appropriate adapters as shown. There is no return line in this type of system.

– Open the pressure gauge valve (position **A**). Handle points in direction of flow.

– Start engine and allow to run at idle speed.

– Observe fuel pressure and compare to specification.

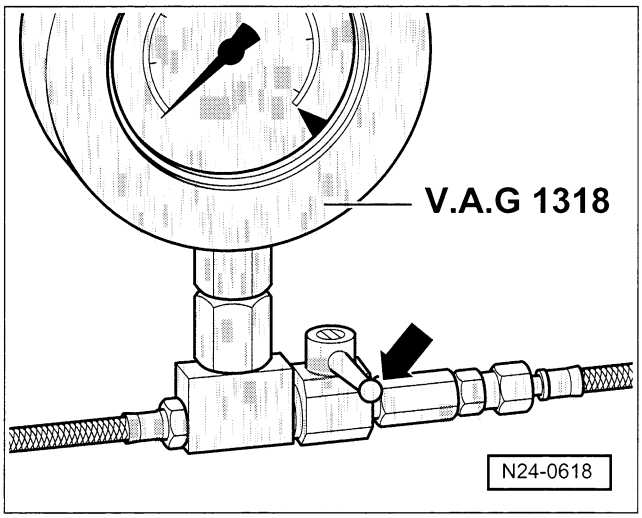
Specification

- Fuel pressure at idle. . . . . approx. 4 bar (58 psi)
- Residual pressure (complete system), after 10 minutes . . . . . minimum 2.0 bar (29 psi)

– Switch off engine.

– Check for leaks and residual pressure by observing pressure drop on gauge after 10 minutes. Pressure must read at least 2 bar (29 psi).

– If pressure drops below specification, start engine and allow to run at idle speed.



➢ Switch off engine while at the same time closing gauge valve (**arrow**).

– Observe gauge reading. If gauge was installed with valve on the engine side, and pressure drops, there is a leak between the tank and the valve. If gauge was installed with valve on the tank side of the system, and pressure drops, there is a leak on the engine side of the system.

WARNING —

Fire Hazard! Fuel will be expelled under pressure when fuel lines are disconnected. Do not smoke or work near heaters or other fire hazards. Keep a fire extinguisher handy. Cover fuel connections with cloth before disconnecting to prevent excess leakage,

FUEL PUMP (FUEL DELIVERY UNIT)

The fuel delivery unit is mounted in the top of the tank and retained by a threaded retaining ring for all engines engines except BBW. BBW engines use a mounting plate bolted into the top of the fuel tank. For gasoline engine cars, the fuel delivery unit includes the fuel pump, the fuel gauge sending unit and the fuel pump check valve.

NOTE —
The procedure given below also applies to removing and installing the fuel gauge sensor on diesel engines.

Fuel delivery unit, removing/installing

The procedures given below are applicable to all 1.8L, 2.0L, and 2.8L, except engine code BBW (see **Fuel delivery unit, removing and installing, 2.0L BBW**).

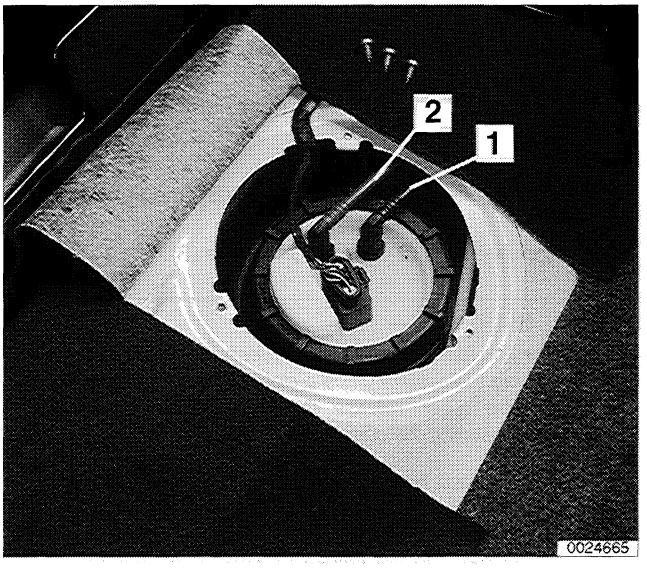
NOTE —
Fuel tank must be no more than ½ full for this procedure on these engines.

– With the ignition switched off, disconnect the negative (-) battery cable.

NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.

– Fold rear seat bottom out of way, pull back floor cover and remove the access plate to the fuel delivery unit.

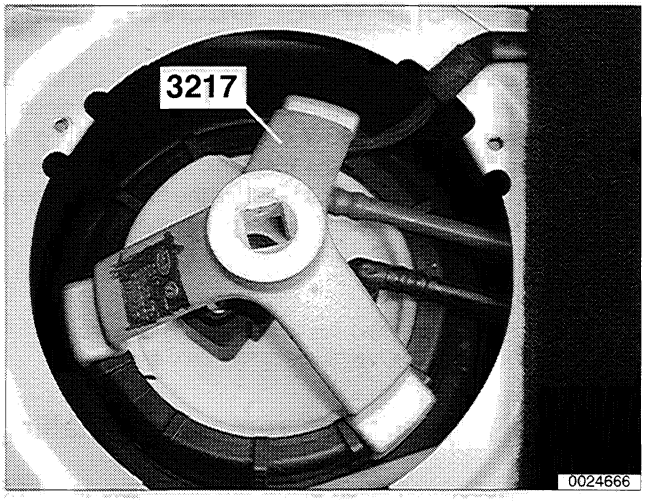
– Disconnect the 4-pin harness connector from the fuel delivery unit.



➤ Disconnect the fuel supply and return lines and wrap with a cloth to prevent fuel spillage.

- Fuel supply line (**1**) is identified with black markings, fuel pump return line (**2**) is identified with blue markings. Alignment marks (small arrows on sending unit and tank) must match during re-assembly. AEG engine shown, others similar.

> ***WARNING —***
> *Fuel will be discharged and dangerous fuel vapors will be present. Work in a well ventilated area. Do not disconnect wires that could cause sparks. Do not smoke or work near heaters or other fire hazards. Keep a fire extinguisher handy.*



➢ Unscrew and remove fuel delivery unit retaining ring using VW special tool 3217, or equivalent.

– Carefully lift fuel delivery unit from tank. Empty fuel delivery unit into a suitable container once it is removed.

– Installation is reverse of removal noting the following:

- Inspect and clean intake screen as needed.
- Do not bend fuel gauge sending unit arm.
- Inspect fuel tank seal and replace if damaged or distorted. Moisten the seal with fuel when installing.

NOTE —

• Note the installed position of the fuel delivery unit; alignment marks on the fuel delivery unit must align with alignment marks on the tank as shown in illustration A20-0096 above.

• Check for leaks before installing access plate.

Fuel delivery unit, removing/installing (2.0L BBW)

The procedures given below are applicable to engine code BBW.

NOTE —

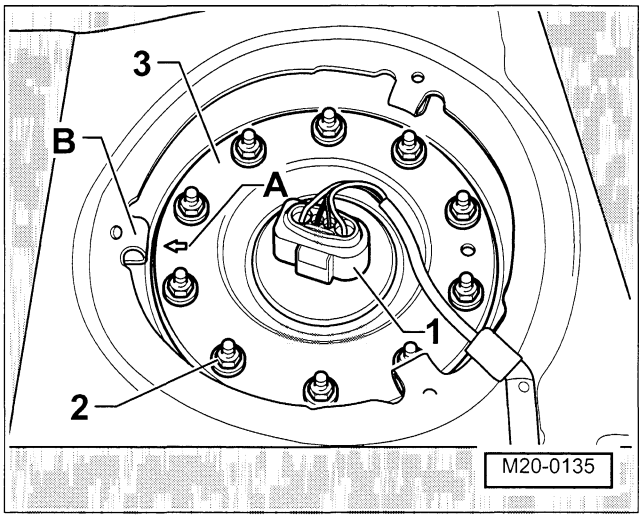
Fuel tank must be empty for this procedure on this engine. Do not drain via the filler neck; damage can result.

– With the ignition switched off, disconnect the negative (-) battery cable.

NOTE —

Be sure to have the anti-theft radio code on hand before disconnecting the battery.

– Fold rear seat bottom out of way, pull back floor cover and remove the access plate to the fuel delivery unit.



➢ Disconnect the 4-pin harness connector (**1**) from the flange.

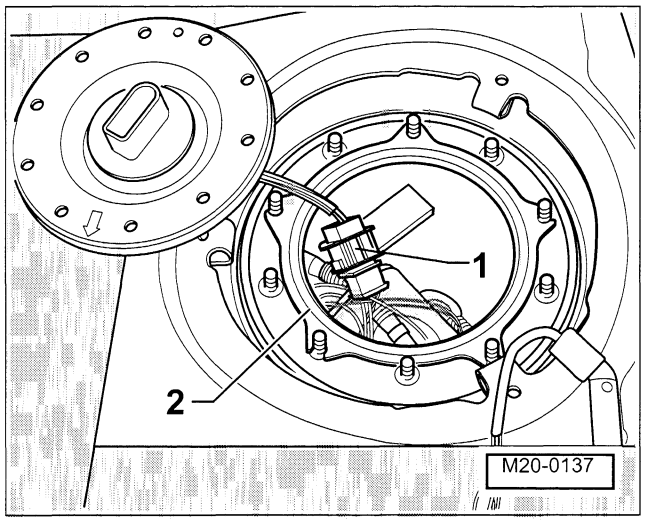
– Note alignment marks on body (**B**) and flange (**A**).

– Remove nuts (**2**) and lift off flange (**3**).

WARNING —

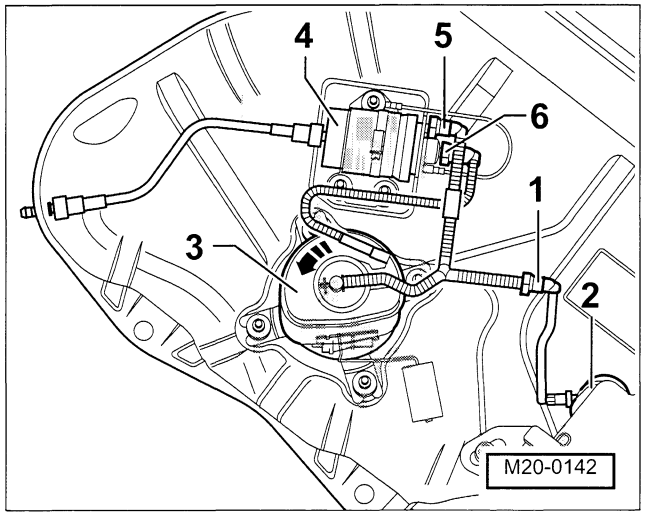
• The fuel system is under pressure! Before opening the system place a cloth around the connection. Then release the pressure by carefully loosening the connection.

• Fuel will be discharged and dangerous fuel vapors will be present. Work in a well ventilated area. Do not disconnect wires that could cause sparks. Do not smoke or work near heaters or other fire hazards. Keep a fire extinguisher handy.



- Disconnect the harness connector (**1**) from the fuel delivery unit.
- Remove seal (**2**).
- Drain any remaining fuel using a suitable, safe container.

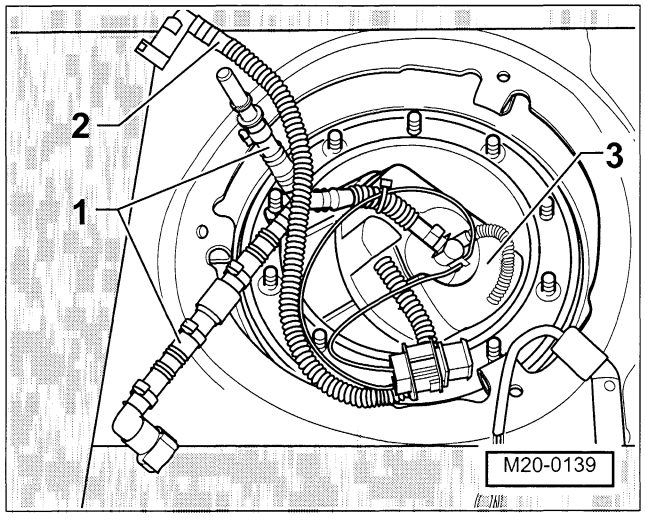
NOTE —
For ease of illustration, the fuel tank upper shell is not shown in the following illustrations. The components are shown simplified.



- Separate connector (**1**) on wiring to suction jet pump (**2**) by pressing in safety ring on connector.
- Turn fuel delivery unit (**3**) in counter-clockwise direction (**arrow**, approximately 45°), take it out of bayonet joint and place to side.

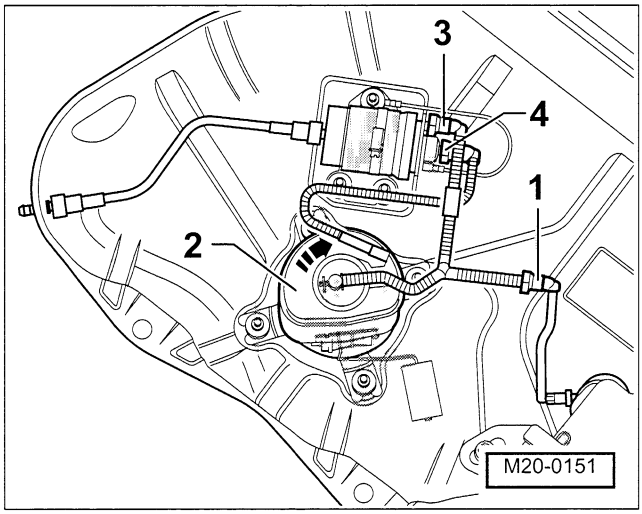
NOTE —
Observe that the strainer filter and the fuel gauge sender are not damaged.

- Remove fuel return hose (**6**) first from fuel filter and then supply hose (**5**).



- Disconnect fuel supply (**1**) and return (**2**) lines. Position lines so that they are above the delivery unit, outside of the access hole in the body. Carefully remove fuel delivery unit (**3**) up through access hole.

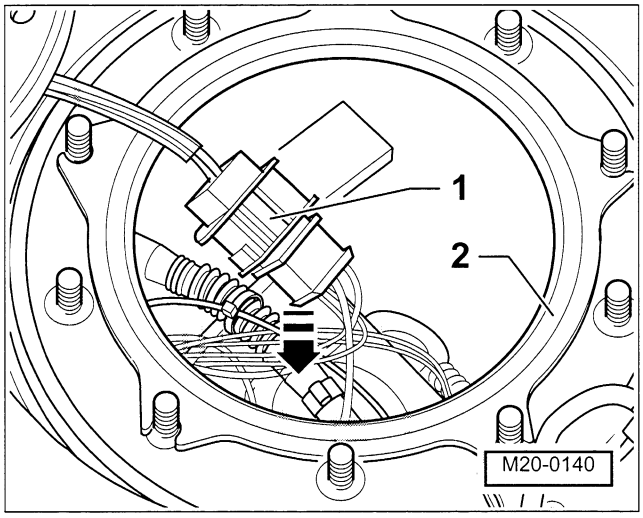
NOTE —
- *When removing the fuel delivery unit, use care to avoid damage to the fuel gauge sending unit.*
- *When removing the fuel delivery unit, use care to avoid damage to both ends of the fuel supply and return lines.*
- *If the fuel delivery unit is to be replaced then drain the old fuel delivery unit before disposal.*



➤ Install fuel delivery unit. Connect suction jet (**1**), return hose (**6**) and supply hose (**5**).

NOTE —
The supply and return hose connectors must audibly engage. Check and ensure correct seating!

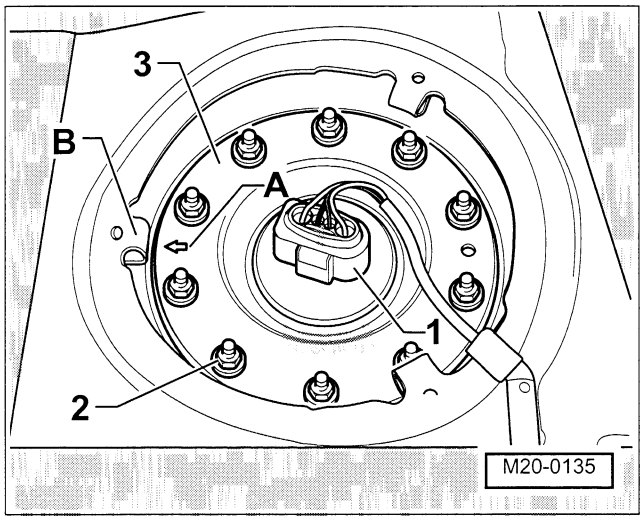
– Fully turn fuel delivery unit (**2**) to the right (**arrow**) in the bayonet joint against the stop.



➤ Install new seal (**2**) with bulge facing into fuel tank.

– Place connector (**1**) in direction of arrow against fuel gauge sender behind fuel supply unit.

NOTE —
The working area of the fuel gauge float must not be restricted.



➤ Install flange (**3**) so that arrow (**A**) is parallel to vehicle longitudinal axle and faces backward (**B**).

– Tighten nuts (**2**) in a diagonal sequence.

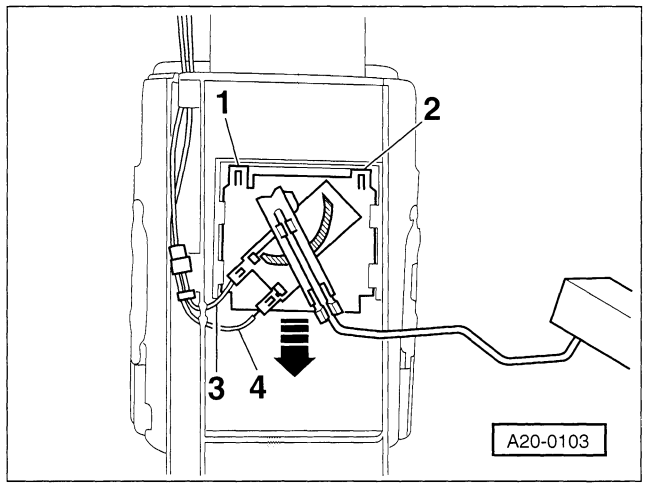
Tightening torque
• Flange to fuel tank . . . . . 7 Nm (62 in-lb)

– Connect 4-pin connector (**1**) on flange.

– Perform procedure following interruption of voltage supply, see **27 Engine Electrical.**

Fuel gauge sensor, removing and installing

The fuel gauge sensor is part of the fuel delivery unit on gasoline engines and can be replaced as a separate component. On diesel engines the fuel gauge sensor (only) is installed in the top of the fuel tank instead of a fuel delivery unit.



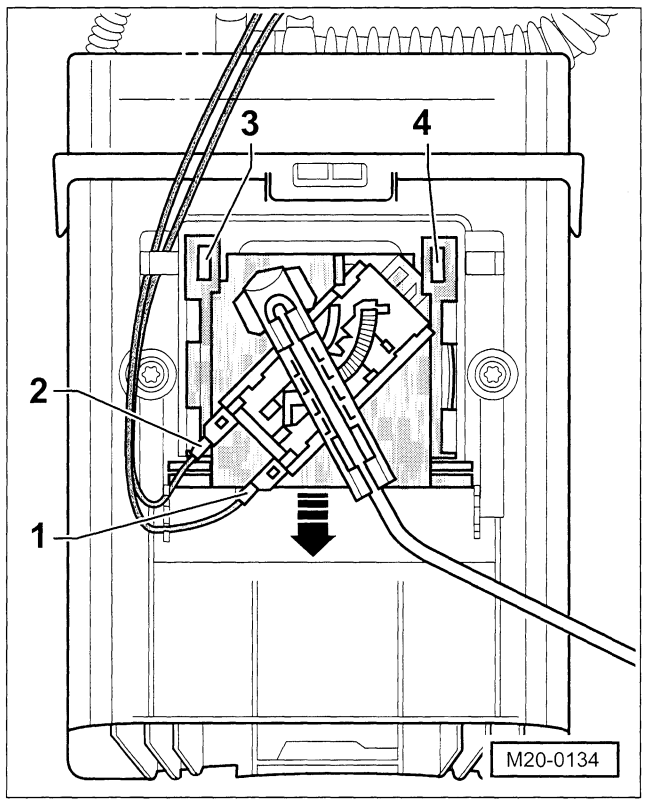
– Remove the fuel delivery unit as described previously.

➤ Release locking tabs and remove electrical sender wires (**3** and **4**) from fuel gauge sensor.

– Lift retaining tabs (**1** and **2**) with a screwdriver and remove fuel gauge sensor downward (**arrow**).

– Installation is the reverse of removal.

Fuel gauge sensor, removing and installing (2.0L BBW)



– Remove the fuel delivery unit as described previously.

➤ Release locking tabs and remove electrical sender wires (**1** and **2**) from fuel gauge sensor.

– Lift retaining tabs (**3** and **4**) with a small screwdriver and remove fuel gauge sensor downward (**arrow**).

– Install by inserting sender into guides on delivery unit and push up until positive engagement is felt.

– Connect wires (**1** blue) and (**2** black).

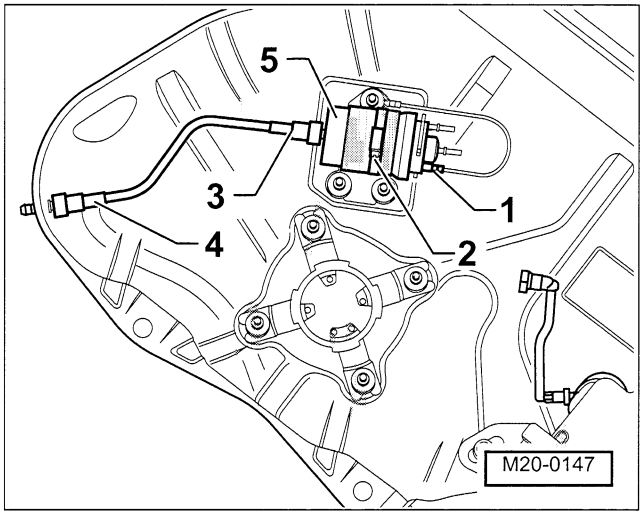
– Install fuel delivery unit.

– Balance of installation is the reverse of removal.

Fuel filter, replacing (2.0L BBW)

NOTE —
Fuel filter replacement for most engines is covered in **0 Maintenance**. *Due to the location of the fuel filter on vehicles with the 2.0L BBW engine, replacement is covered here.*

The BBW engine has the fuel filter located in the fuel tank. Replacement requires removal of the fuel delivery unit.



– Remove the fuel delivery unit as described previously.

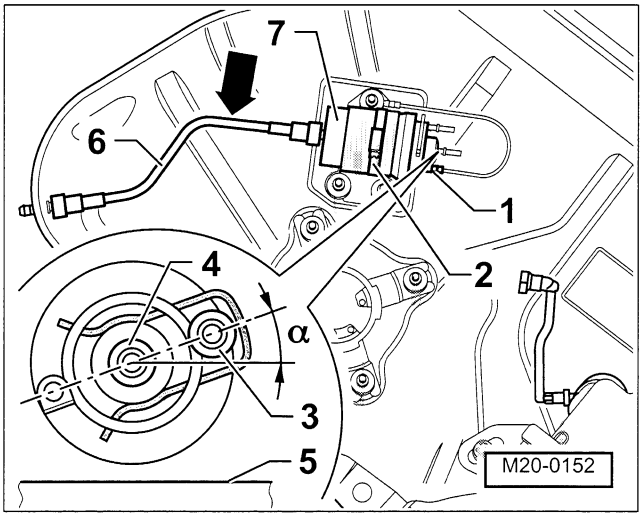
NOTE —
For ease of illustration, the fuel tank upper shell is not shown in the following illustrations. The components are shown simplified.

➢ Disconnect grounding strap (**1**).

– Disconnect supply hose from either connection (3) or (4) (depending upon accessibility) by pressing in locking ring on connector.

– Loosen hold down clamp (**2**) and remove fuel filter (**5**) to side.

– Transfer fuel pressure regulator to new filter.



➢ Position new fuel filter in the tank as shown in inset

- α - approximately 20°
- (**3**) - Supply line
- (**4**) - Return line
- (**5**) - Fuel tank
- (**6**) - Fuel supply line. Note installed position. Long straight section (**arrow**) must be at filter end.
- (**7**) - Fuel filter

Tightening torque
- Clamp to fuel tank (**2**). . . . . 3 Nm (27 in-lb)

– Connect supply line (**6**) to fuel tank union or fuel filter.

– Install grounding strap (**1**)

– Install fuel delivery unit.

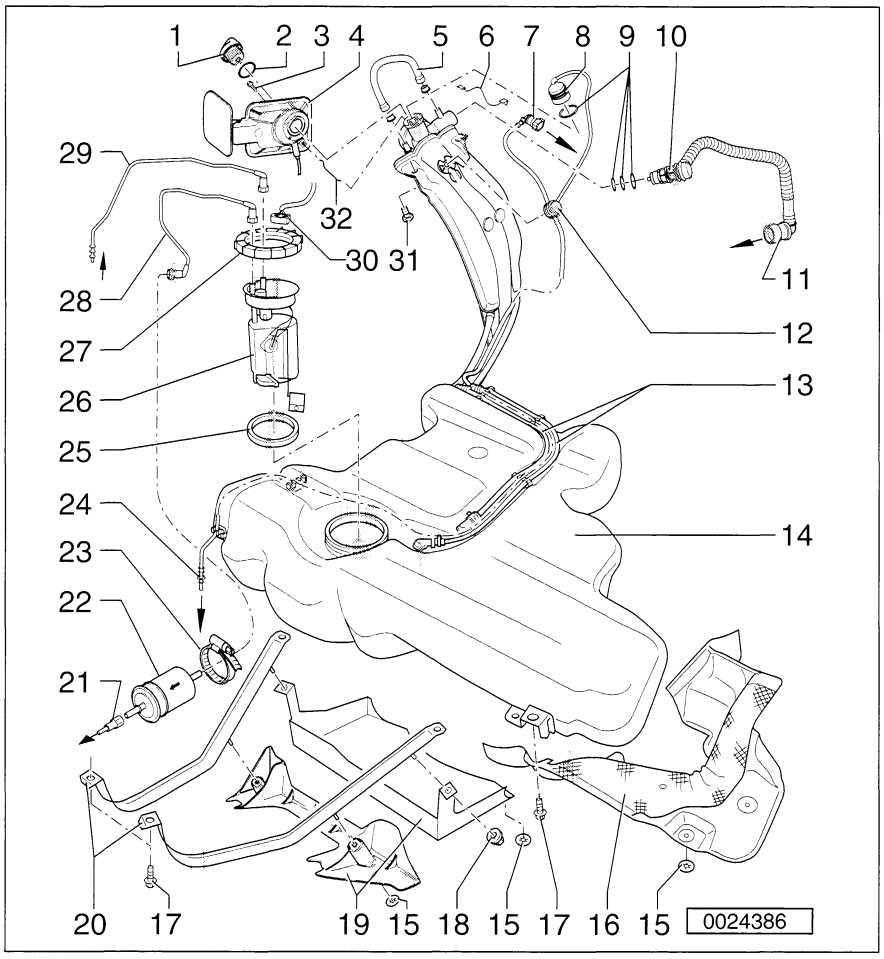
– Balance of installation is the reverse of removal

NOTE —
The supply and return hose connectors must audibly engage. Check and ensure correct seating!

FUEL TANK AND LINES

Fuel tanks for all gasoline and diesel engines are constructed of molded plastic with details shown in the following illustrations. 1.8L and 2.0L systems, with the exception of the 2.0L BBW, are similar. See **Fuel tank assembly (gasoline engine, 2.0L BBW)**

Fuel tank assembly (gasoline engines)



1. **Fuel tank cap**
   - Secured with retaining strap from m.y. 2000
2. **Seal**
   - Replace if damaged
3. **Screw**
4. **Fuel filler door assembly**
   - Shape and configuration varies with model
5. **Vent line (black)**
6. **Ground connection wire**
   - Ensure tight connection
7. **Vent line (white)**
   - To activated carbon canister
8. **Gravity/overflow valve**
   - Removing: pull up out of mount
   - Check valve for flow: valve vertical: OPEN valve tilted 45°: CLOSED
9. **O-ring**
   - Replace if damaged
10. **Change-over valve**
    - Removing: unclip from side of filler neck
    - Before installing, remove fuel tank cap (item 1)
    - See, **Change-over valve, checking**
11. **Vent line (black)**
    - Ensure it is securely seated
    - To EVAP canister
12. **Pressure retention valve**
    - For fuel reservoir ventilation
    - See **Pressure retention valve, checking**
13. **Vent line (black)**
    - Ensure secure seating
14. **Fuel tank**
    - When removing, support with an appropriate engine/transmission jack
15. **Clamping washer**
16. **Heat shield**
    - For fuel tank
17. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
18. **Nut, self-locking**
    - Tighten to 2 Nm (18 in-lb)
19. **Fuel tank cover**
20. **Mounting straps**
    - Note differing lengths
    - Attaching points (holes) point in direction of travel
21. **Supply line (black)**
    - To fuel rail
    - Ensure secure seating
22. **Fuel filter**
    - Installed position: arrow points in direction of flow
23. **Screw clamp**
    - Ensure that screw head of clamp has at least 5mm (3/16 in.) of clearance from fuel tank
    - See **Fuel filter clamp, installed position**
24. **Vent line (white)**
    - Clipped onto top of fuel tank
    - With EVAP canister purge regulator valve (N80)
    - Ensure secure seating
25. **Sealing ring**
    - Replace if damaged
    - Coat with fuel after installing into fuel tank
26. **Fuel delivery unit**
    - Note installed position on fuel tank
    - Clean strainer if dirty
27. **Retaining ring**
    - Tighten to 75 Nm (55 ft-lb)
    - Remove and install using 3217

(Continued)

Fuel tank assembly (gasoline engines) (continued)

28. Supply line (black)
- To connection marked **V**
- Clipped to side of fuel tank
- Ensure secure seating
- To fuel filter

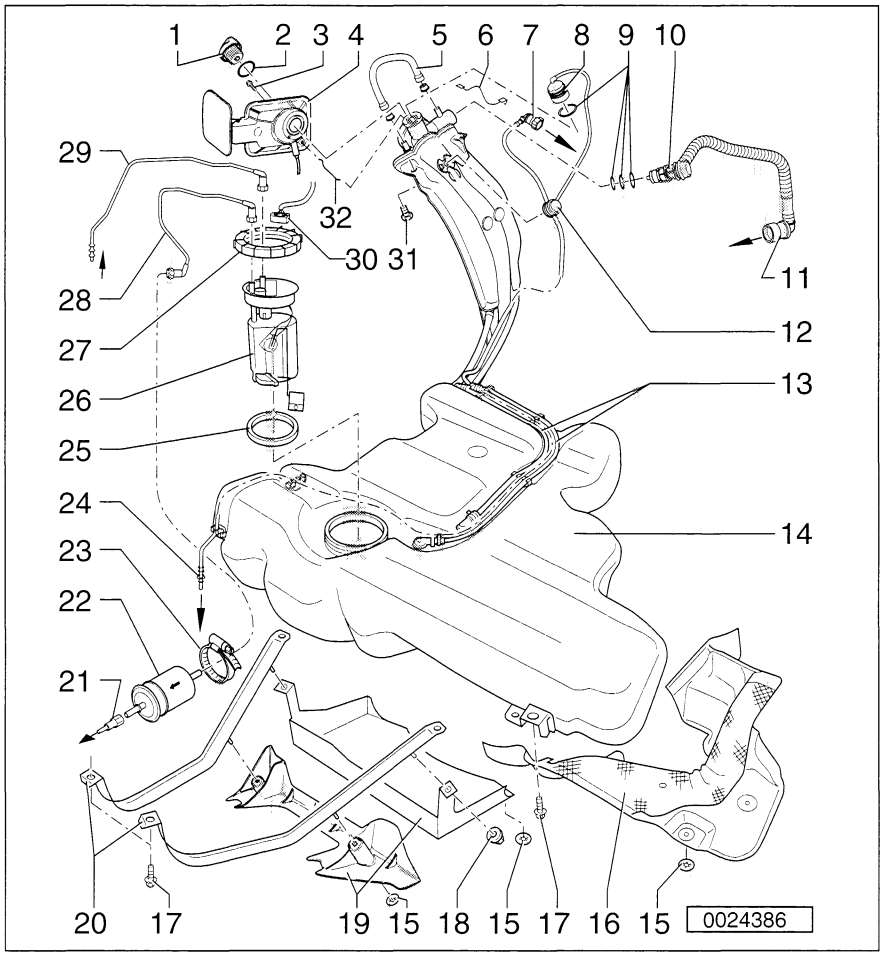
29. Return line (blue or blue marked)
- To connection marked **R**
- Clipped to side of fuel tank
- Ensure secure seating
- From fuel rail

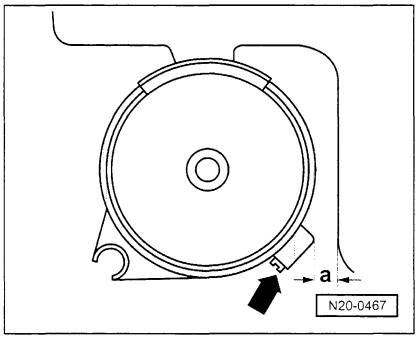
30. Connector
- Black, 4-pin

31. Bolt
- Tighten to 10 Nm (7 ft-lb)

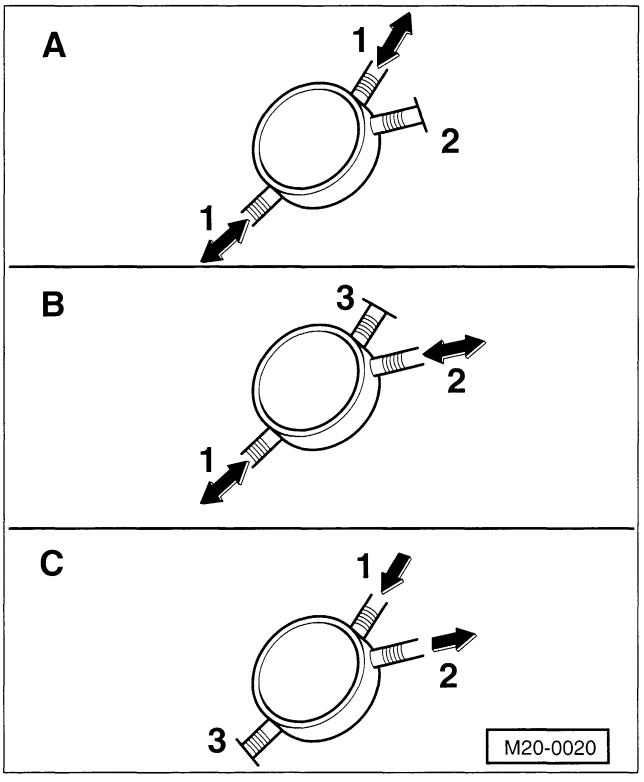
32. Grounding strap
- Not included with replacement tank
- Insert lower end (with bend tab) through hole in ground tab in fuel filler neck. Slide down in until reaching hooked end of strap. Bend ground tab down to secure in fuel filler neck.

WARNING —
- *If working on a lift or hoist be sure to support the front of the vehicle before removing the fuel tank. The sudden removal of the fuel tank and associated components can unbalance the vehicle sufficiently to cause the vehicle to fall.*
- *When removing or installing fuel tank, the tank should be as empty as possible for easier handling.*
- *When removing or installing fuel tank,, support with an appropriate engine/transmission jack.*





Fuel filter clamp, installed position
- Illustration shows the fuel filter as seen from the front.
- Install screw-type clamp (**arrow**) as shown.
- Ensure sufficient distance between clamping screw cover and fuel tank.
- Dimension "**a**" must be at least 5 mm (3/16 in.) between clamp and tank.



Pressure retention valve, checking

Check the valve for flow in various directions:

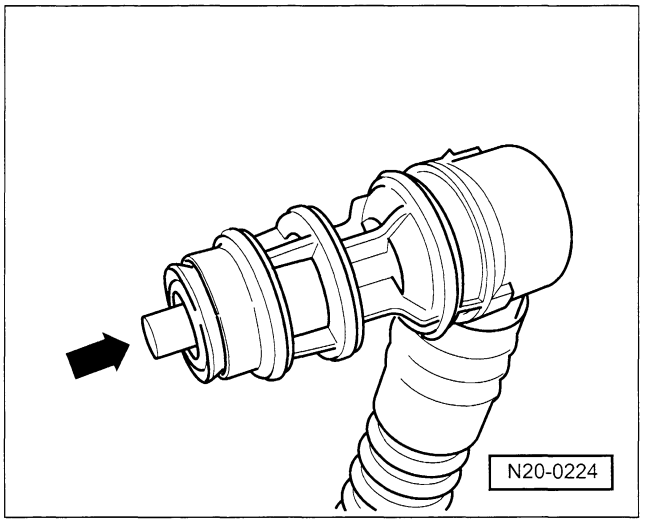
A. Orifices 1 and 1, flow in both directions when port 2 is closed

B. Orifices 2 and 1, flow in both directions when port 3 is closed

C. Orifices 1 and 2, flow in one directions when port 3 is closed

NOTE —

*The valve will close when there is vacuum at opening **1**.*

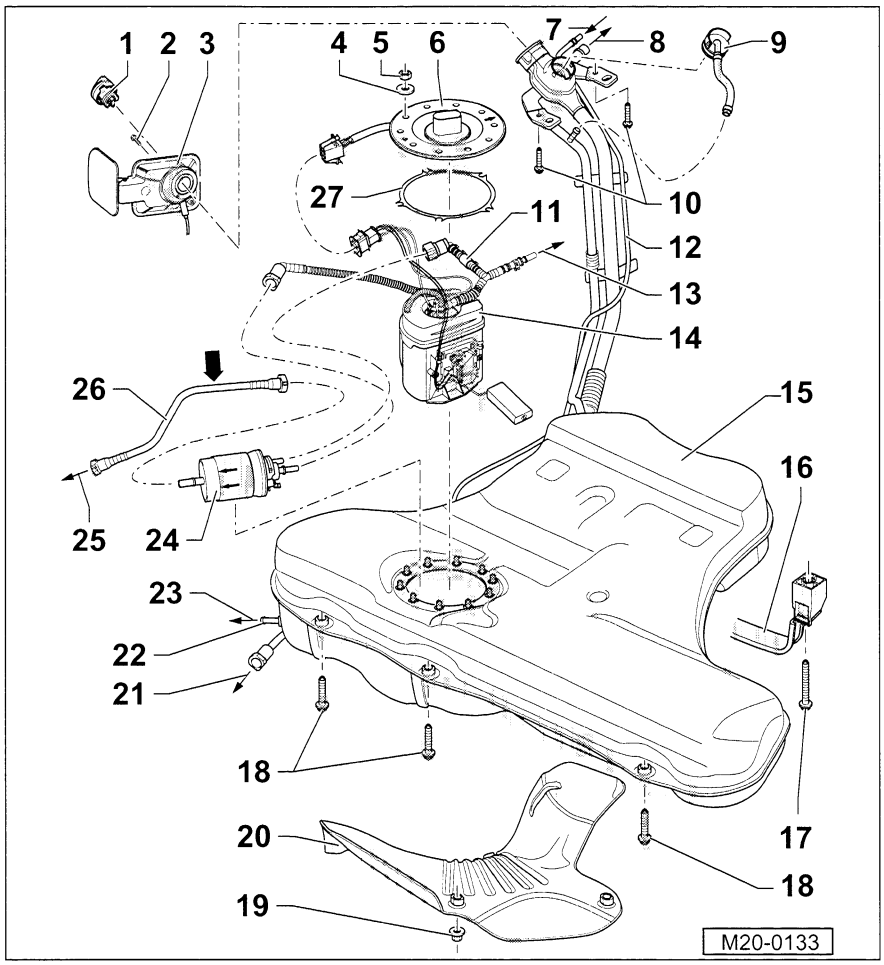


Change-over valve, checking

Remove valve to test.

- Plunger in at-rest position: valve closed.
- Plunger pushed in: valve open.
- Remove filler cap before re-installing change-over valve.

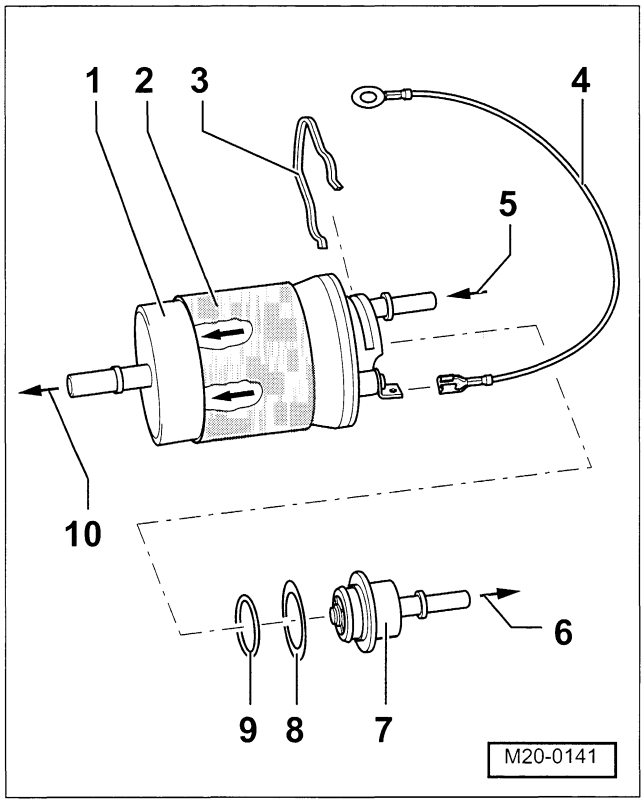
Fuel tank assembly (gasoline engine, 2.0L BBW)



1. **Fuel tank cap**
   - Secured with retaining strap from m.y. 2000
2. **Screw**
3. **Fuel filler door assembly**
   - Shape and configuration varies with model
4. **Washer**
5. **Nut**
   - Tighten to 10 Nm (7 ft-lb)
6. **Fuel tank flange**
   - Observe installation position, see **Fuel tank flange, installed position**
7. **Vapor flow**
   - From evaporative emissions (EVAP) canister
8. **Vapor flow**
   - To evaporative emissions (EVAP) canister
9. **Check valve**
   - Remove fuel tank for access
   - Depress locking tabs to remove
   - Must have a passageway in direction of filler neck
10. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
11. **Fuel pump check valve**
12. **Vent line (white)**
    - Clipped onto side of fuel tank
    - To EVAP canister purge regulator valve (N80)
    - Ensure secure seating
13. **Fuel flow**
    - To suction jet pump in fuel tank
    - Suction jet pump enables access to full tank capacity
14. **Fuel delivery unit**
    - Note installed position on fuel tank
    - Clean strainer if dirty
    - Bleed system after replacement
15. **Fuel tank**
    - When removing, support with an appropriate engine/transmission jack
16. **Mounting straps**
    - With rubber insulators and spacers
17. **Bolt**
    - Tighten to 20 Nm (15 ft-lb) + ¼ turn (90°) further
    - Always replace
18. **Bolt**
    - Tighten to 20 Nm (15 ft-lb) + ¼ turn (90°) further
    - Always replace
19. **Nut**
    - Tighten to 3 Nm (27 in-lb)
20. **Heat shield**
    - For fuel tank
21. **Vapor flow**
    - To EVAP canister purge regulator valve (N80)
22. **Connection**
    - Union to fuel supply line
23. **Fuel flow**
    - To fuel rail
24. **Fuel filter**
    - Installed position: arrow points in direction of flow
    - Installed in fuel tank
    - With attached fuel pressure regulator
    - Bleed system after replacement
    - See **Fuel filter with fuel pressure regulator**
25. **Connection (inside fuel tank)**
    - To fuel outlet
26. **Supply line (black, inside fuel tank)**
    - To fuel rail
    - Ensure secure seating
    - Note installed position, long straight section (**arrow**) must be at filter end.
27. **Seal**
    - Bulge faces into fuel tank
    - Always replace
    - Ensure secure seating

WARNING —

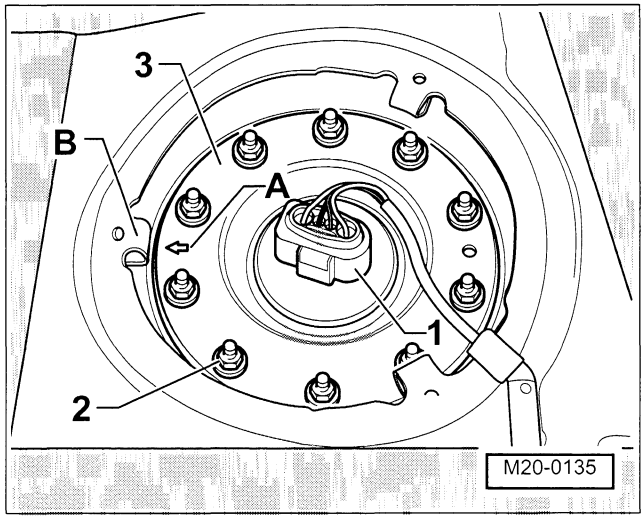
- *If working on a lift or hoist be sure to support the front of the vehicle before removing the fuel tank. The sudden removal of the fuel tank and associated components can unbalance the vehicle sufficiently to cause the vehicle to fall.*
- *When removing or installing fuel tank, the tank should be as empty as possible for easier handling.*
- *When removing or installing fuel tank,, support with an appropriate engine/transmission jack.*



Fuel filter with fuel pressure regulator

All components are located inside the fuel tank.

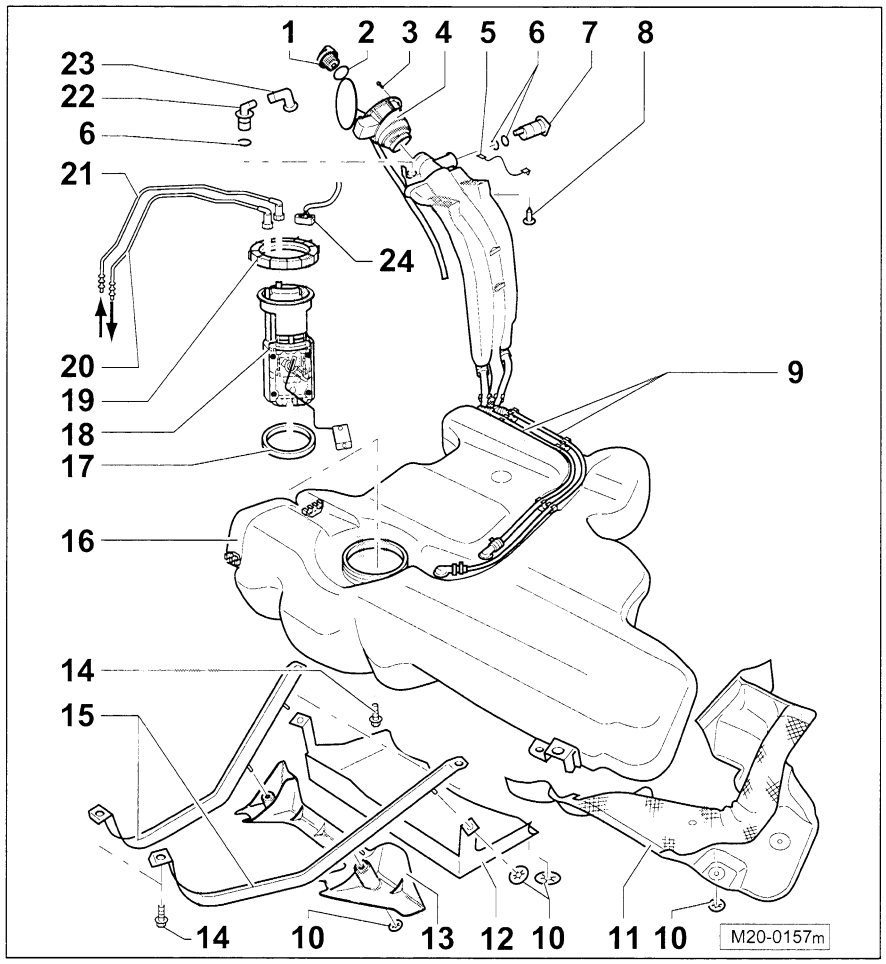
1. **Fuel filter**
   - Arrows point in direction of flow
2. **Rubber insulating sleeve**
   - Insure installation on new fuel filter
3. **Retaining clip**
   - Ensure secure seating
4. **Ground strap**
   - Attached to filter mounting clamp (not shown)
5. **Fuel supply line**
   - From fuel pump
6. **Fuel return line**
   - To fuel pump
7. **Fuel pressure regulator**
   - Transfer to new fuel filter when replacing filter
8. **Seal**
   - Always replace
9. **O-ring**
   - Always replace
10. **Fuel outlet**
    - To connection inside tank for fuel outlet



Fuel tank flange, installed position

Install flange (**3**) so that arrow (**A**) is parallel to vehicle longitudinal axle and faces backward (**B**).

Fuel tank assembly (diesel engine)



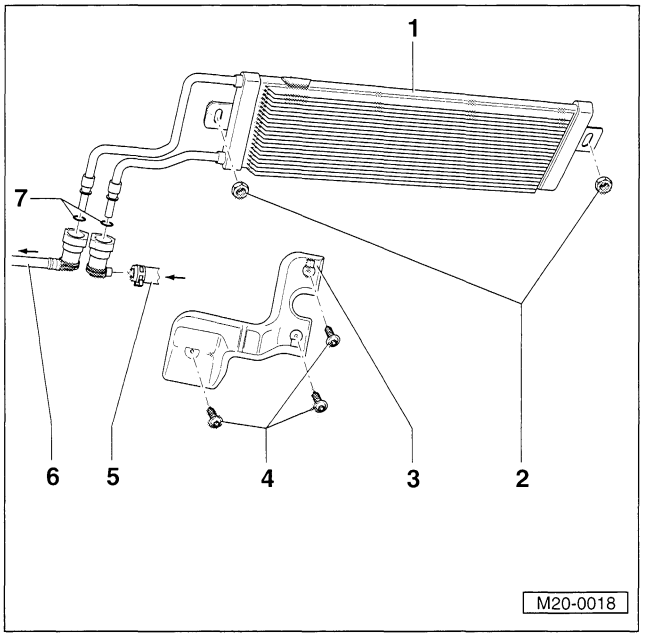
1. **Fuel tank cap**
   - Secured with retaining strap from m.y. 2000
2. **Seal**
   - Replace if damaged
3. **Screw**
4. **Tank flap unit**
   - Shape and configuration varies with model
5. **Ground connection**
   - Ensure tight connection
6. **O-ring**
   - Always replace
7. **Breather valve**
   - To remove: unclip valve from side of filler neck
   - Before installing, remove fuel tank cap (item 1)
   - See **Breather valve, checking**
8. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
9. **Vent line (black)**
   - Secured with spring clamps
   - Clipped onto top of fuel tank
   - Ensure secure seating
10. **Clamping washer**
11. **Heat shield**
    - For fuel tank
12. **Fuel tank cover**
    - Not used on Jetta Wagon
13. **Fuel tank cover**
14. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
15. **Mounting straps**
    - Note differing lengths
    - Note installation position: locator (hole) must point forward
16. **Fuel tank**
    - Support with engine/transmission jack when removing
17. **Sealing ring**
    - Replace if damaged
    - Moisten with fuel when installing
18. **Fuel gauge sending unit**
    - Note installed position on fuel tank
    - Mark on sender must align with mark on fuel tank
19. **Retaining ring**
    - Remove and install using 3217 wrench
20. **Supply line (black)**
    - To connection marked **V**
    - To fuel filter
    - Clipped onto fuel tank
    - Ensure it is securely seated
    - To remove from flange, press down on tabs at connection
21. **Return line (blue or blue marked)**
    - To connection marked **R**
    - Clipped to side of fuel tank
    - Ensure secure seating
    - From fuel filter
    - To remove from flange, press down on tabs at connection
    - Vehicles with automatic transmission are equipped with a fuel cooler, see **Fuel cooler (1.9L TDI with automatic transmission, 1.9L PD TDI with automatic or manual transmission)**
22. **Gravity overflow valve**
    - To remove, unclip upwards out of support
    - Check valve for flow valve vertical: OPEN valve tilted 45°: CLOSED
23. **Angled connector**
24. **Electrical connector**
    - Black, 2-pin
    - Some versions with 4-pin connector

WARNING —

- *If working on a lift or hoist be sure to support the front of the vehicle before removing the fuel tank. The sudden removal of the fuel tank and associated components can unbalance the vehicle sufficiently to cause the vehicle to fall.*
- *When removing or installing fuel tank, the tank should be as empty as possible for easier handling.*
- *When removing or installing fuel tank,, support with an appropriate engine/transmission jack.*

NOTE —

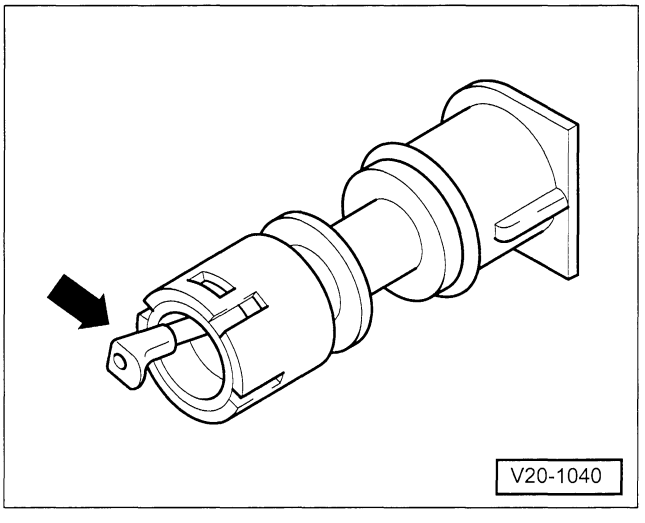
Vehicle equipment and configuration varies depending upon model year and engine code.



Fuel cooler (1.9L TDI with automatic transmission, 1.9L PD TDI with automatic or manual transmission)
(1.9L TDI shown, 1.9L PD TDI is similar)

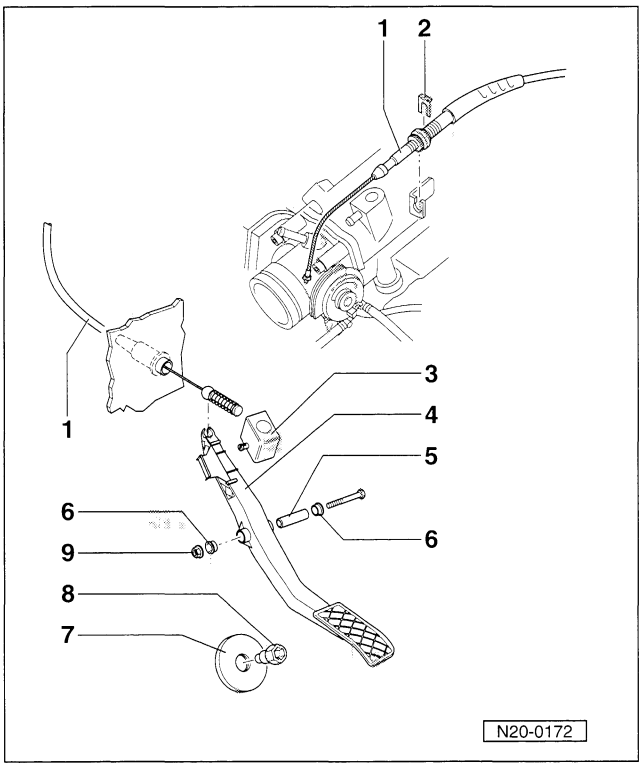
1. **Fuel cooler**
   - Located under vehicle on right side
2. **Nut**
   - Tighten to 20 Nm (15 ft-lb)
3. **Cover**
4. **Bolts**
5. **Return line from fuel filter**
6. **Return line to fuel tank**
7. **O-ring**
   - Always replace

\- **V166 pump (not shown)**
- 1.9L PD TDI only



Breather valve, checking
Remove valve to test.

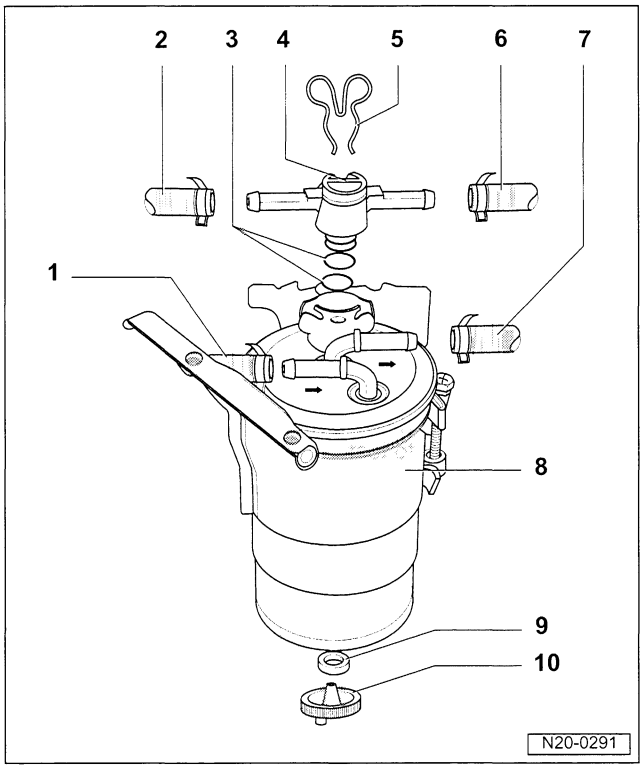
- Plunger (**arrow**) in at-rest position: valve closed.
- Plunger (**arrow**) pushed in: valve open.
- Remove filler cap before re-installing change-over valve.



ADDITIONAL FUEL SYSTEM COMPONENTS

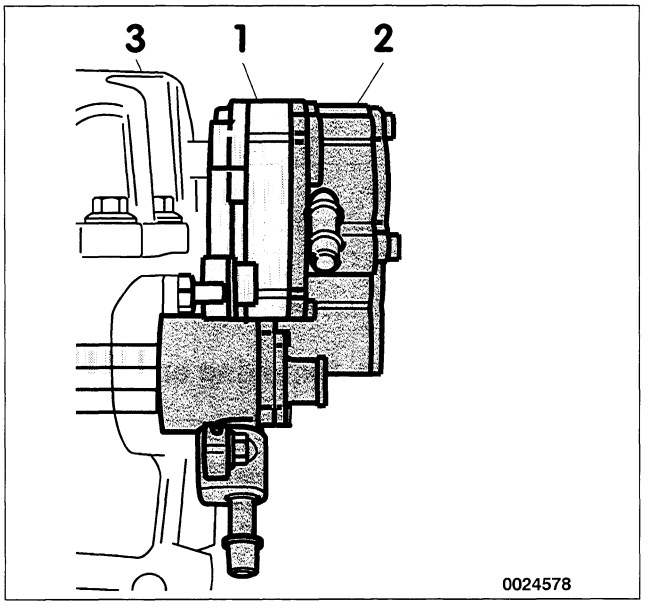
Throttle mechanism (AEG 2.0L engine)

1. **Throttle cable**
   - Never reuse a damaged cable, replace
2. **Retaining clip**
3. **Balance weight**
4. **Throttle pedal**
5. **Spacer sleeve**
6. **Bushing**
7. **Washer**
8. **Stop bolt**
9. **Bolt**
   - Tighten to 20 Nm (15 ft-lb)



Fuel filter assembly (1.9L PD TDI engine)

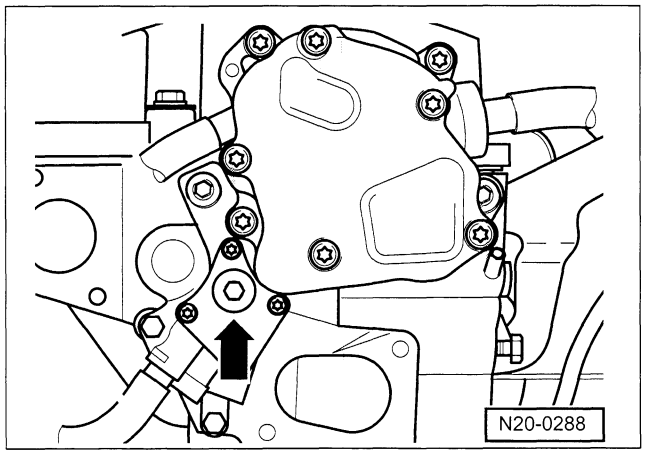
1. **Fuel supply line**
   - From fuel tank
   - White or marked with white
   - Ensure a tight, no-leakage fit
2. **Fuel return line**
   - To fuel cooler
   - Blue or marked with blue
   - Ensure a tight, no-leakage fit
3. **O-ring**
   - Always replace
4. **Regulating (control) valve**
   - Controls fuel temperature
     Temperature greater than 31° C (88° F), no fuel recirculation, fuel returns to tank
     Temperature less than 15° C (59° F), fuel recirculation, fuel returns to filter
   - Installed position: arrow point toward fuel tank
   - When changing fuel filter, unclip from filter and carefully remove with fuel lines still attached
5. **Securing clip**
   - Ensure secure seating
6. **Fuel return line**
   - From tandem pump on cylinder head
   - Ensure a tight, no-leakage fit
7. **Fuel supply line**
   - To tandem pump on cylinder head
   - Ensure a tight, no-leakage fit
8. **Fuel filter**
   - Fill with diesel fuel before installing, facilitates starting
   - Flow direction marked with arrows
   - Do not interchange connections
   - Consult maintenance schedules for replacement intervals
9. **Seal**
   - Replace if damaged
10. **Water drain plug**
    - To bleed, lift off regulating valve (with hoses connected)
    - Loosen plug and allow approximately 100 cc fluid to drain



TANDEM PUMP (1.9L PD TDI)

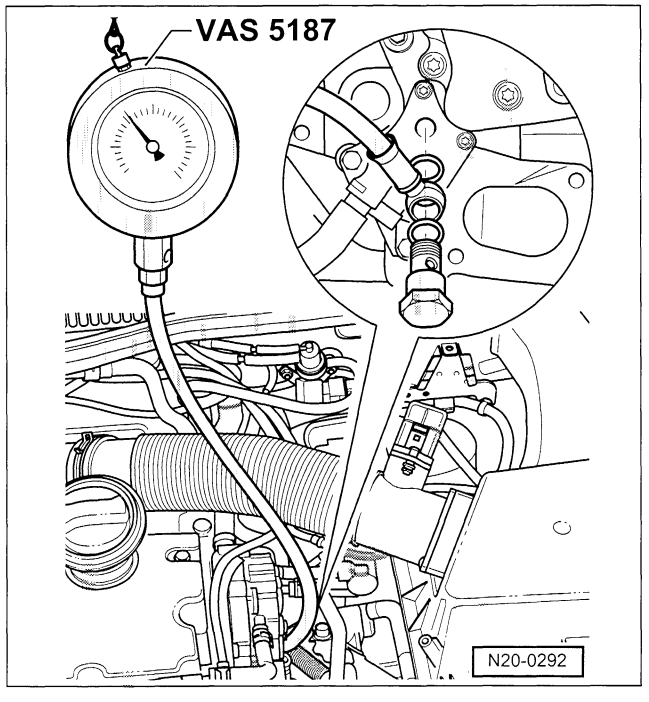
The 1.9L Pumpe Duse TDI engine uses a camshaft-driven fuel pump on the end of the cylinder head to move fuel from the fuel tank to the supply line in the cylinder head. Combined with the fuel pump is a second pump supplying vacuum to the power brake booster and other vehicle systems as needed. These two pumps are collectively known as the tandem pump.

➤ Tandem pump on cylinder head (**3**) consists of two sections, the vacuum pump (**1**) and the fuel pump (**2**).



Tandem pump, checking fuel pressure

➤ Remove sealing plug (**arrow**) on fuel section of tandem pump.



➤ Connect pressure gauge VAS 5187 or equivalent to test port with a banjo bolt and sealing washers as shown (**inset**).

– Start engine and run at idling speed.

– Connect Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program and configure it to read engine speed (RPM). An accurate tachometer can also be used.

– Increase engine speed to 1500 RPM.

– Observe pressure indicated on pressure gauge.

Specification

- Pressure at 1500 RPM. . . . . approx. 3.5 bar (51 psi)

– Switch off engine.

– If the specification is not obtained, replace tandem pump.

– Remove pressure gauge.

– Install sealing plug, with new seal, into test port on tandem pump.

Tightening torque

• Sealing plug on test port . . . . . 25 Nm (18 ft-lb)

– Disconnect and remove scan tool or tachometer.

Tandem pump, removing and installing

WARNING —

• The fuel system is also under pressure! Before opening the system, place cloths around the connection. Then carefully loosen the connection to release the pressure.

• Fuel and fuel vapors will be present during many of the operations described in this repair group. Do not smoke or create sparks. Be aware of pilot lights in gas operated equipment (heating systems, water heaters, etc.). Have an approved fire extinguisher handy.

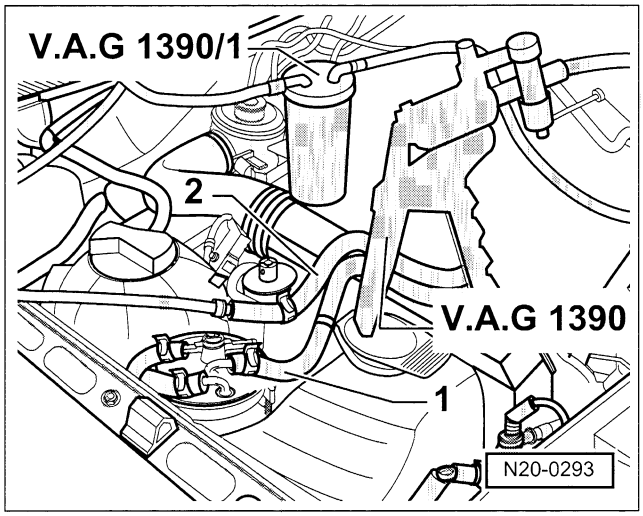
• The fuel and the fuel lines in the PD fuel system can become very hot as a result of heat generated by the extremely high operating pressures. Use caution; there is danger from scalding!

• Keep removed components clean. Seal or cover them with plastic or paper, especially if the repair cannot be completed immediately. Seal open fuel supply and return lines to prevent contamination.

• Wear eye and hand protection when performing any type of repair work on the fuel system!

Before removing the tandem pump, all fuel in the pump and the passages in the cylinder head must be removed. When installing, fuel must be manually pumped into the pump and passages in the reverse procedure.

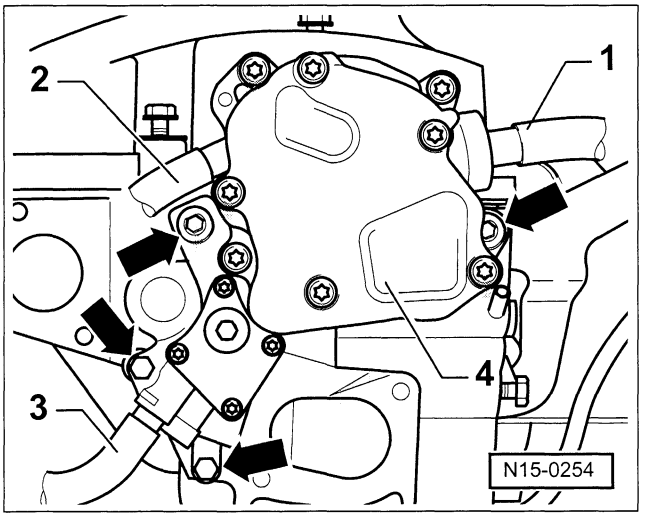
Removing



➤ Disconnect fuel supply hose (**1** marked with white) and fuel return hose (**2** marked with blue) from fuel filter.

– Connect hand operated vacuum pump VAG 1390 or equivalent, with a bleeder container (VAG1390/1 shown) to return hose.

– Operate hand vacuum pump until no more fuel comes out of return hose. Be sure that no fuel is drawn into hand vacuum pump, only into the container.



➢ Disconnect vacuum hose (**1**) for power brake servo from tandem pump (**4**).

– Disconnect fuel supply hose (**2** marked with white) from tandem pump (**4**).

– Remove securing bolts (**arrows**).

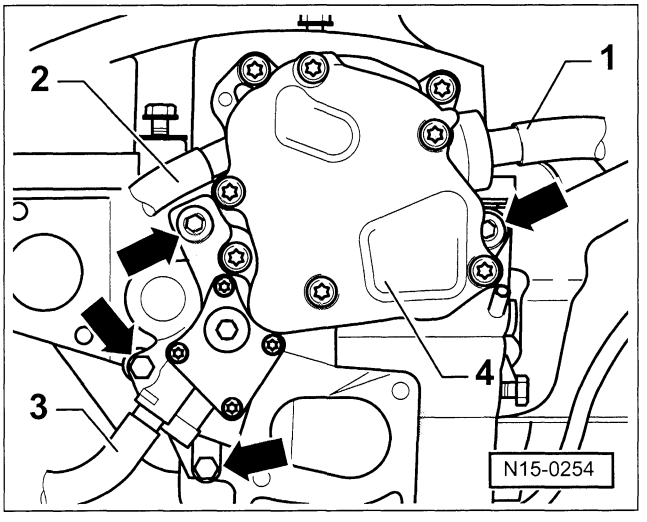
– Pull tandem pump (**4**) slightly upward from cylinder head and disconnect fuel return hose (**3** marked with blue).

– Remove tandem pump (**4**).

Installing

– Installation is performed in the reverse order of removal. When installing, note the following:

- Ensure proper seating of tandem pump coupling in camshaft.
- Always replace tandem pump seals.



➢ Connect return hose (**3** marked with blue) to return connection of tandem pump.

– Install tandem pump and tighten upper securing bolts.

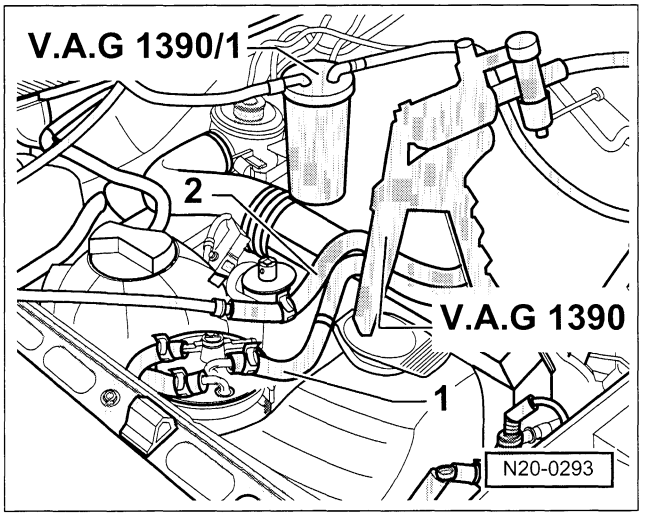
- Tighten to 20 Nm (15 ft-lb)

– Tighten lower securing bolts.

- Tighten to 10 Nm (7 ft-lb)

– Connect supply hose (**2** marked with white) to supply connection of tandem pump.

– Connect vacuum hose (**1**) from brake servo to tandem pump (**4**).



➢ Connect supply hose (**1** marked with white) to fuel filter.

– Connect hand operated vacuum pump VAG 1390 or equivalent, with a bleeder container (VAG1390/1 shown) to return hose to return hose (**2** marked with blue) of fuel filter.

– Operate hand vacuum pump until fuel comes out of return hose. Ensure that no fuel is drawn into hand vacuum pump.

– Connect return hose (**2** marked with blue) to fuel filter.

ELECTRONIC POWER CONTROL (EPC) SYSTEM

The engines covered by this manual, with the exception of the 2.0L AEG engine, use an electronic power control (EPC) system. In the EPC system, commonly known as drive-by-wire, the throttle valve is not operated via a cable from the accelerator pedal, but rather by an electric motor in the throttle valve control module. There is no mechanical connection between the accelerator pedal and the throttle valve.

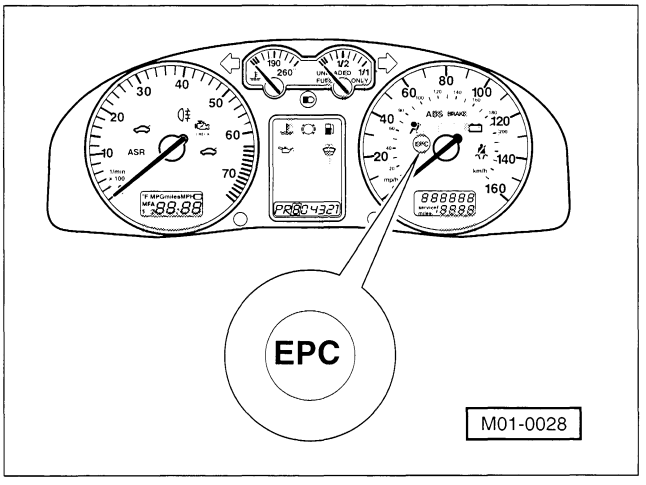
The position of the accelerator pedal is communicated to the engine control module via two sensors for accelerator pedal position (changeable resistances; stored in one housing) that are connected with the accelerator pedal. The position of the accelerator pedal is a main input value for the Engine Control Module (ECM).

Operation of the throttle valve occurs throughout the entire RPM and load range via an electric motor (throttle valve actuator) in the throttle valve control module. The throttle valve is operated by the throttle valve actuator according to the specifications of the ECM.

With the engine at standstill and the ignition switched on, the ECM activates the throttle valve actuator exactly according to the specifications of the accelerator pedal position sensor. For example, if the pedal is depressed halfway, the throttle valve actuator opens the throttle valve and the throttle valve is then opened halfway.

With the engine running (under load), the ECM can open and close the throttle valve independently of the accelerator pedal position sensor. In this way, the throttle valve can already be completely open, even though the accelerator pedal has only been depressed half way. This is advantageous since charging losses at the throttle valve can be avoided.

It would be wrong to assume that EPC consists of only one or two components. EPC is much more of a system containing all components that contribute to determining, regulating and monitoring the throttle valve position (e.g. accelerator pedal position sensor, throttle valve control module, Electronic Power Control (EPC) warning lamp, Engine Control Module).



EPC warning light

A functional check of the EPC warning lamp can be conducted by first switching on the ignition and noting if the EPC warning lamp comes on.

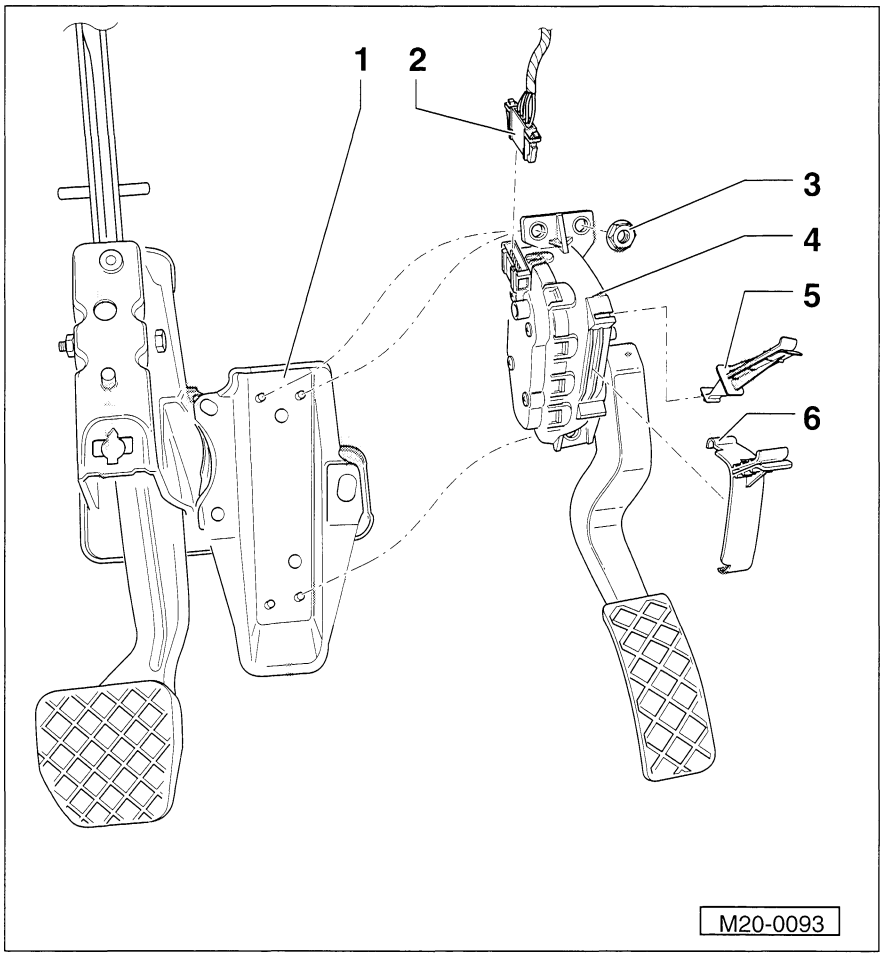
The EPC light should go out once the engine is started and running at idle speed if there are no Diagnostic Trouble Codes (DTCs) relating to the EPC system. Further diagnosis of the EPC warning light involves the use of Volkswagen special tools which is outside the scope of this manual. An assembly view of the electronic throttle pedal is shown on the following page.

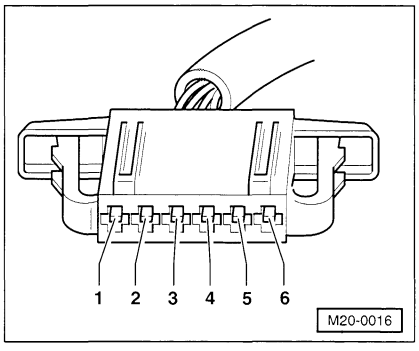
EPC pedal components

NOTE —
Gasoline and diesel engine vehicles are similar.

1. **Pedal bracket**
2. **Connector**
   - For throttle position sensors (G79 and G185)
   - Black, 6-pin
   - See **Throttle position sensor, checking supply voltage**
3. **Nut**
   - Tighten to 10 Nm (7 ft-lb)
4. **Accelerator pedal position sensor (G79)**
   - Not adjustable
   - Communicates the driver's intentions to the control module
   - Remove cover in footwell before removing sensor
5. **Bracket**
   - For cover in footwell
   - From 2002 m.y.
   - Clipped on at accelerator pedal position sensor
6. **Bracket**
   - For cover in footwell
   - Through 2001 m.y.
   - Clipped on at accelerator pedal position sensor

NOTE —
Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*





Throttle position sensor, checking supply voltage

- Disconnect connector and switch ignition on, check voltage between the following terminals:
  terminal 1 and ground
  terminal 1 and 5
  terminal 2 and ground
  terminal 2 and 3
- Specification: 4.5 volts minimum
- Switch ignition off before re-connecting

EVAPORATIVE EMISSIONS (GASOLINE ENGINES)

The gasoline-engined vehicles covered by this manual are equipped with evaporative emissions (EVAP) system monitoring. This system includes the On-board Refueling Vapor Recovery (OVRV) system with a Leak Detection Pump (LDP). Overviews of the OVRV, EVAP and LDP systems for the various gasoline engines are shown on the following pages.

The ORVR system filters fuel vapors through the EVAP canister to prevent these vapors from escaping directly into the atmosphere.

The Engine Control Module (ECM) determines when the appropriate conditions are met and activates the LDP to pump a small amount of air pressure into the fuel tank and lines. The pump runs until a pre-determined pressure or time is reached. If the system does not hold the pressure, a fault or DTC is stored in the ECM memory and the Malfunction indicator Light (MIL) will be illuminated. Often, a DTC is recorded after refueling and the MIL comes on. This is almost always due to the filler cap being inadvertently left off. Proper re-installation of the cap will allow the system to maintain pressure and the MIL will shortly turn off.

Basic troubleshooting should begin with a visual inspection of the evaporative system hoses and components with particular attention paid to the fuel cap and seal. Further testing will require use of a scan tool such as Volkswagen special tool VAG 1551 or VAG 1552.

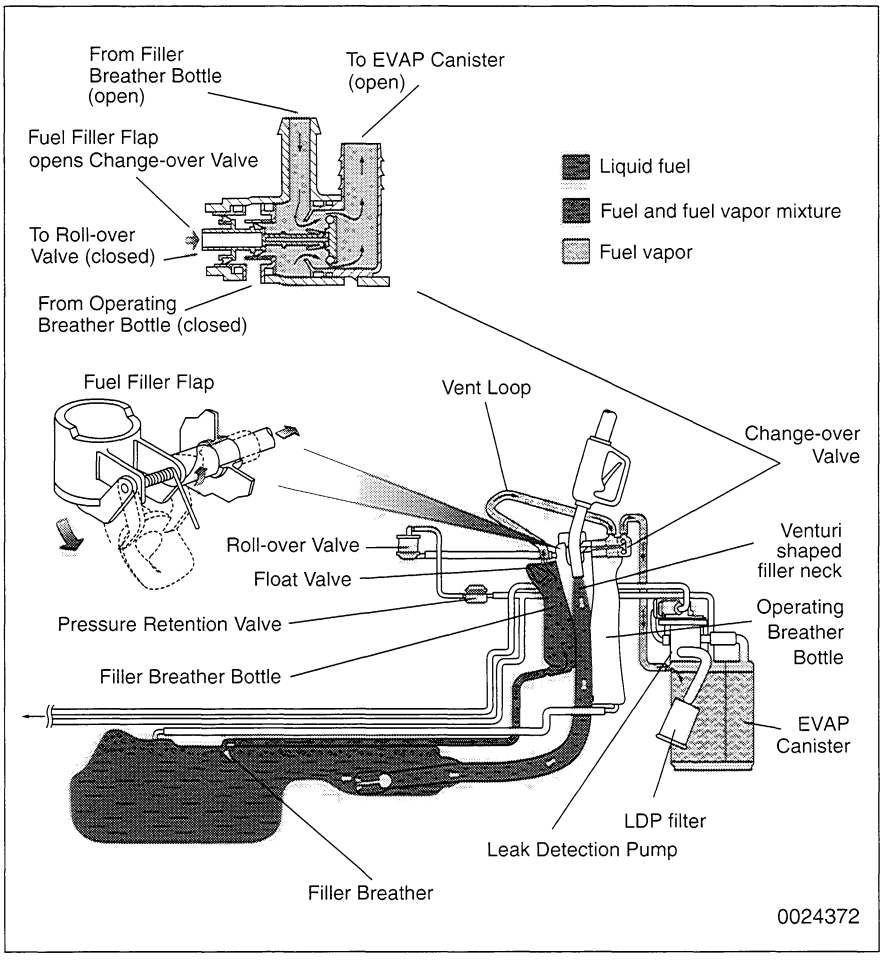
On-board refueling vapor recovery system

When the vehicle is being refueled, the fuel filler flap is opened when the fuel filler nozzle is inserted. The fuel filler flap operates the change-over valve, closing off the operating breather bottle and the vent to the roll-over valve.

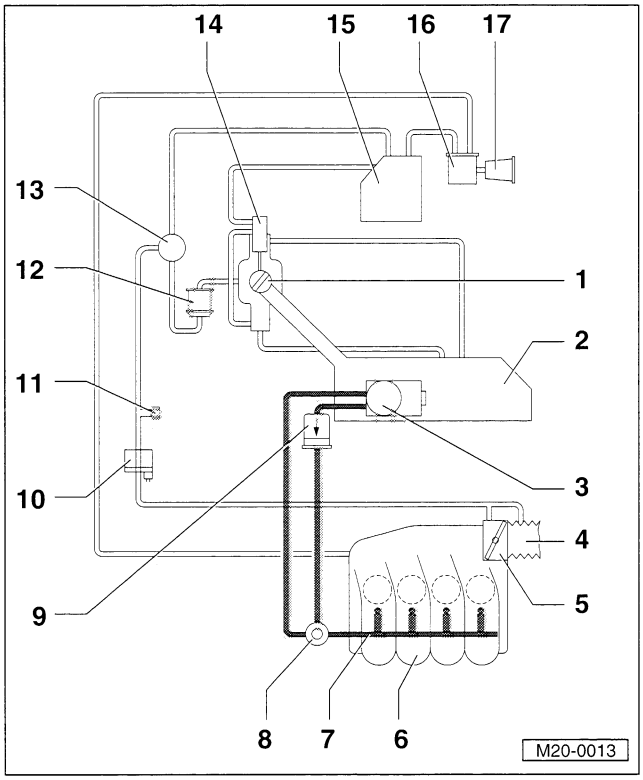
The narrow fuel filler neck creates a "liquid seal" as fuel flows into the tank preventing vapors from escaping out the filler neck. The fuel filler insert, shaped like a venturi also helps keep vapors from escaping.

All vapors vent through the filler breather bottle to the change-over valve and then to the EVAP canister through the large diameter vent loop.

The float valve closes the outlet in the filler breather bottle when the fuel tank is topped off to prevent liquid fuel from entering the EVAP system.

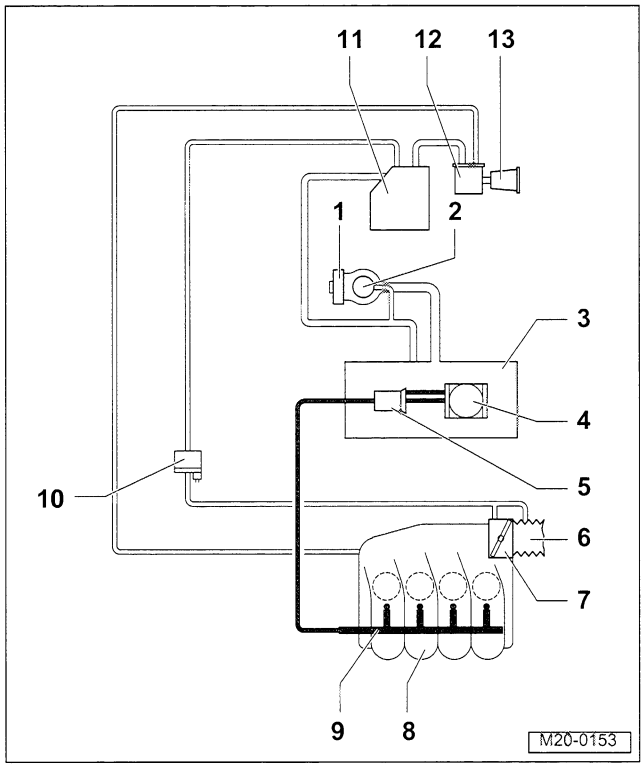


EVAP system overviews



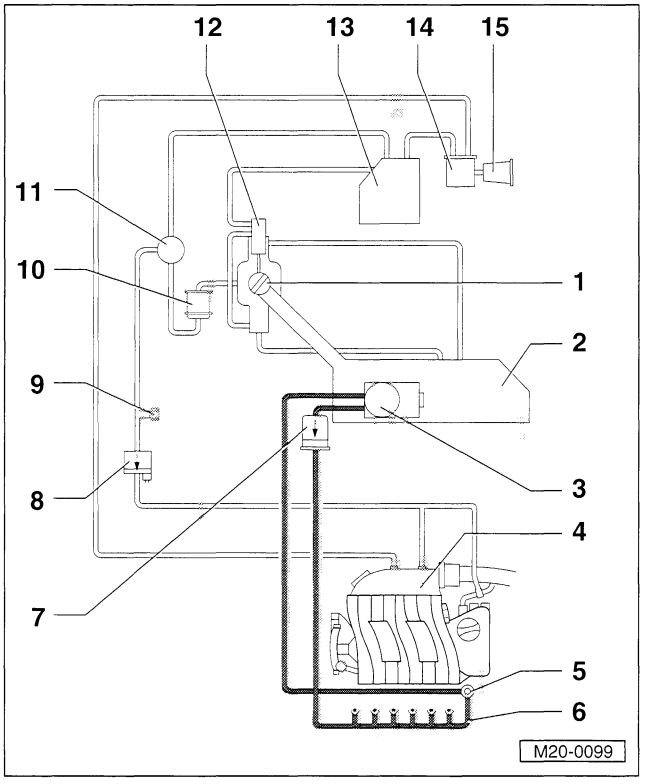
EVAP system overview (1.8L and 2.0L engine, except BBW)

1. **Tank cap unit**
2. **Fuel tank**
3. **Fuel pump**
4. **Intake hose**
5. **Throttle valve control module (J338)**
6. **Intake manifold**
7. **Fuel rail with injectors**
8. **Fuel pressure regulator**
9. **Fuel filter**
   - Arrow points in direction of flow
10. **EVAP canister purge regulator valve (N80)**
    - In right side of engine compartment
    - Arrow points in direction of flow
11. **Test socket**
12. **Gravity/overflow valve**
13. **Check valve**
14. **Change-over valve**
15. **EVAP canister**
    - In right rear wheel housing, mounted on body
16. **Leak Detection Pump (LDP), (V144)**
    - On EVAP canister
17. **Air filter for leak detection pump**



EVAP system overview (2.0L BBW engine)

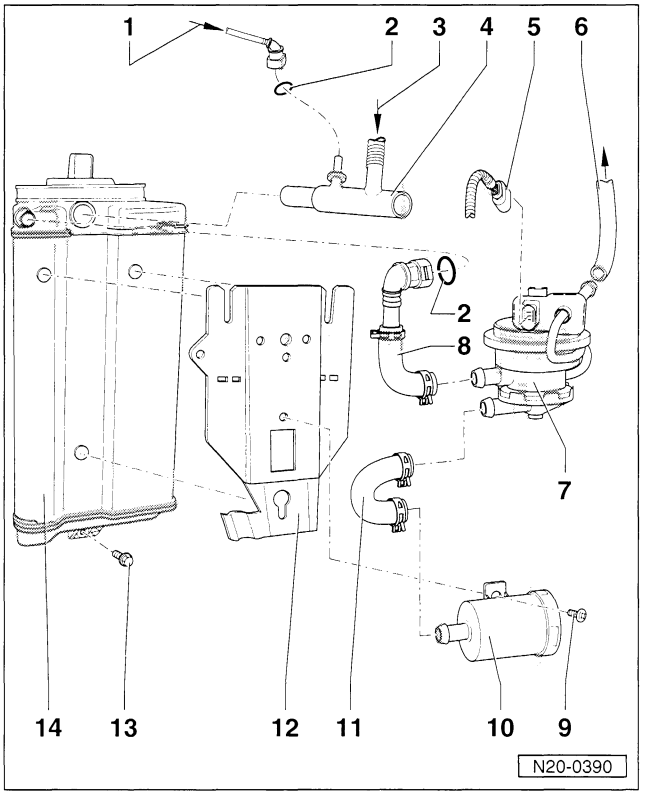
1. **Tank cap unit**
2. **Check valve**
3. **Fuel tank**
4. **Fuel delivery unit (fuel pump)**
5. **Fuel filter with fuel pressure regulator (inside tank)**
   - Arrow points in direction of flow
6. **Intake hose**
7. **Throttle valve control module (J338)**
8. **Intake manifold**
9. **Fuel rail with injectors**
10. **EVAP canister purge regulator valve (N80)**
    - In right side of engine compartment
    - Arrow points in direction of flow
11. **EVAP canister**
    - In right rear wheel housing, mounted on body
12. **Leak detection pump (V144)**
    - On EVAP canister
13. **Air filter for leak detection pump**



EVAP system overview (2.8L engine)

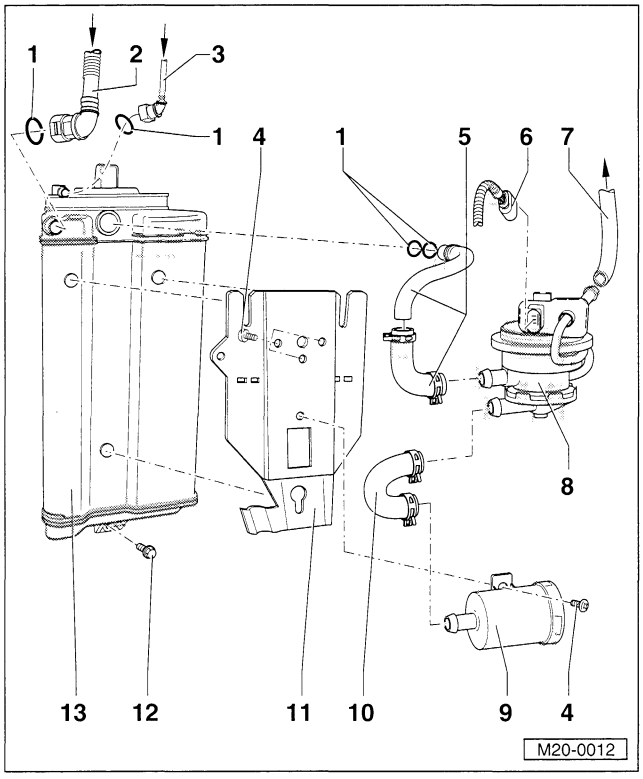
1. **Tank cap unit**
2. **Fuel tank**
3. **Fuel delivery unit**
4. **Upper intake manifold**
5. **Fuel pressure regulator**
6. **Fuel rail with injectors**
7. **Fuel filter**
   - Arrow points in direction of flow
8. **EVAP canister purge regulator valve (N80)**
   - In right side of engine compartment
   - Arrow points in direction of flow
9. **Test socket**
10. **Gravity/overflow valve**
11. **Pressure retention valve**
12. **Change-over valve**
13. **EVAP canister**
    - In right rear wheel housing, mounted on body
14. **Leak detection pump (LDP) (V144)**
    - On EVAP canister
15. **Air filter for leak detection pump**

LDP system overviews



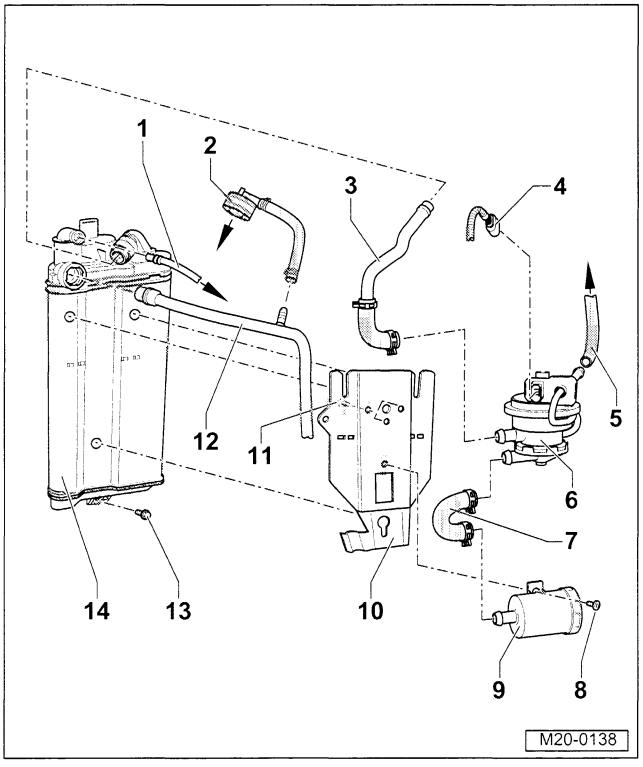
Leak detection system (1.8L and 2.8L BDF)

1. **Vent line**
   - White
   - To EVAP canister purge regulator valve (N80)
2. **O-ring**
   - Replace if damaged
3. **Vent line**
   - Black
   - To change-over valve
4. **Connector/junction**
5. **Connector**
   - Black 3-pin
6. **Vacuum line**
   - To throttle valve control module
7. **Leak detection pump (V144)**
   - Engine vacuum operated
   - Electrical connection is for pressure switch contacts
   - In rear left wheel housing under wheel housing liner
8. **Discharge hose**
   - Ensure tight fit
9. **Retaining screw**
   - Tighten to 3 Nm (27 in-lb)
10. **Air filter**
    - For leak detection pump (LDP)
11. **Intake hose**
    - Ensure tight fit
12. **Mounting plate**
    - Clipped onto the charcoal canister
13. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
14. **Activated charcoal canister (EVAP canister)**
    - In right rear wheel housing, fastened to body



Leak detection system (2.0L except BBW, and 2.8L AFP)

1. **O-ring**
   - Replace if damaged
2. **Vent line (black)**
   - Ensure tight fit
   - From change-over valve on fuel tank
3. **Vent line (white)**
   - Ensure tight fit
   - From pressure retention valve on fuel tank
4. **Retaining screw**
   - Tighten to 3 Nm (27 in-lb)
5. **Discharge hose**
   - Ensure tight fit
6. **Connector**
   - Black, 3-pin
7. **Vacuum line**
   - To upper intake manifold
8. **Leak detection pump (V144)**
   - Engine vacuum operated
   - Electrical connection is for pressure switch contacts
   - In rear left wheel housing under wheel housing liner
9. **Air filter**
   - For leak detection pump (LDP)
10. **Intake hose**
    - Ensure tight fit
11. **Mounting plate**
    - Clipped onto the charcoal canister
12. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
13. **Activated charcoal canister (EVAP canister)**
    - In right rear wheel housing, fastened to body



Leak detection system (2.0L BBW)

1. **Vent line (white)**
   - Ensure tight fit
   - From pressure retention valve on fuel tank
2. **Check valve (non-return valve)**
   - Must have a passageway in direction of filler neck
   - Clipped into filler neck
3. **Discharge hose**
   - Ensure tight fit
4. **Connector**
   - Black 3-pin
5. **Vacuum line**
   - To upper intake manifold
6. **Leak detection pump (V144)**
   - Engine vacuum operated
   - Electrical connection is for pressure switch contacts
   - In rear left wheel housing under wheel housing liner
7. **Intake hose**
   - Ensure tight fit
8. **Retaining screw**
   - Tighten to 3 Nm (27 in-lb)
9. **Air filter**
   - For leak detection pump (LDP)
10. **Mounting plate**
    - Clipped onto the charcoal canister
11. **Retaining screw**
    - Tighten to 3 Nm (27 in-lb)
12. **Vent line**
    - Ensure tight fit
    - Part of fuel tank
13. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
14. **Activated charcoal canister (EVAP canister)**
    - In right rear wheel housing, fastened to body

21 Turbocharger and Intercooler

GENERAL 21-1

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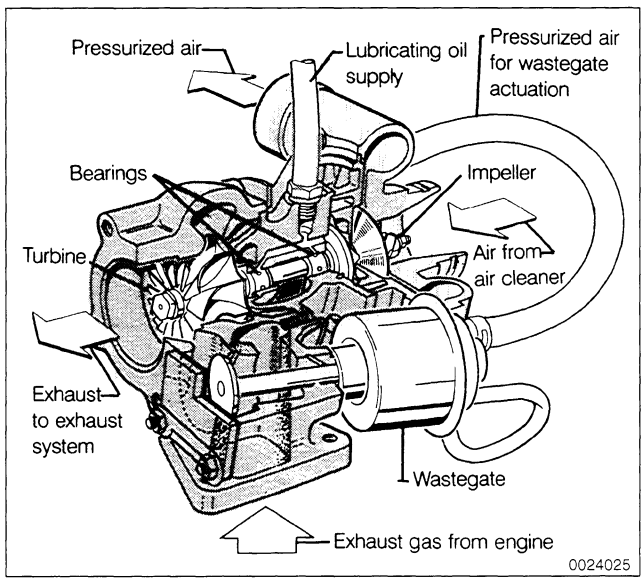
21

GENERAL

This section covers turbocharger and intercooler service and repair for the 1.8L gasoline and 1.9L diesel engines. Turbocharger boost pressure is not adjustable and separate parts for the turbocharger are usually not available from Volkswagen.

NOTE —

- *The turbocharger and related components operate at very high temperature. Always allow the system to cool or use proper protective clothing to prevent severe burns.*
- *Thoroughly clean all joints, pipe unions and connections, before disconnecting or reconnecting the turbocharger or any of its related components.*
- *Take measures to prevent dust and dirt contamination. Cover all components with dust-free paper or seal them in plastic bags. Do not use cloth material. Avoid nearby use of compressed air. Do not move the car or work in dusty conditions while the turbocharger is open or removed. Install only clean components. Do not remove components from packaging until just before installation. Avoid use of components that have been stored loose.*



A cutaway view of a typical turbocharger is shown at left.

The exhaust-driven turbocharger vanes spin at very high speeds and are precisely balanced. The turbocharger is cooled and lubricated by engine oil with additional cooling supplied by a connection to the engine cooling system. Boost pressure is controlled by a mechanical wastegate operated by the Engine Control Module (ECM). When the boost pressure exceeds programmed values, the ECM opens the wastegate to bypass some of the exhaust gases around the turbine.

As the turbocharger compresses the incoming air, it also raises the air temperature. Output from the turbocharger is routed to an air-to-air radiator called a charge-air cooler or intercooler. The intercooler removes the excess heat allowing for greater boost pressure.

TURBOCHARGER DIAGNOSTICS

Due to the extremely high speeds and temperatures, proper lubrication of the turbocharger is critical. Small oil and coolant passages are drilled into the turbocharger housing and bearings. Seals are placed around the shaft at each end to prevent oil and coolant from entering the compressor and turbine housing. When the turbocharger bearings and seals become worn, the lubricating oil can slip past the seals and into the combustion chamber or exhaust system. The result is blue-gray oil smoke from the tailpipe. When the bearings become severely worn, the turbocharger compressor and turbine impeller may contact the turbocharger housing, making loud screeching or thumping noises.

The major cause of turbocharger bearing and seal failure is "coking", or baking of oil in the turbocharger's oil passages. During operation, the temperature of the turbocharger housing can exceed the boiling point of the oil running through it. However, because oil and coolant are constantly circulating, the turbocharger stays cool enough to prevent oil coking. If the oil or coolant pipes are clogged or if the engine is turned off before the turbocharger has had time to cool down, the oil can quickly turn to coke. When these carbon deposits form, oil flow to the turbocharger is reduced. In addition, this substance is abrasive and can wear the seals, bearing and shafts prematurely.

If engine performance is low, and low boost pressure is suspected, first check for any loose or broken hoses or fittings. Make sure the control line to the wastegate is not blocked, loose, or leaking. Make sure there are no restrictions in the intake air system, such as a dirty air filter element or damage to the intercooler. Check the exhaust system for restrictions such as a damaged catalytic converter or clogged muffler. If no visible faults can be found, check the turbo boost pressure with a scan tool such as the Volkswagen VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent aftermarket scan tool or scan tool program.

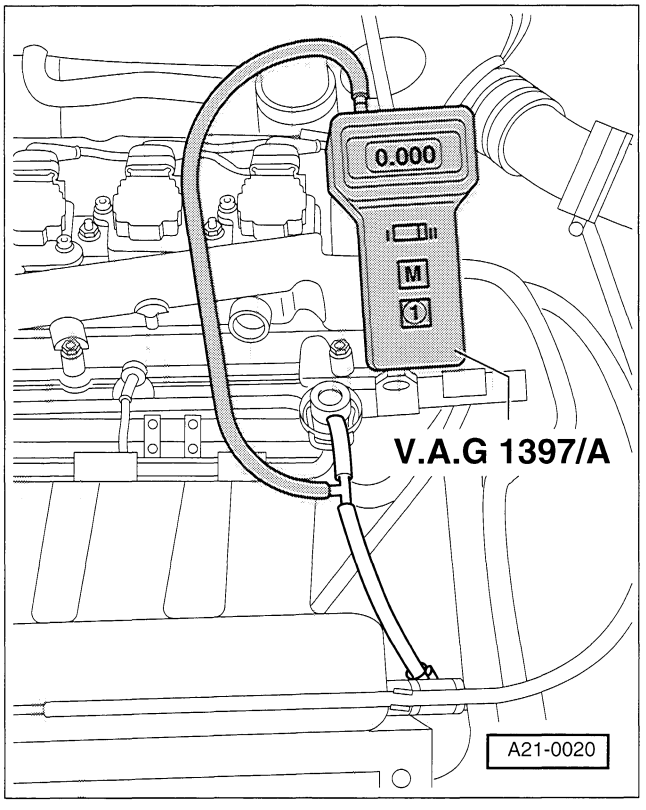
NOTE —

Suspected engine performance problems must first be investigated with an appropriate scan tool such as the Volkswagen VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent aftermarket scan tool or scan tool program. Diagnostic Trouble Codes (DTCs) stored in ECM memory must be repaired and the DTCs erased before proceeding. Use of these specialized tools must be in accordance with instructions with the tool by the manufacturer.

Turbo boost pressure, checking

Boost pressure measurements using a conventional pressure gauge on the 1.9L TDI and PD engines are generally not possible due to the lack of an attachment fitting for a gauge. Volkswagen specifies testing with scan tool VAG 1551/ 1552 or diagnostic computer VAS 5051/5052. In the case of the PD engine, no specifications are given because of the requirement to troubleshoot with the VAS 5051/5052 in the Guided Fault Finding (GFF) mode.

Boost pressure on the 1.8L engine can be measured with Volkswagen digital boost pressure gauge VAG1397A or equivalent as follows.



➤ For **1.8L** engines, connect boost pressure gauge to vacuum line of fuel pressure regulator (AWD engine shown).

– Observe the following preliminary conditions:
  - Intake and exhaust systems free of leaks and restrictions
  - Engine temperature:
    (1.8L) 60°C (140°) minimum
  - (1.9L) 85°C (185°) minimum
  - Engine compression OK. See **1 Engine**
  - No DTCs in ECM memory

– Road test the vehicle under the following conditions:
  - For safety reasons, road test with a helper operating and/or observing the pressure gauge.
  - Road test in an area free from vehicular and pedestrian traffic.
  - Observe all applicable traffic laws.

– Accelerate at full throttle from approx. 1500 rpm in 3rd gear (manual transmission) or 2nd gear (automatic).

– Observe and record pressure gauge at specified rpm while accelerating to full throttle.

– Compare to specification.

Boost pressure (at specified rpm)
- 1.8L engine (AWD, AWW)
  (1800 to 2300 rpm) . . 1350 to 1650 mbar (absolute)
- 1.8L engine (AWP)
  (1800 to 2300 rpm) . . 1700 to 2000 mbar (absolute)
- 1.9L engine (ALH)
  (3000 rpm) . . . . . 1700 to 2200 mbar (absolute)

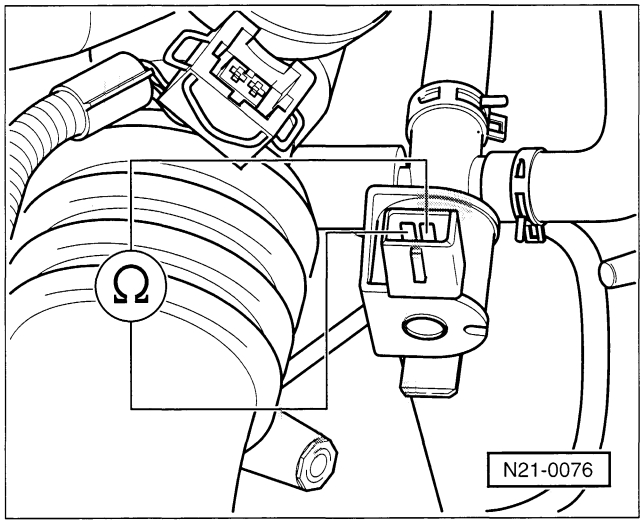
NOTE —
Pressure measurements as specified by Volkswagen are given in "absolute' values. This system as used for automotive purposes does not recognize vacuum. The starting point for measurements is 1 atmosphere (1000 mbar). Values commonly referred to as vacuum are simply pressures less than 1 atmosphere.

– If specified values are not reached or are exceeded, additional testing using an appropriate scan tool will be needed.

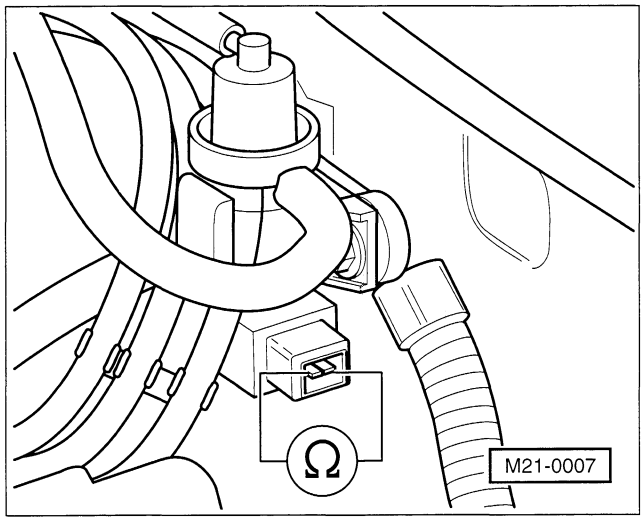
Wastegate by-pass regulator valve, checking

– Disconnect harness connector from wastegate by-pass regulator valve.

For **1.8L** engine, measure resistance between terminals of by-pass regulator valve.



For **1.9L** engine, measure resistance between terminals of by-pass regulator valve.



Resistance of wastegate by-pass regulator valve

- 1.8L engine . . . . . 25 to 35 Ω
- 1.9L engine . . . . . 14 to 20 Ω

NOTE —

At room temperature, the resistance value of the wastegate bypass regulator valve should be at the lower end of the range. At normal operating temperature, the resistance should be at the upper end of the range.

Recirculating valve, checking (1.8L engine)



– Switch ignition off and remove harness connector from recirculating valve for turbocharger

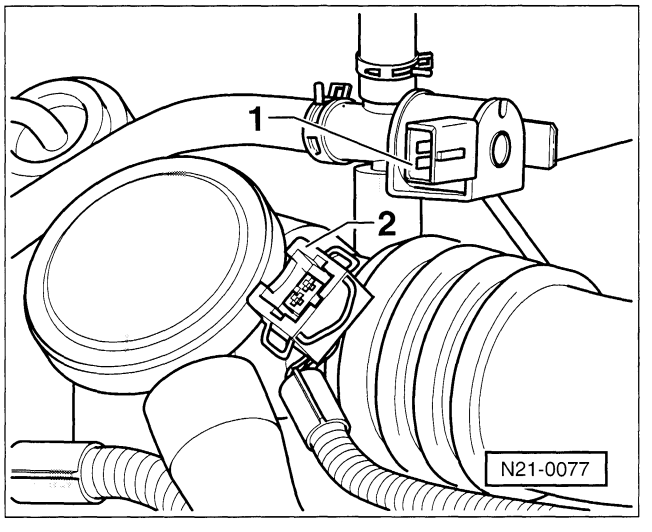
◀ Measure resistance between terminals (**arrow**) on recirculating valve.

Recirculating valve resistance

• 1.8L engine . . . . . 27 to 30 Ω

– If the specification is not obtained, replace recirculating valve.

Pressure unit (servo) for wastegate, checking (1.8L engine)

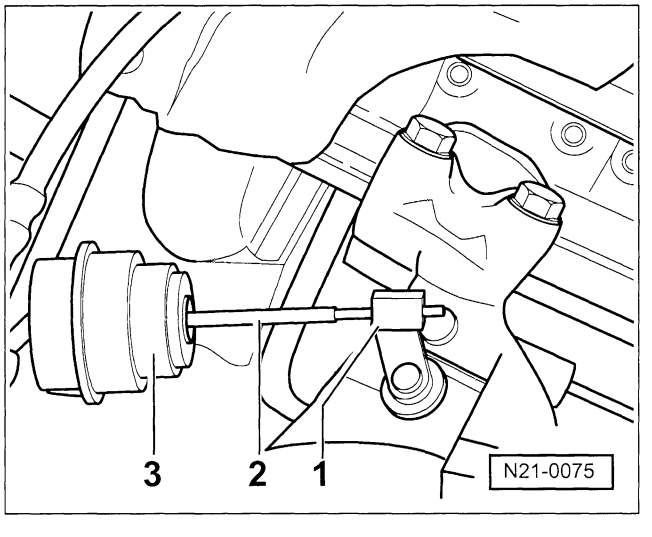


– Warm up engine until oil temperature is at least 60°C (140°F).

– Ensure that there are no leaks in the intake and exhaust systems.

◀ Pull off wastegate bypass regulator valve N75, (**1**) connector (**2**).

– Start engine and raise to maximum speed briefly by operating throttle pedal.



◀ Operating rod (**2**) for charge air pressure regulating valve (**3**) must move. If the operating rod does not move:

• Check charge air pressure control valve lever (**1**) for ease of movement. If corroded/rusted together, replace turbocharger.

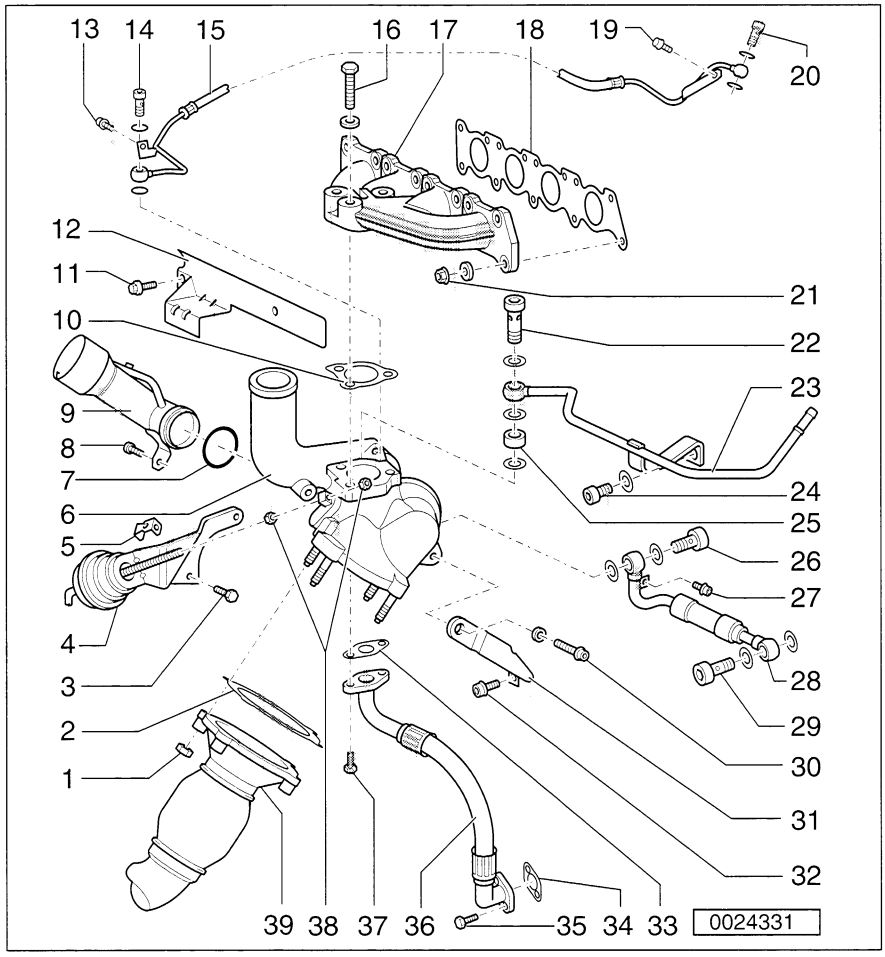
– If the operating rod does not move, even though the lever is free to move:

• Turbocharger is malfunctioning, replace turbocharger.

TURBOCHARGER, ASSEMBLY

When replacing the turbocharger, the oil return and supply pipes/lines and coolant return and supply pipes/lines should be removed and thoroughly cleaned using a stiff brush and solvent. If the pipes cannot be completely cleaned, they should be replaced. The engine oil and oil filter should also be changed. If the impeller blades are damaged, inspect the intake connecting pipes and the intercooler for debris and clean or replace as needed. Be sure to check the boost pressure once installation is complete. The various turbocharger components for the 1.8L and 1.9L engines are shown on here and on the pages that follow.

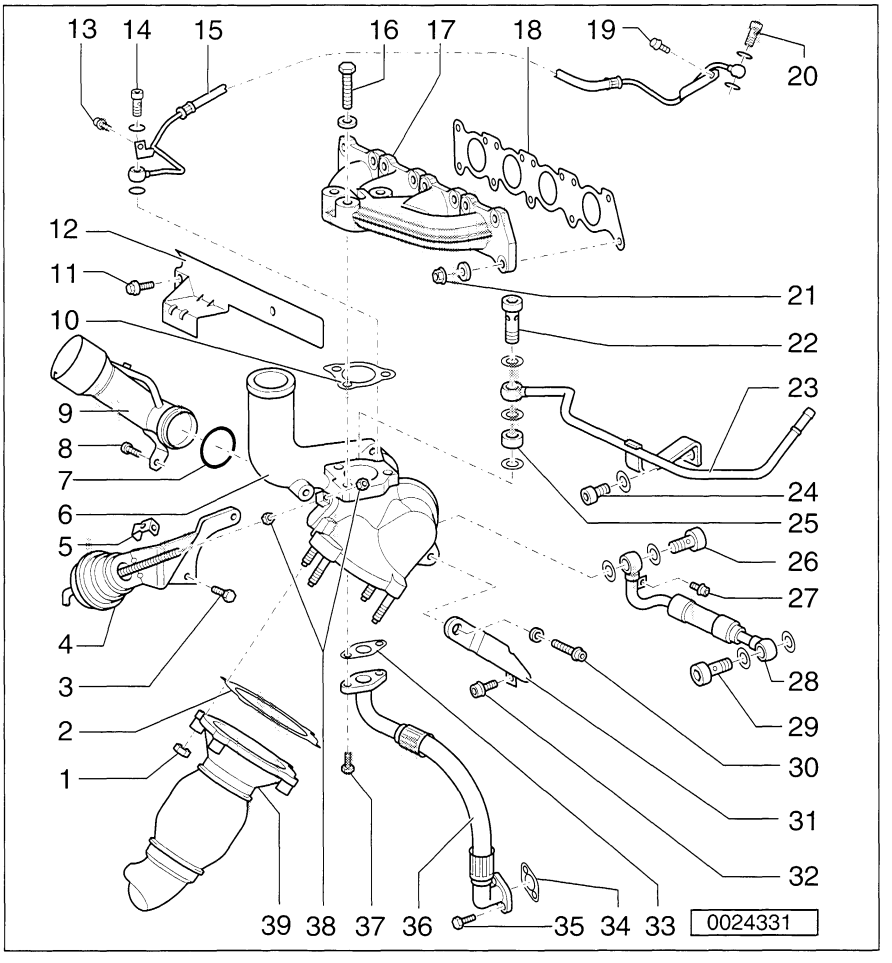
Turbocharger assembly (1.8L engine)



1. **Nut**
   - Tighten to 40 Nm (30 ft-lb)
   - Always replace
   - Coat threads with high temperature anti-seize G 052 112 A3
2. **Gasket**
   - Always replace
3. **Bolt**
   - Do not loosen
   - Tighten to 10 Nm (7 ft-lb)
4. **Pressure unit (servo) for wastegate**
   - Integral with turbocharger
5. **Locking clip**
6. **Turbocharger**
   - With integral wastegate and servo
   - Fill with engine oil at oil passage connection sleeve before attaching oil supply line
   - Let engine idle for at least 1 minute after installing and do not rev engine immediately to ensure turbocharger has adequate oil supply
7. **O-ring**
   - Always replace
8. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
9. **Intake pipe**
   - Intake from air cleaner
10. **Gasket**
    - Always replace
    - Note installation position
11. **Bolt**
    - Tighten to 20 Nm (15 ft-lb)
12. **Heatshield**
13. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
14. **Banjo bolt**
    - Tighten to 30 Nm (22 ft-lb)
15. **Oil supply line**
    - From oil filter flange
16. **Bolt**
    - Tighten to 30 Nm (22 ft-lb)
    - Always replace
    - Coat threads with high temperature anti-seize G 052 112 A3
17. **Exhaust manifold**
18. **Gasket**
    - Always replace
    - Note installation position
19. **Bolt**
    - Tighten to 20 Nm (15 ft-lb)
20. **Banjo bolt**
    - Tighten to 30 Nm (22 ft-lb)
21. **Nut**
    - Tighten to 25 Nm (18 ft-lb)
    - Always replace
    - Coat threads with high temperature anti-seize G 052 112 A3
22. **Banjo bolt**
    - Tighten to 35 Nm (26 ft-lb)
23. **Coolant return line**
24. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
25. **Spacer sleeve**
26. **Banjo bolt**
    - Tighten to 35 Nm (26 ft-lb)
27. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
28. **Coolant supply line**

(continued on following page)

Turbocharger assembly (1.8L engine, continued)



29. Banjo bolt
- Tighten to 35 Nm (26 ft-lb)

30. Bolt, special
- Tighten to 30 Nm (22 ft-lb)

31. Support bracket
- Between turbocharger and cylinder block

32. Bolt
- Tighten to 25 Nm (18 ft-lb)

33. Gasket
- Always replace

34. Gasket
- Always replace

35. Bolt
- Tighten to 10 Nm (7 ft-lb)

36. Oil return line
- To oil pan

37. Bolt
- Tighten to 10 Nm (7 ft-lb)

38. Nut, adjusting
- Do not loosen or alter setting
- Tighten to 10 Nm (7 ft-lb)

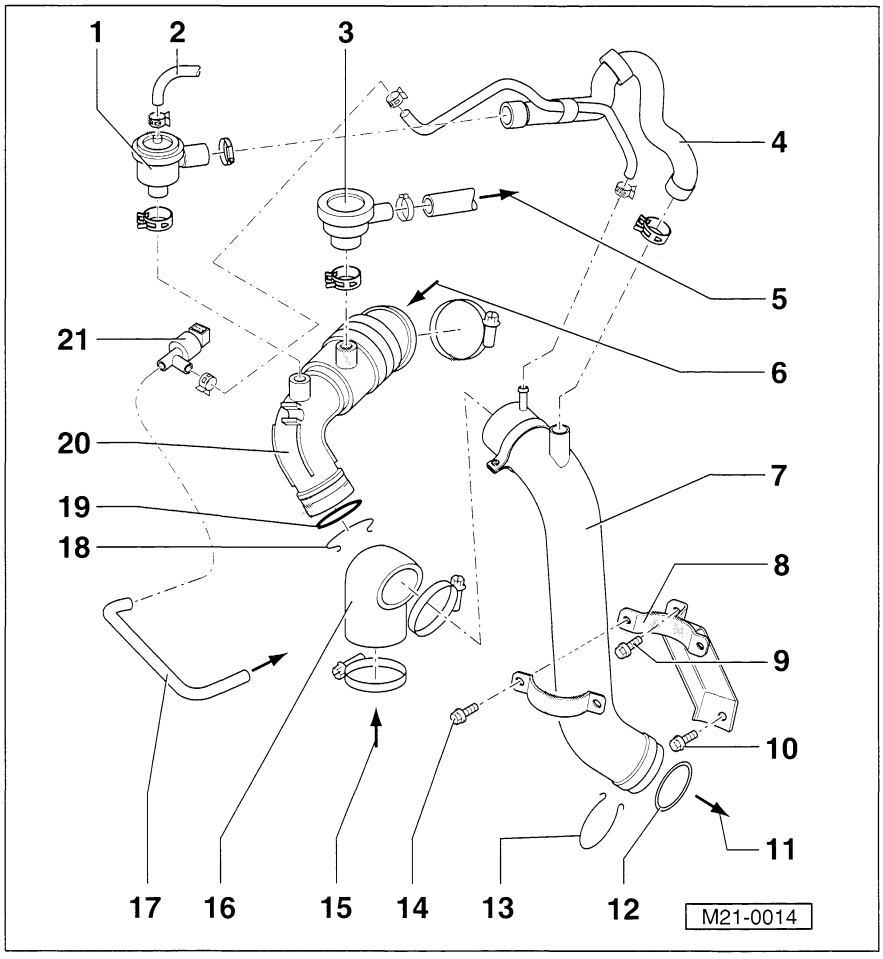
39. Front exhaust pipe

Anti-seize compound (not shown)
- High temperature
- Volkswagen recommended anti-seize compound for all operations, G 052 112 A3

NOTE —

Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.

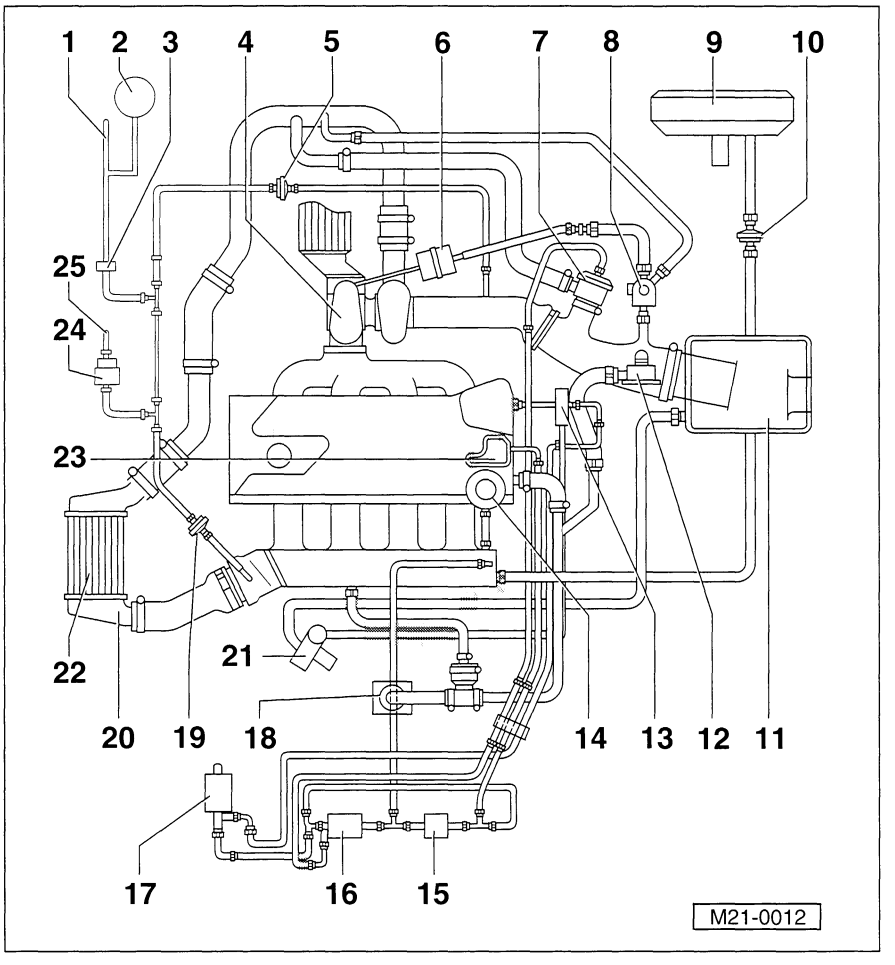
Turbocharger hose connections (1.8L engine)



1. **Charge pressure by pass valve**
2. **Connecting line**
   - To recirculating valve for turbocharger (N249)
3. **Pressure regulation valve for crankcase ventilation**
4. **Connecting line**
   - From mechanical recirculating valve to upper air shaft
5. **Flow**
   - To crankcase ventilation
6. **Flow**
   - From air filter
7. **Upper air tube**
   - Note installation position of heat insulation mat
   - AWD engines have screw-type clamps
   - AWW, AWP engines use quick release connectors with securing bracket and O-rings
8. **Bracket**
9. **Bolt**
   - Tighten to 40 Nm (30 ft-lb)
10. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
11. **Flow**
    - To charge air cooler (intercooler)
12. **O-ring**
    - Always replace
    - Only on vehicles with AWW, AWP engine
13. **Circlip**
    - Always replace
    - Ensure correct seating
    - Only on vehicles with AWW. AWP engine
14. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
15. **Flow**
    - From turbocharger outlet
16. **Connecting elbow**
17. **Connecting hose**
18. **Circlip**
    - Ensure correct seating
19. **O-ring**
    - Always replace
20. **Intake hose**
    - To turbocharger intake
21. **Wastegate bypass regulator valve (N75)**
    - Activated (pulsed) by engine control module

Turbocharger components and hose connections (AWD 1.8L engine)

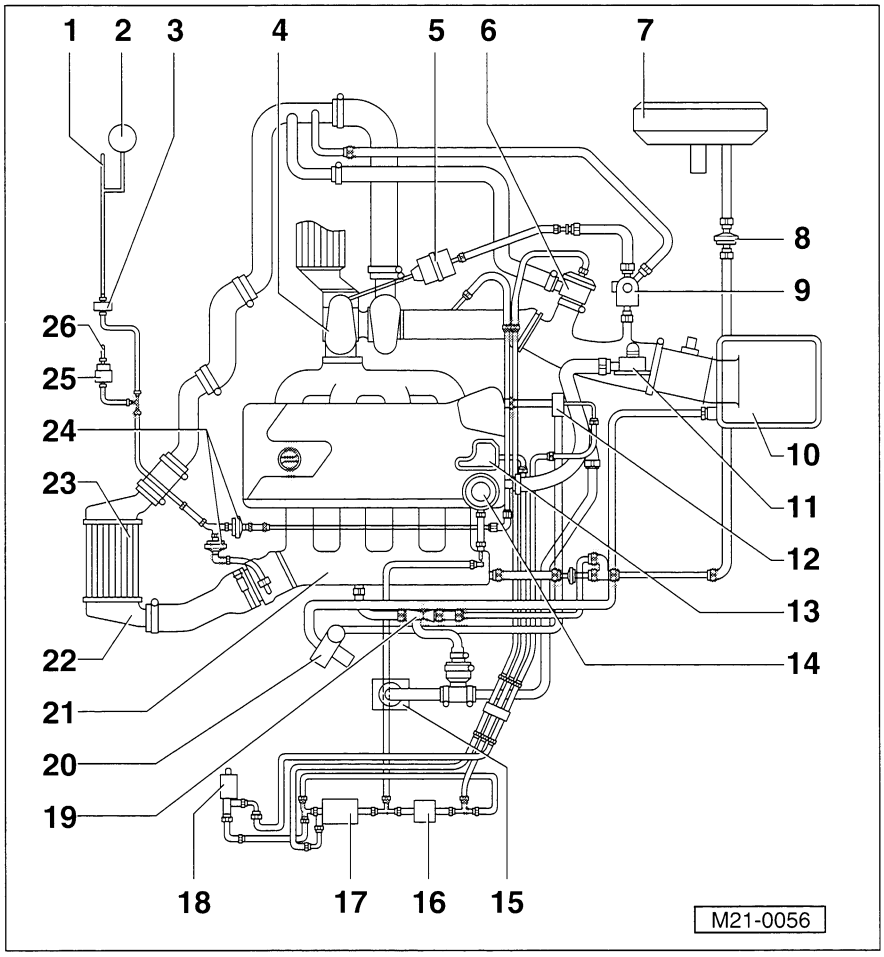
1. **Connecting line**
   - From Leak Detection Pump (LDP)
2. **Vacuum reservoir**
   - Below right wheel housing liner
3. **Non-return (check) valve**
4. **Turbocharger assembly**
5. **Non-return (check) valve**
6. **Pressure unit (servo)**
   - For wastegate
7. **Overrun shut off valve**
8. **Wastegate bypass regulator solenoid valve (N75)**
9. **Power brake servo**
10. **Non-return (check) valve for power brake booster**
11. **Air cleaner assembly with mass air flow (MAF) sensor (G70)**
12. **Crankcase pressure regulating (breather) valve**
13. **Combination valve**
    - For secondary air injection
    - Controlled by secondary air injection solenoid valve (N112)
14. **Fuel pressure regulator**
15. **Non-return (check) valve**
16. **Recirculating valve for turbocharger (N249)**
17. **Secondary air injection solenoid valve (N112)**
18. **Crankcase breather valve**
19. **Non-return (check) valve**
20. **Charge air pressure sensor (G31)**
    - In or near charge air cooler (intercooler)
    - O-ring seal
21. **Secondary Air Injection (AIR) pump motor (V101)**
22. **Charge air cooler (intercooler)**
23. **Vacuum reservoir**



24. **Evaporative emissions (EVAP) canister purge regulator valve (N80)**
25. **Connecting hose to EVAP canister**

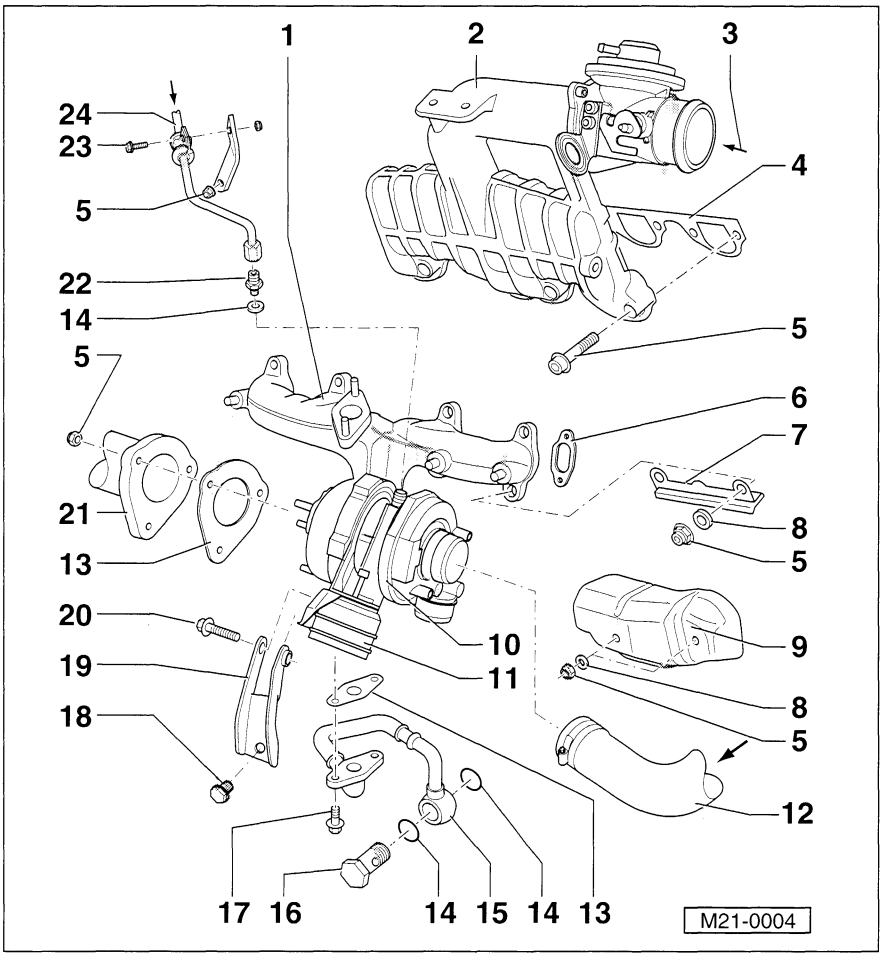
Turbocharger component and hose connections (AWW, AWP 1.8L engine)

1. **Connecting line**
   - From Leak Detection Pump (LDP)
2. **Vacuum reservoir**
   - Below right wheel housing liner
3. **Non-return (check) valve**
4. **Turbocharger assembly**
5. **Pressure unit (servo)**
   - For wastegate
6. **Overrun shut off valve**
7. **Power brake servo**
8. **Non-return (check) valve for brake booster**
9. **Wastegate bypass regulator solenoid valve (N75)**
10. **Air cleaner assembly with mass air flow (MAF) sensor (G70)**
11. **Crankcase pressure regulating (breather) valve**
12. **Combination valve for secondary air system**
    - For secondary air injection
    - Controlled by secondary air injection solenoid valve (N112)
13. **Vacuum reservoir**
14. **Fuel pressure regulator**
15. **Crankcase breather valve**
16. **Non-return (check) valve**
17. **Recirculating valve for turbocharger (N249)**
18. **Secondary air injection solenoid valve (N112)**
19. **Vacuum booster (vacuum amplifier)**
20. **Secondary Air Injection (AIR) pump motor (V101)**
21. **Intake manifold**
22. **Charge air pressure sensor (G31)**
    - In or near charge air cooler (intercooler)
    - O-ring seal



23. **Charge air cooler (intercooler)**
24. **Non-return (check) valve**
25. **Evaporative emissions (EVAP) canister purge regulator valve (N80)**
26. **Connecting hose to EVAP canister**

Turbocharger assembly (1.9L engine)

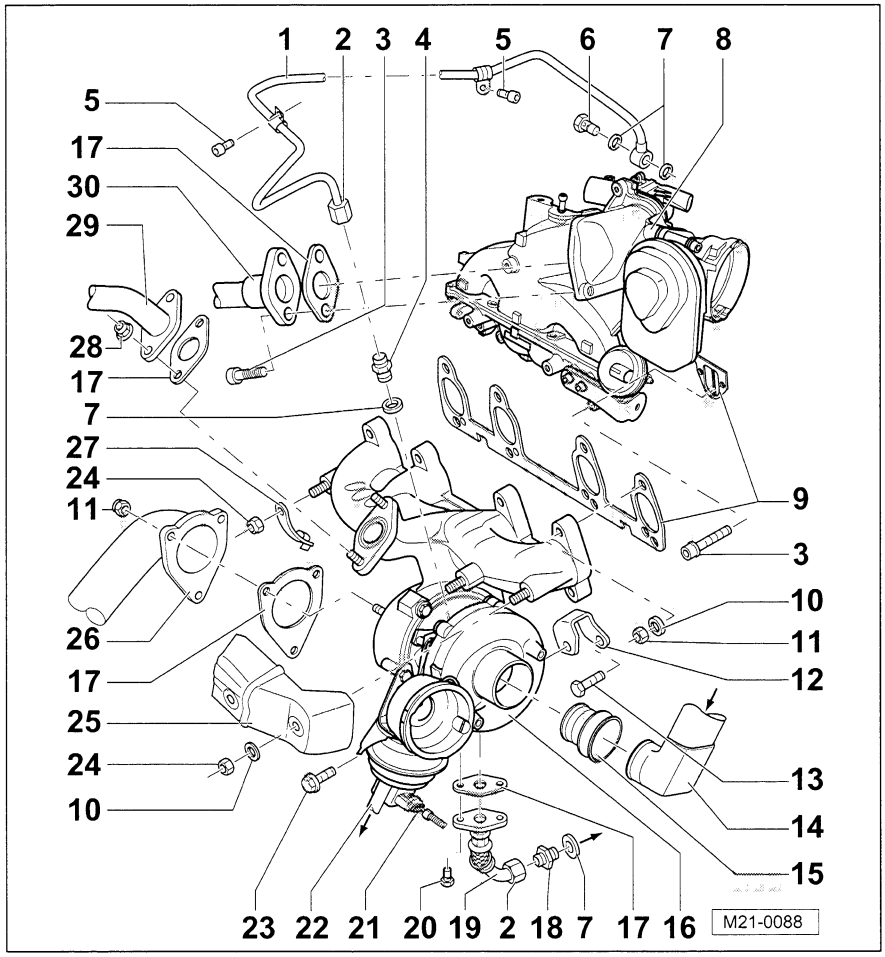


1. **Exhaust manifold**
   - Integral with turbocharger
2. **Intake manifold**
   - Shown with EGR valve and manifold flap
   - Manifold flap operation controlled by change-over valve for for intake manifold (N239)
3. **Flow**
   - In from intercooler
4. **Gasket**
   - Always replace
   - Coated (beaded) side faces intake manifold
5. **Bolt**
   - Tighten to 25 Nm (18 ft-lb)
6. **Gasket**
   - Always replace
   - Note installation position
7. **Bracket**
   - For heatshield
8. **Washer**
9. **Heatshield**
10. **Turbocharger**
    - Only replace as complete assembly
    - Remove right drive shaft at transmission before removing turbocharger
    - With integral wastegate and servo
    - Fill with engine oil at oil passage connection sleeve before attaching oil supply line
    - Let engine idle for at least 1 minute after installing and do not rev engine immediately to ensure turbocharger has adequate oil supply
11. **Pressure unit (servo) for wastegate**
    - Integral part of turbocharger
12. **Intake hose**
    - Arrow indicates air flow from air cleaner
13. **Gasket**
    - Always replace
14. **O-ring**
    - Always replace
15. **Oil return line**
    - To cylinder block
16. **Banjo bolt**
    - Tighten to 40 Nm (30 ft-lb)
17. **Bolt**
    - Tighten to 15 Nm (11 ft-lb)
18. **Bolt**
    - Tighten to 40 Nm (30 ft-lb)
19. **Turbocharger support bracket**
20. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
21. **Front exhaust pipe (headpipe)**
22. **Connection (union)**
23. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
24. **Oil supply line**
    - From oil filter flange

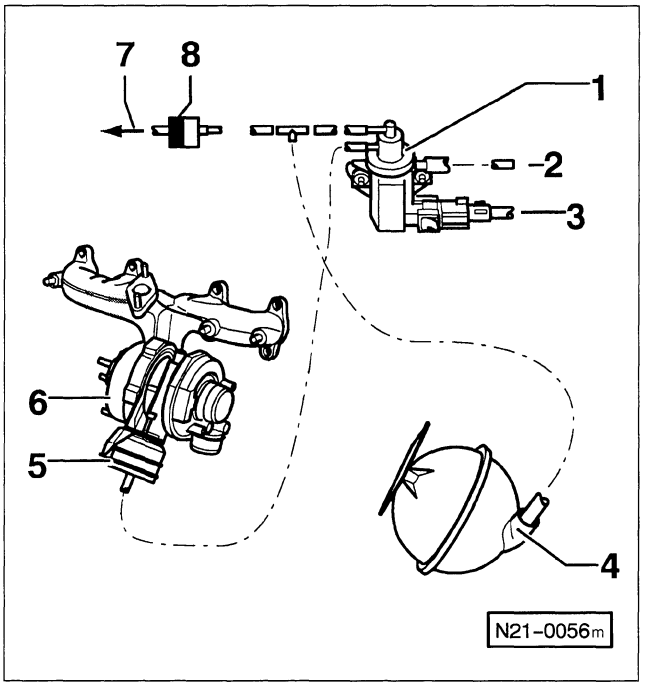
NOTE —

- *If the turbocharger is being replaced because of excessive exhaust smoke, there will probably be some residual oil in the exhaust upon start-up. Be sure to test drive the car long enough to clear the left over oil from the exhaust system.*
- *Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See* **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*

Turbocharger assembly (1.9L PD engine)

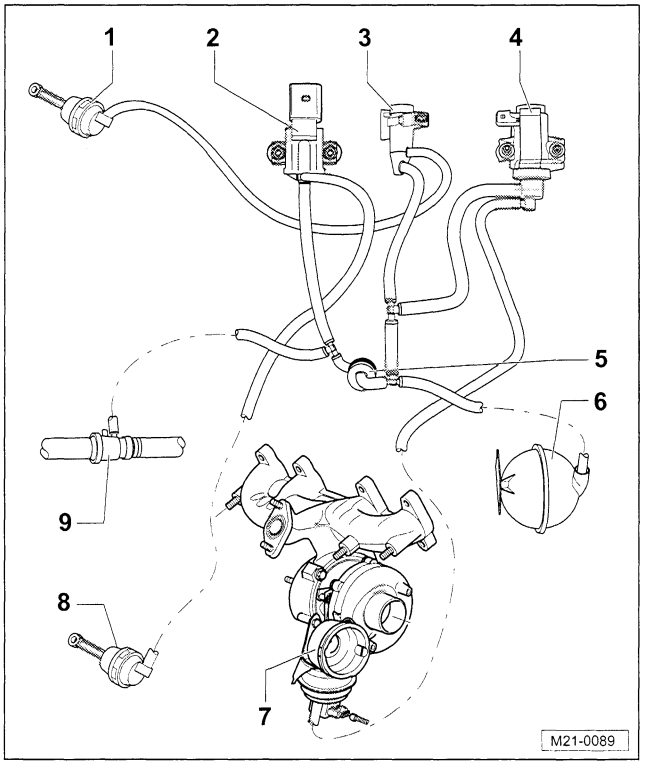


1. **Oil supply line**
   - From oil filter flange
   - Fill with engine oil before connecting line
2. **Union nut**
   - Tighten to 40 Nm (30 ft-lb)
3. **Bolt**
   - Tighten to 22 Nm (16 ft-lb)
4. **Connection (union)**
   - Tighten to 40 Nm (30 ft-lb)
   - Fill with engine oil before connecting line
   - Coat threads with high temperature anti-seize G 052 112 A3
5. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
6. **Banjo bolt**
   - Tighten to 35 Nm (26 ft-lb)
7. **Seals**
   - Always replace
8. **Intake manifold assembly**
9. **Gaskets**
   - Always replace
   - Note installation position
10. **Washer**
11. **Nut**
    - Tighten to 25 Nm (18 ft-lb)
12. **Support**
    - Between turbocharger and cylinder block
13. **Bolt**
    - Tighten to 40 Nm (30 ft-lb)
    - Install all fasteners hand tight before applying final torque
14. **Intake hose**
    - Arrow indicates air flow from air cleaner
15. **Transition piece/adaptor**
16. **Turbocharger**
    - Only replace as complete assembly
    - Remove right drive shaft at transmission before removing turbocharger
    - With integral wastegate and servo
    - Fill with engine oil at oil passage connection sleeve before attaching oil supply line
    - Let engine idle for at least 1 minute after installing and do not rev engine immediately to ensure turbocharger has adequate oil supply
17. **Seal**
    - Always replace
18. **Connection (union)**
    - Tighten to 40 Nm (30 ft-lb)
19. **Oil return line**
    - To cylinder block
20. **Bolt**
    - Tighten to 17 Nm (13 ft-lb)
21. **Connector**
    - For turbocharger (TC) vane position sensor (G500)
22. **Vacuum hose**
    - Pressure unit (servo) for wastegate
    - To wastegate bypass regulator valve (N75)
23. **Bolt**
    - Tighten to 20 Nm (15 ft-lb)
    - Install all fasteners hand tight before applying final torque
24. **Nut**
    - Tighten to 20 Nm (15 ft-lb)
25. **Heatshield**
26. **Front exhaust pipe (headpipe)**
27. **Bracket**
    - For oil supply line
    - Install and secure oil line before installing bracket
28. **Nut**
    - Tighten to 22 Nm (16 ft-lb)
29. **Connecting pipe**
    - To exhaust gas recirculation (EGR) cooler
30. **Connecting pipe**
    - From exhaust gas recirculation (EGR) cooler



Turbocharger hose connections (1.9L engine)

1. Wastegate bypass regulator valve (N75)
2. Vent connection
3. Electrical connector
4. Vacuum reservoir
5. Pressure unit (servo) for wastegate
6. Exhaust manifold with turbocharger
7. Connection to vacuum source
8. Non-return (check) valve
   - Black end faces vacuum source
   - White end faces N75, and vacuum reservoir



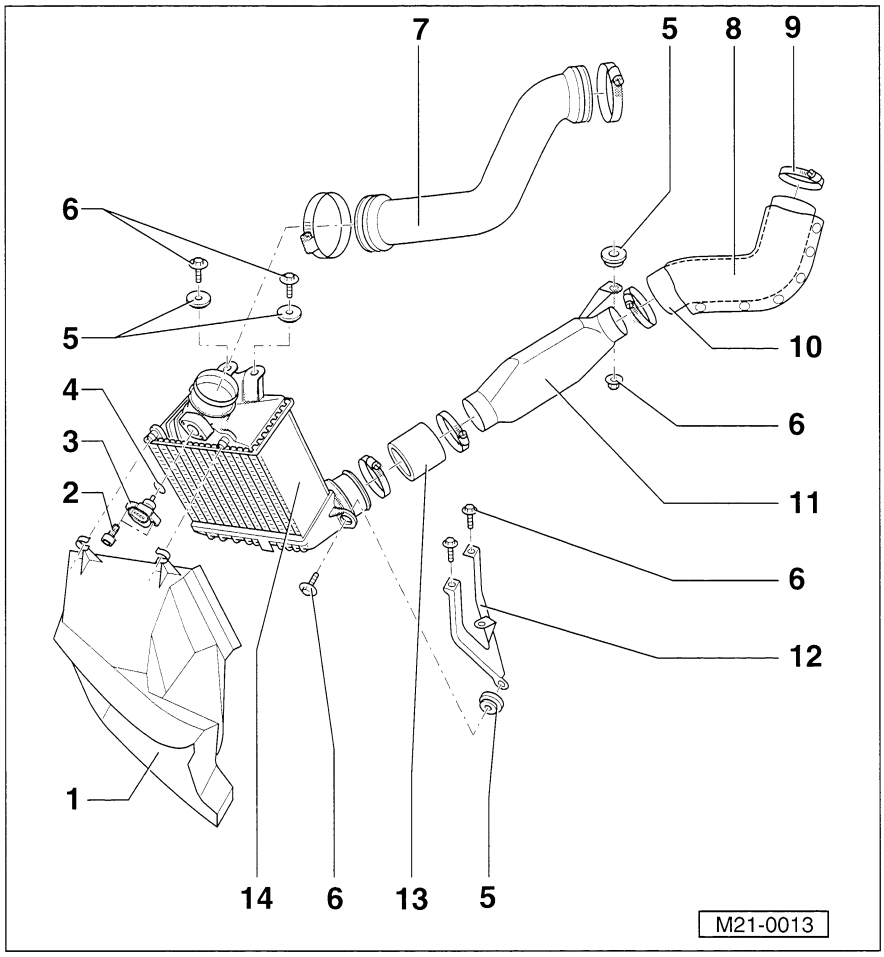
Turbocharger and EGR hose connections (1.9L PD engine)

1. EGR vacuum servo I
2. EGR vacuum regulator solenoid valve II (N213)
3. EGR vacuum regulator solenoid valve I (N18)
4. Wastegate bypass regulator valve (N75)
5. Non-return (check) valve
   - Black end faces vacuum source and N213
   - White end faces N18, N75, and vacuum reservoir
6. Connection to air filter
7. Pressure unit (servo) for wastegate
8. EGR vacuum servo II
9. Connection to vacuum source (tandem pump)

CHARGE AIR COOLER (INTERCOOLER)

The intercooler for the 1.8L and 1.9L engines are shown on the following pages. The intercooler is used to reduce the temperature of the air compressed by the turbocharger. This cooler air has greater density which reduces Nitrous Oxide (NOS) gases and improves performance.

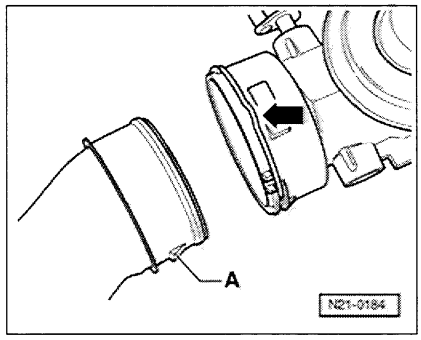
Intercooler assembly (1.8L engine)



1. **Air duct (guide)**
   - Clip in at intercooler
2. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
3. **Charge pressure sender (G31)**
4. **O-ring**
   - Always replace
5. **Rubber grommet**
   - With metal sleeve
6. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
7. **Intake hose**
   - Intercooler outlet
   - Between intake manifold and intercooler
8. **Heat insulation mat**
   - Observe installed position
9. **Screw-type clamp**
   - Only for engine code AWD
   - Engine codes AWP and AWW have quick release connection with O-ring and mounting bracket
   - See **Hose connections with couplings**
10. **Connecting hose**
    - From turbocharger
11. **Air duct**
12. **Support bracket**
13. **Connecting hose**
14. **Charge air cooler (intercooler)**

NOTE —

- *All hose connections are secured with a clamp or a quick release clip.*
- *System must be free of all leakage especially when under pressure.*



Hose connections with couplings

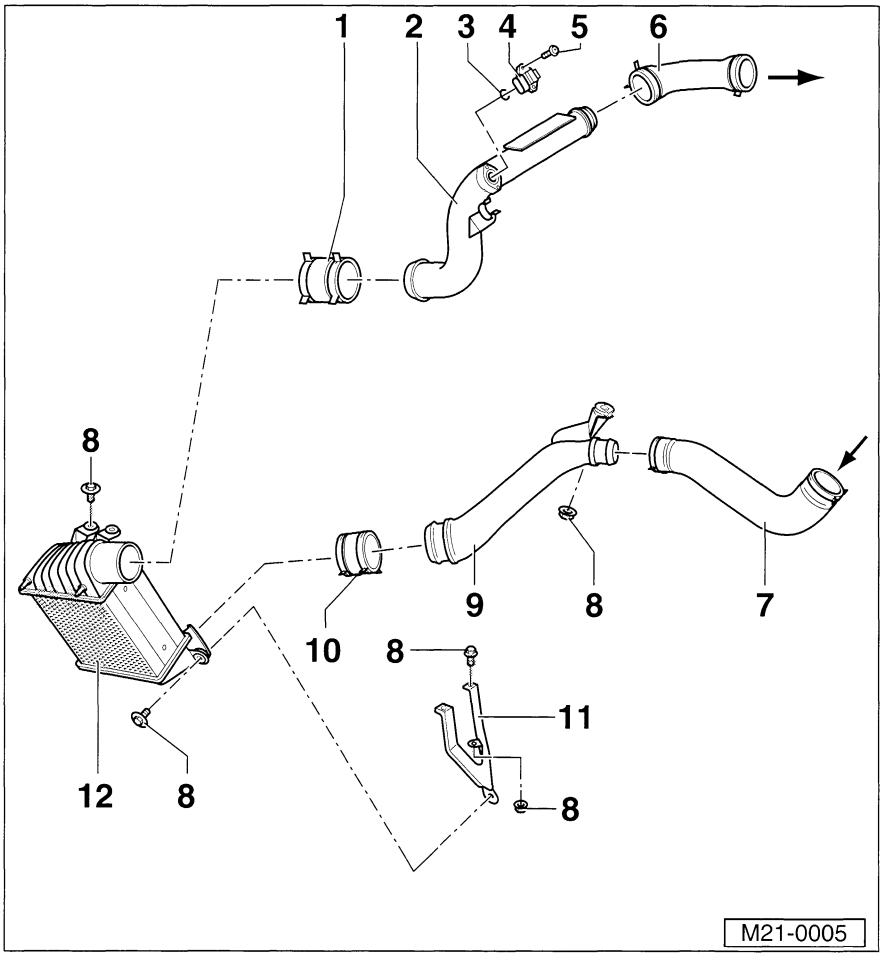
- Release connection by pulling locking clip (**arrow**).
- Separate hose/line without using tools.
- When assembling ensure that retaining tabs (**A**) are engaged securely.

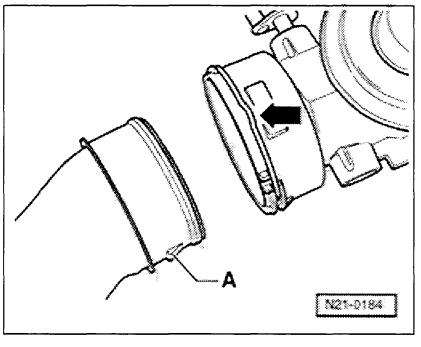
Intercooler assembly (1.9L engine)

1. **Connecting hose**
   - Ensure correct seating
   - See **Hose connections with couplings**
2. **Connecting pipe**
   - Intercooler outlet
   - Between intercooler and intake manifold
   - Remove right headlight to remove pipe
3. **O-ring**
   - Always replace
4. **Intake Air Temperature (IAT) sensor (G72)**
5. **Bolt**
   - Tighten to 5 Nm (44 in-lb)
6. **Connecting hose**
   - To intake manifold
   - Ensure correct seating
7. **Connecting hose**
   - From turbocharger
8. **Nut**
   - Tighten to 10 Nm (7 ft-lb)
9. **Air duct/pipe**
10. **Connecting hose**
11. **Support bracket**
12. **Charge air cooler (intercooler)**

NOTE —

- *All hose connections are secured with a quick release spring-type clips or connector couplings.*
- *System must be free of all leakage especially when under pressure.*





Hose connections with couplings

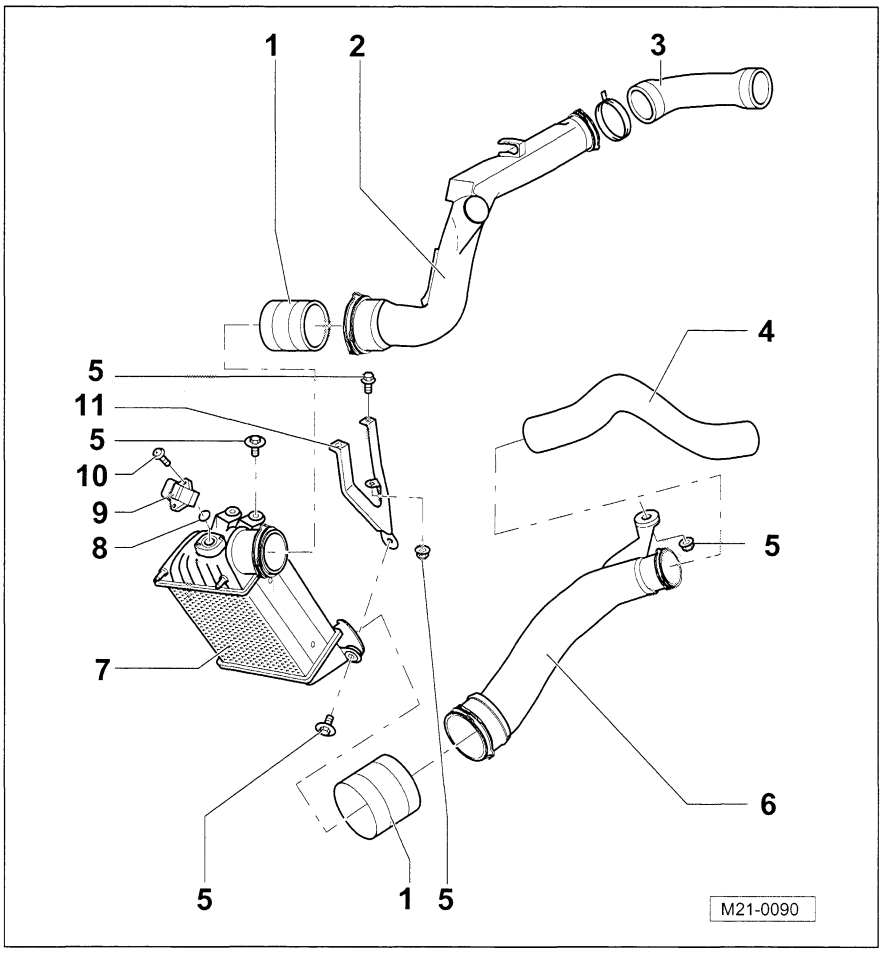
- Release connection by pulling locking clip (**arrow**).
- Separate hose/line without using tools.
- When assembling ensure that retaining tabs (**A**) are engaged securely.

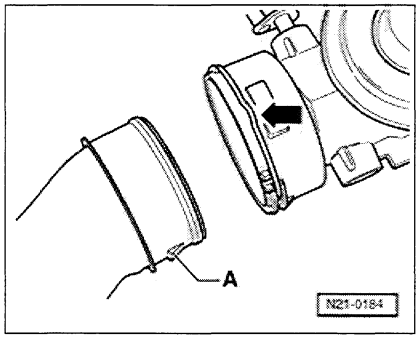
Intercooler assembly (1.9L PD engine)

1. **Connecting hose**
   - Ensure correct seating
2. **Connecting pipe**
   - Intercooler outlet
   - Between intercooler and intake manifold
   - Remove right headlight to remove pipe
3. **Connecting pipe**
   - At intake manifold
4. **Connecting hose**
   - Ensure correct seating
   - From turbocharger
5. **Nut**
   - Tighten to 10 Nm (7 ft-lb)
6. **Air duct/pipe**
7. **Charge air cooler (intercooler)**
8. **O-ring**
   - Always replace
9. **Manifold Absolute Pressure (MAP) sensor with integral Intake Air Temperature (IAT) sensor (G72)**
10. **Screw**
    - Tighten to 5 Nm (4 ft-lb)
11. **Support bracket**

NOTE —

- *All hose connections are secured with a clamp or a quick release clip.*
- *System must be free of all leakage especially when under pressure.*





Hose connections with couplings

- Release connection by pulling locking clip (**arrow**).
- Separate hose/line without using tools.
- When assembling ensure that retaining tabs (**A**) are engaged securely.

23 Fuel Injection–Diesel (1.9L Engine)

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GENERAL

This repair group covers the diesel fuel injection system for the 1.9 liter Turbo Direct Injection (TDI) diesel and the 1.9 liter PD (Pumpe Duse, or Pump Injection) TDI diesel engine. Testing for both TDI glow plug systems is covered in **28b Ignition System–Diesel (1.9L engine)**.

Engine Codes

- ALH . . . . . 1.9L 4-cylinder TDI diesel
- BEW . . . . . 1.9L 4-cylinder PD TDI diesel

NOTE —

- *Repairs and adjustments to the injection pump require specialized equipment, and parts for rebuilding are not generally available. Faulty pumps must be serviced by the manufacturer. Internal problems usually require replacement of the pump.*
- *Adjustments and repairs to the fuel injection system should be made carefully. Cleanliness is especially important. Always clean fuel unions before removing lines.*
- *Diesel fuel is damaging to rubber. Wipe off any fuel that spills on hoses, wiring, and rubber steering and suspension parts and wash with soap and water. If coolant hoses have been contaminated with diesel fuel, they must be replaced.*
- *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using a VAG 1551/1552 or equivalent scan tool.*

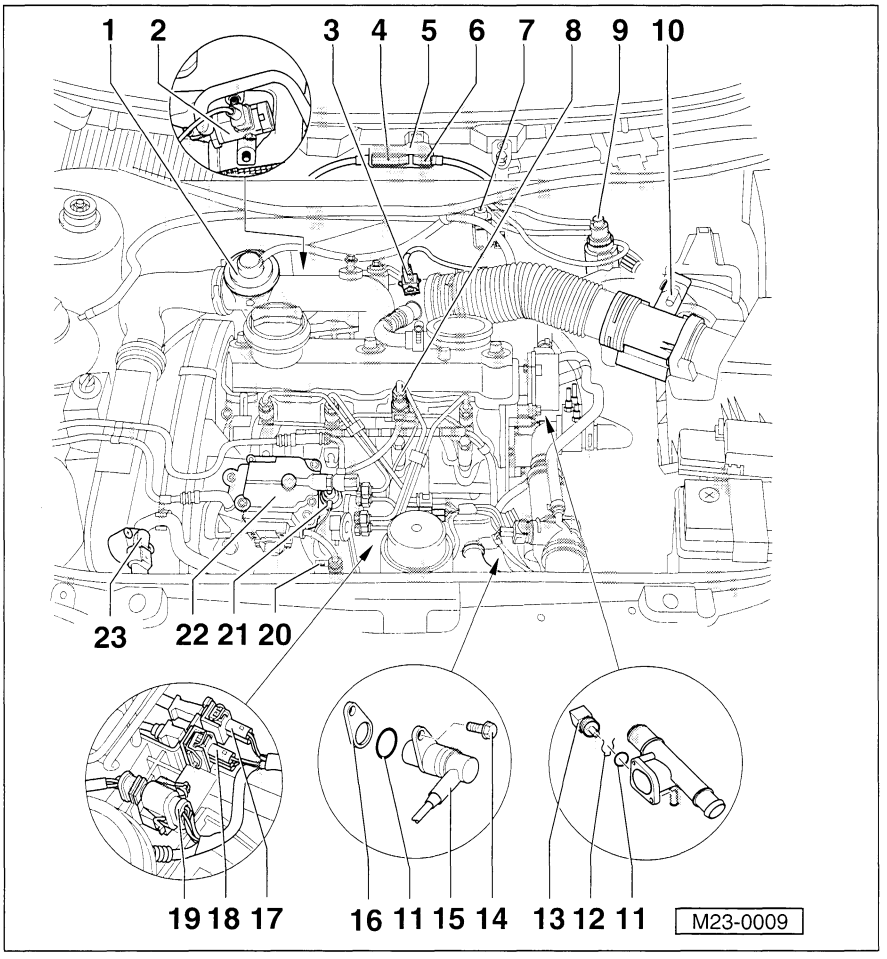
DIESEL INJECTION SYSTEM (1.9L TDI DIESEL)

Major components of the TDI diesel injection system are shown on pages 3 and 4 of this section. Additional components not shown in this illustration are identified by letter at the end of the numbered list.

NOTE —

Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed as an aid to electrical troubleshooting particularly when working with the wiring diagrams.*

Diesel injection system, component overview (1999-2001 m.y.)



1. **EGR valve**
2. **Intake manifold change-over valve (N239)**
3. **Positive Crankcase ventilation (PCV) heating element (N79)**
   - Check voltage supply between terminals 1 and 2 of connector with ignition on; specification: at least 11.5V
4. **ECM Connector I**
   - Through m.y. 1999: 52 pin
   - From m.y. 2000: 81 pin
   - Only disconnect or connect with ignition switched off
5. **Diesel direct injection system ECM (J248)**
   - With BARO (altitude) sensor (F96)
6. **ECM Connector II**
   - Through m.y. 1999: 28 pin
   - From m.y. 2000: 40 pin
   - Only disconnect or connect with ignition switched off
7. **EGR vacuum regulator solenoid valve (N18)**
8. **Injector**
   - For cylinder #3 only, with needle lift sensor (G80)
9. **Wastegate bypass regulator valve (N75)**
10. **Mass air flow sensor (G70)**
11. **O-ring**
    - Always replace
12. **Retaining clip**
    - Ensure correct seating
13. **Engine coolant temperature sensor (G62)**
    - Release pressure in cooling system before removing
    - Integral with gauge sensor G2
14. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
15. **Engine speed sensor (G28)**
16. **Spacer**
17. **Harness connector**
    - For needle lift sensor (G80)
    - Brown, 2-pin
18. **Harness connector**
    - For engine speed sensor (G28)
    - Black, 2-pin
19. **Harness connector**
    - For fuel temperature sensor (G81)
    - For cold start injector (N108)
    - For fuel shut-off valve (N109)
    - For quantity adjuster (N146)
    - For modulating piston displacement sensor (G149)
    - Black, 10-pin
20. **Cold start injector (N108)**
    - Does not inject fuel; modifies cold injection timing
21. **Fuel shut-off valve (N109)**
22. **Injection pump quantity adjuster**
    - With fuel temperature sensor (G81)
    - With quantity adjuster (N146)
    - With modulating piston displacement sensor (G149)
23. **Manifold absolute pressure sensor (G71) and intake air temperature sensor (G72)**

A. **Brake pedal switch (F47) and brake light switch (F) (not shown)**
   - Located in combined housing in footwell on brake pedal bracket

B. **Throttle position sensor (G79) (not shown)**
   - Located in footwell on throttle pedal support bracket
   - In case of malfunction, the scan tool display is Throttle Position Sensor G69

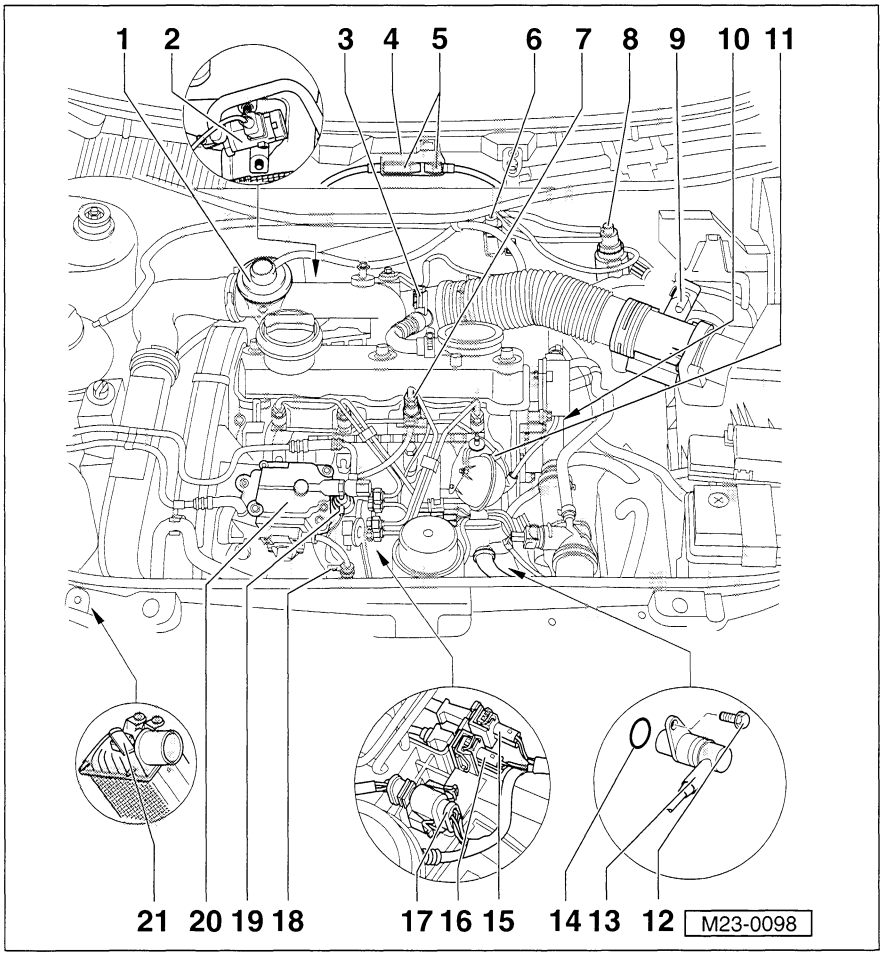
C. **Clutch pedal switch (F36) (not shown)**
   - Located in footwell on clutch pedal support bracket

D. **Malfunction Indicator Light, MIL (K83) and Glow plug warning light (K29)**
   - In instrument cluster

NOTE —

Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed as an aid to electrical troubleshooting.*

Diesel injection system, component overview (2002-2003 m.y.)



1. **EGR valve**
2. **Intake manifold change-over valve (N239)**
3. **Positive Crankcase ventilation (PCV) heating element (N79)**
   - Check voltage supply between terminals 1 and 2 of connector with ignition on; specification: at least 11.5V
4. **Diesel direct injection system ECM (J248)**
   - With BARO (altitude) sensor (F96)
5. **ECM Connectors**
   - **Connector I**
   - Through m.y. 1999: 52 pin
   - From m.y. 2000: 81 pin
   - **Connector II**
   - Through m.y. 1999: 28 pin
   - From m.y. 2000: 40 pin
   - Only disconnect or connect with ignition switched off
6. **EGR vacuum regulator solenoid valve (N18)**
7. **Injector**
   - For cylinder #3 only, with needle lift sensor (G80)
8. **Wastegate bypass regulator valve (N75)**
9. **Mass air flow sensor (G70)**
10. **Engine coolant temperature sensor (G62)**
    - Release pressure in cooling system before removing
11. **Vacuum reservoir**
12. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
13. **Engine speed sensor (G28)**
14. **O-ring**
    - Always replace
15. **Harness connector**
    - For needle lift sensor (G80)
    - Brown, 2-pin
16. **Harness connector**
    - For engine speed sensor (G28)
    - Brown, 3-pin
17. **Harness connector**
    - For fuel temperature sensor (G81)
    - For cold start injector (N108)
    - For fuel shut-off valve (N109)
    - For quantity adjuster (N146)
    - For modulating piston displacement sensor (G149)
    - Black, 10-pin
18. **Cold start injector (N108)**
    - Does not inject fuel; modifies cold injection timing
19. **Fuel shut-off valve (N109)**
20. **Injection pump quantity adjuster**
    - With fuel temperature sensor (G81)
    - With quantity adjuster (N146)
    - With modulating piston displacement sensor (G149)
21. **Manifold absolute pressure sensor (G71) and intake air temperature (IAT) sensor (G72)**

A. **Brake pedal switch (F47) and brake light switch (F) (not shown)**
   - Located in combined housing in footwell on brake pedal bracket

B. **Throttle position sensor (G79) (not shown)**
   - Located in footwell on throttle pedal support bracket
   - In case of malfunction, the scan tool display is Throttle Position Sensor G69

C. **Clutch pedal switch (F36) (not shown)**
   - Located in footwell on clutch pedal support bracket

D. **Malfunction Indicator Light, MIL (K83) and Glow plug warning light (K29)**
   - In instrument cluster

NOTE —

Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed as an aid to electrical troubleshooting.*

Troubleshooting

Proper operation of the diesel engine requires a supply of clean fuel under pressure, an unrestricted supply of air, and properly timed fuel delivery. Fuel must be of the proper grade and properly winterized for cold-start and cold-running conditions. Dirt and water can interfere with combustion and will cause problems.

Good compression is especially necessary for the engine to run well. Engine mechanical faults leading to poor compression can cause problems that may seem to be injection related. Engine lubricating oil that leaks past worn piston rings, valve stem seals or turbocharger seals may produce exhaust smoke that also can be mistaken for fuel injection problems.

A faulty glow plug system may contribute to cold starting problems. See **28b Ignition System–Diesel (1.9L engine)**. The battery must have the correct electrical capacity and the starter must be able to turn the engine fast enough (generally at least 150 rpm) to begin compression ignition. See **27 Engine Electrical System**. Insufficient engine power can also be the result of turbocharger or intercooler malfunctions. See **21 Turbocharger and Intercooler**.

Because the diesel engine speed is controlled by the amount of fuel injected and not by the amount of air admitted past a throttle plate, the air intake must be unrestricted. A clogged air filter, faulty turbocharger, or restricted intercooler can lower the air flow and reduce power output.

The injection pump, under the control of the Engine Control Module (ECM), produces the high pressure necessary to open the injectors and spray fuel. Fuel leaks or air in the fuel lines may reduce system pressure. Since power is controlled by the amount of fuel injected, low pressure may cause sluggish performance.

For cold starting, when the compression heat necessary for combustion is dissipated quickly by a cold engine, injection timing is automatically advanced by the ECM to give the fuel more time to burn. At higher rpm, there is less time for fuel to burn, so injection timing is advanced to start the fuel burning sooner. Since the injection pump is driven by the engine and externally mounted, its precise fuel metering and timing can be degraded by such things as a loose timing belt, worn sprocket, or loose mounting bolts. Correct Cetane rating as specified by the vehicle's Owner's Manual will profoundly influence starting and overall performance as well.

Most of the in-depth troubleshooting of this electronically controlled engine management system will require the use of a scan tool or diagnostic computer. These include the Volkswagen supplied VAG 1551/1552, VAS 5051/5052, or equivalent, or aftermarket scan tool computer programs. In most cases, problems of an electrical nature will cause a Diagnostic Trouble Code (DTC) to be

stored in the ECM. Also, many mechanical problems can be picked up by he system and stored as electrical malfunctions. In these instances, the MIL and/or the glow plug light will be illuminated.

Even though the above mentioned warning lights may be on, there are several basic tests that should not be overlooked. After the repair is made, the system will generally recognize this situation and switch off the light. The DTC will remain in the ECM memory for a time and will erase itself after a programmed number of cycles.

Table a lists symptoms, their probable causes, and corrective actions. The boldface type refers to other sections in the manual where the repairs are described.

Table a. TDI Diesel Fuel Injection Troubleshooting

Problem	Probable cause	Corrective action
1. Engine does not start	a. Cranking speed too low or will not crank	a. Repair starting system or charge/replace battery. See **27 Engine Electrical Systems.**
	b. No fuel or wrong fuel in fuel tank	b. Verify sufficient fuel of correct type in tank. Add as necessary.
	c. No voltage at fuel cut-off valve on injection pump. Fuel cut-off valve loose or faulty	c. Valve should click each time ignition is turned on and off. If not, check for voltage at connector. See **97 Wiring Diagrams, Fuses and Relays.** Replace a faulty solenoid.
	d. No voltage at glow plug bus or glow plug(s) faulty	d. The glow plug circuit is activated by the Engine Control Module. See **28b Ignition System–Diesel (1.9L engine)** for glow plug testing and repair information.
	e. Excessive air in fuel system	e. Check fuel supply lines from fuel tank for cracks and connections for leaks, especially at and around fuel filter and injection pump inlet.
	f. Injection pump not delivering fuel	f. Check for basic fuel delivery to engine. Check for cracked or damaged lines, clogged fuel filter or other fuel supply problems.
	g. Injection timing incorrect	g. Adjust injection timing. Requires scan tool VAG 1551/1552.
	h. Faulty injectors	h. Test and, if necessary, replace injectors.
	i. Engine mechanical faults	i. Test compression. See **15b Cylinder Head and Valvetrain (1.9L engine).**
	j. Faulty injection pump	j. Replace pump.
	k. Fault in engine speed sensor (G28)	k. Test sensor at connector.
	l. Fault in ECM or other engine management system component	l. Interrogate permanent fault memory. Repair or replace components as required. Requires scan tool VAG 1551/1552.
2. Glow plug warning light not working	a. Bulb burned out or malfunction in glow plug relay circuit	a. Test and repair as described in **28b Ignition System–Diesel (1.9L engine).**
3. Idle speed incorrect, rough or irregular	a. Accelerator pedal or linkage binding	a. Remove driver's side trim panels under dash and inspect pedal and linkage for free movement. Repair as required.
	b. Excessive air in fuel system	b. Check fuel supply line from fuel tank for cracks, kinks, or leaks.
	c. Clogged fuel filter, or fuel return line and injector pipes leaking, dirty, kinked, or damaged at connectors	c. Inspect and, if necessary, replace lines and hoses, replace fuel filter. See **0 Maintenance.**
	d. Faulty injectors	d. Test and, if necessary, replace injector.
	e. Injection timing incorrect	e. Adjust injection timing. Requires scan tool VAG 1551/1552.
	f. Engine mechanical faults	f. Test compression. See **15b Cylinder Head and Valvetrain (1.9L engine).**
	g. Faulty injection pump	g. Replace pump.

Table a. TDI Diesel Fuel Injection Troubleshooting

Problem	Probable cause	Corrective action
4. Smoky exhaust (black, blue, or white)	**a.** Faulty injectors	**a.** Check and, if necessary, replace injectors.
	b. Injection timing incorrect	**b.** Adjust injection timing. Requires scan tool VAG 1551/1552.
	c. Turbocharger leaking internally	**c.** Inspect and repair, or replace turbocharger.
	d. Engine mechanical faults	**d.** Test compression. See **15b Cylinder Head and Valvetrain (1.9L engine)**.
	e. Faulty injection pump	**e.** Replace pump.
	f. Fault in ECM or other engine management system component	**f.** Interrogate permanent fault memory. Repair or replace components as required. Requires scan tool VAG 1551/1552.
5. Poor power output, slow acceleration or top speed	**a.** Accelerator pedal or linkage binding	**a.** Remove driver's side trim panels under dash and inspect pedal and linkage for free movement. Repair as required.
	b. Air filter dirty or restricted	**b.** Clean or replace air filter. Inspect housing and ducting for debris. See **0 Maintenance.**
	c. Clogged fuel filter; or fuel return line and injection pipes leaking, dirty, kinked, or damaged at connections	**c.** Check for basic fuel delivery to engine. Inspect and, if necessary, replace lines and hoses, replace fuel filter. See **0 Maintenance.**
	d. Excessive air in fuel system	**d.** Check fuel supply line from fuel tank for cracks, kinks, or leaks, especially at and around fuel filter and injection pump inlet.
	e. Faulty injectors	**e.** Check and, if necessary, replace injectors.
	f. Injection timing incorrect	**f.** Adjust injection timing. Requires scan tool VAG 1551/1552.
	g. Engine mechanical faults	**g.** Test compression. See **15b Cylinder Head and Valvetrain (1.9L engine)**.
	h. Faulty injection pump	**h.** Replace pump.
	i. Fault in ECM or other engine management system component	**i.** Interrogate permanent fault memory. Repair or replace components as required. Requires scan tool VAG 1551/1552.
6. Engine runs at a high constant idle and speed does not vary	**a.** Throttle position sensor (G79), malfunctioning	**a.** Interrogate permanent fault memory. Repair or replace components as required. Requires scan tool VAG 1551/1552.
7. Excessive fuel consumption	**a.** Air filter dirty or restricted	**a.** Clean or replace air filter element. Inspect housing and ducting for debris. See **0 Maintenance**.
	b. Fuel leaks	**b.** Check and, if necessary, replace or tighten all pipes, hoses and connections.
	c. Fuel return pipe blocked or restricted	**c.** Check return line for kinks and dents; replace faulty lines. If line is clogged, blow it out with compressed air, then bleed fuel system.
	d. Faulty injectors	**d.** Test and, if necessary, repair or replace injectors.
	e. Injection timing incorrect	**e.** Adjust injection timing. Requires scan tool VAG 1551/1552.
	f. Faulty injection pump	**f.** Replace pump.
	g. Fault in ECM or other engine management system component	**g.** Interrogate permanent fault memory. Repair or replace components as required. Requires scan tool VAG 1551/1552.

Diagnostic quick checks

These tests are used to isolate and diagnose diesel fuel system problems. It is assumed that the glow plug system is functioning within normal parameters and that injection pump timing and valve timing are correct.

NOTE —

Testing and repair information on the diesel glow plug system is covered in **28b Ignition System–Diesel (1.9L engine).**

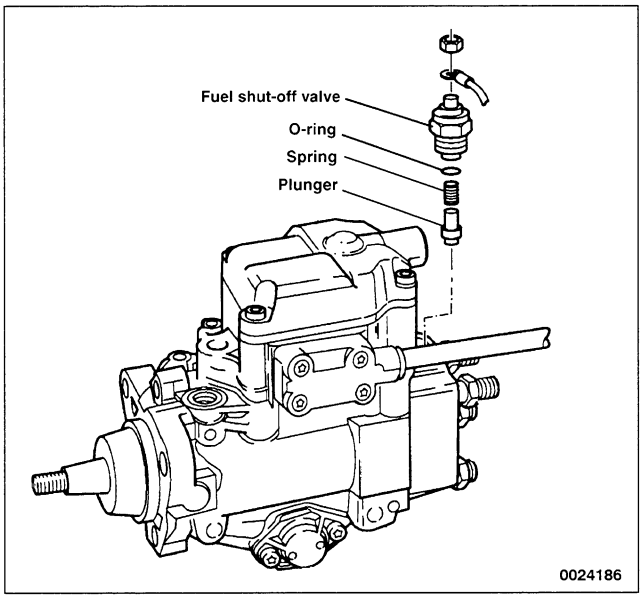
Fuel shut-off valve, checking

The diesel engine is stopped by cutting off its fuel supply. This is done by means of an electrical solenoid (N109) located on the diesel injection pump. The solenoid is energized by the ECM with the key switched on. This opens a passage within the pump allowing fuel to flow internally. When the key is switched off, the ECM cuts power to the solenoid and the engine stops. If the valve does not work, the engine will not start. Conversely, a faulty valve could also allow the engine to continue running after the key is switched off.

– Turn ignition key on and off without operating the starter. Listen for the valve to operate.
  - The fuel cut-off valve should click open when the key is turned on and click closed when the key is turned off. Do not confuse this sound with continuous sounds coming from other electronic components on the pump.

– If valve does not operate, check for voltage at harness connector with key on.
  - If voltage is not present, check for wiring faults. See **97 Wiring Diagrams, Fuses and Relays.**
  - If voltage is present, disconnect battery ground (GND) strap from battery negative (–) terminal and proceed with step 3. See the **Caution** at the beginning of this repair group regarding battery disconnection.

NOTE —
Before disconnecting battery cables, be sure to obtain radio anti-theft code.



➤ Clean the area around fuel shut-off valve and remove the valve, spring and plunger.

WARNING —
Fuel will be expelled. Do not smoke or work near heaters or other fire hazards. Have a fire extinguisher handy.

– Clean and inspect solenoid plunger and seat. Slide plunger into the valve without spring and check for free movement. If plunger does not move freely, replace valve assembly.

– Carefully check for dirt and metal particles in valve bore of injection pump. The slightest amount of debris can cause malfunctions.

– Install fuel cut-off valve using a new O-ring.

– Reconnect battery negative (–) terminal.

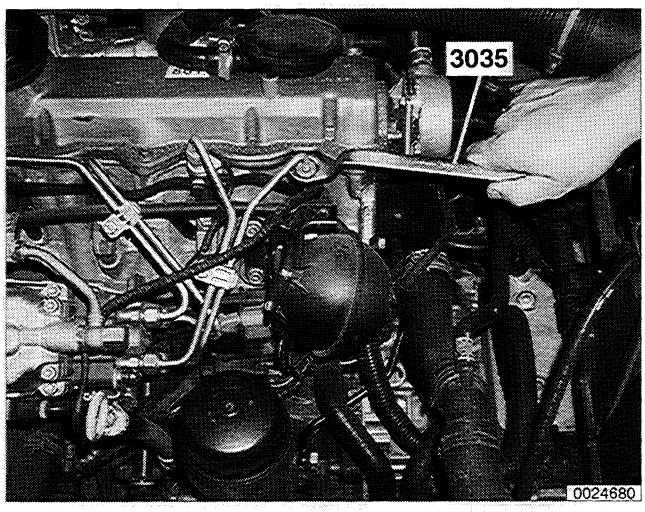
Tightening Torque
- Fuel shut-off valve to injection pump 40 Nm (30 ft-lb)

– Be sure to quality check your work, see **Quality Review** at the end of this repair group.

Basic fuel delivery, checking

This test checks if fuel is being delivered to the pump and fuel injectors. Make this test when experiencing hard starting or no-start problems.

– Check visually for fuel leaks on injector pump and especially around injector line unions.



➢ If no leaks are found, clean the fuel union nut for cylinder No. 1 fuel injector pipe at the injector. Slightly loosen the fuel union nut using a flare-nut wrench (Volkswagen special tool 3035 shown)

NOTE —

Flare-nut wrench 3035 is shown on injector union nut for cylinder #4 on an earlier diesel engine version. The same tool is used on TDI (1.9L) diesel engines covered by this manual.

WARNING —

- *Loosen the nut only about one-half turn to limit the amount of fuel leakage. The fuel injection system operates at very high pressure. Keep hands and eyes clear. Wear heavy gloves and eye protection. Wrap a cloth around the nut when loosening.*
- *Fuel will be expelled. Do not smoke or work near heaters or other fire hazards. Have a fire extinguisher handy.*

– Crank the engine and look for fuel to run out of the loosened union nut at the injector.

WARNING —

Diesel fuel is damaging to rubber. Wipe off any fuel that spills on hoses, wiring, and rubber steering and suspension parts and wash with soap and water. If coolant hoses have been contaminated with diesel fuel, they must be replaced.

– If no fuel is observed, the most likely cause is a restriction or air leak in fuel lines between fuel tank and injection pump, or possibly a clogged fuel filter. It is also possible that vehicle has run out of fuel regardless of fuel gauge readings. If vehicle has a semi-transparent plastic fuel pipe on the supply side of diesel injection pump, check for movement of fuel in the line.

NOTE —

A stream of tiny air bubbles moving in the line is normal (unlike previous versions of the diesel engine).

– If fuel is observed, but engine still fails to start, consult **Table a**, given earlier, for additional troubleshooting checks.

NOTE —

It is not necessary to test basic fuel delivery on the remaining three cylinders due to the way the TDI system operates.

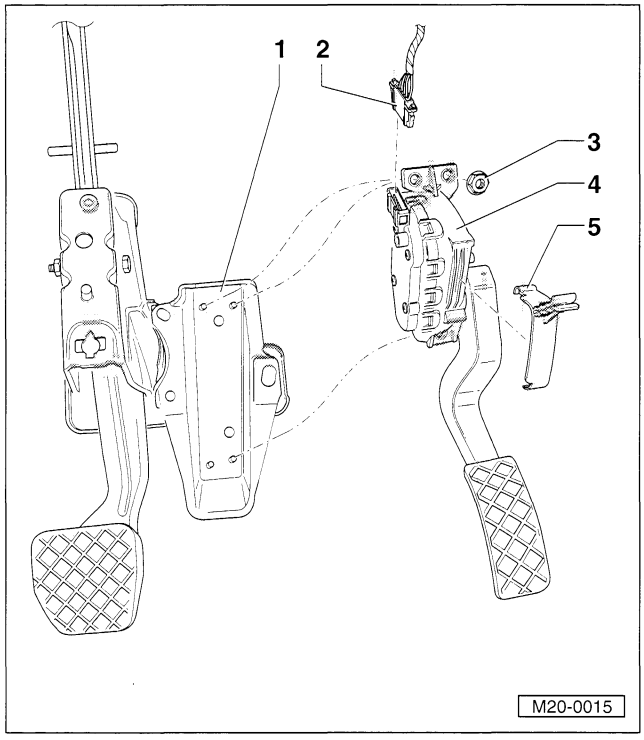
– When finished testing, tighten the fuel union nuts and check for leaks. Clean up any spilled fuel.

Tightening torque

- Fuel injector union nut to injector or pump . . . . . 25 Nm (18 ft-lb)

– Be sure to quality check your work, see **Quality Review** at the end of this repair group.

Throttle position sensor



Fuel quantity is controlled by the Engine Control Module (ECM) in TDI equipped vehicles. There is no accelerator cable connection between the pedal and the engine.

The throttle position sensor is part of the electronic accelerator. This system is described as electronic throttle control (EPC) in **2 General Information** as well as in **20 Fuel Storage and Supply**.

1. Pedal mounting bracket
- Bracket supports accelerator and brake pedals

2. Connector
- Black, 6-pin

3. Nut
- Tighten to 10 Nm (7 ft-lb)

4. Throttle Position Sensor (G79)

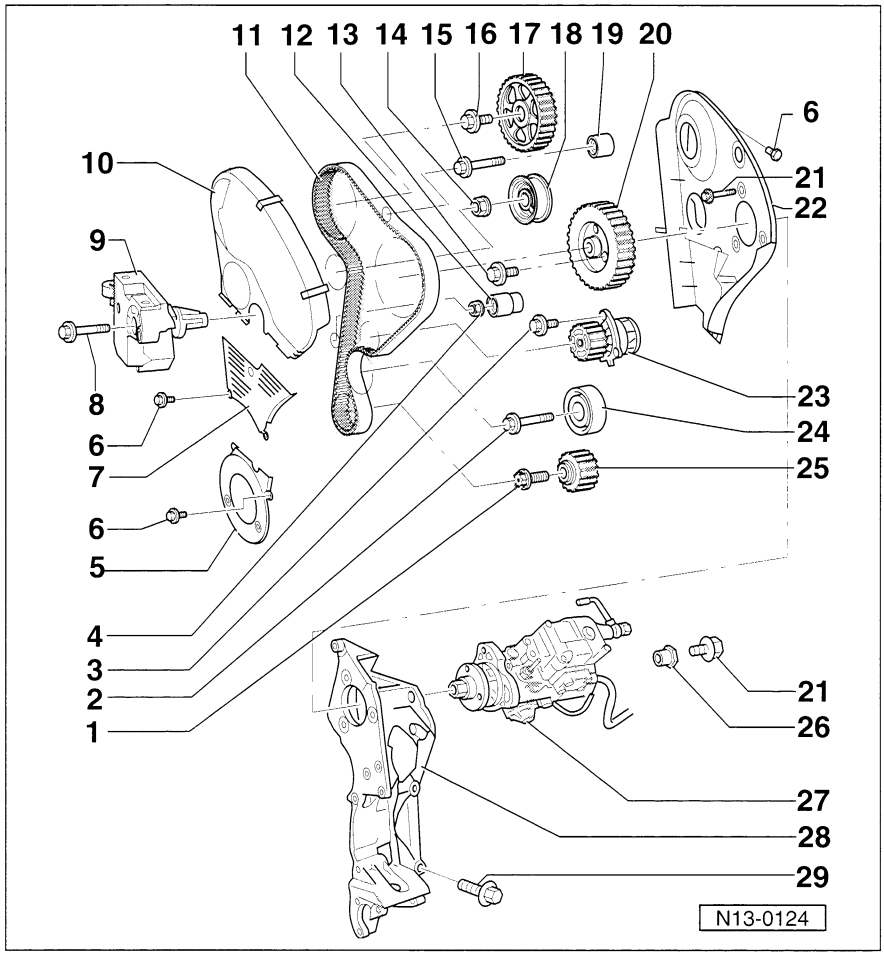
5. Bracket
- For cover in footwell
- Clipped to throttle position sensor

Testing and adjustment of the throttle position sensor requires the use of a scan tool or diagnostic computer such as VAG 1551/1552, VAS 5051/5052 or equivalent. Faults related to the throttle position sensor will be stored as diagnostic trouble codes (DTCs) in the ECM. If the fault is severe enough, the ECM will ignore the throttle position sensor completely and run the engine at a constant high idle speed. This should enable the driver to reach the nearest workshop.

Timing belt, camshaft/injection pump drive

Any time the camshaft drive belt is removed or installed, camshaft and injection pump timing must be checked and adjusted as required. Special tools are required for setting drive belt tension, camshaft TDC position, and injection pump timing. In addition, a scan tool such as the VAG 1551/1552 is required to properly set injection pump timing on this electronically controlled diesel injection system. The illustration at right shows an exploded view of the camshaft/injection pump drive belt assembly on the 1.9L Turbo Direct Injection diesel engine. See **15b Cylinder Head and Valvetrain (1.9L Engine)** for timing belt removal and installation.

Timing belt - camshaft drive, assembly



1. **Bolt**
   - Always replace
   - Tighten to 120 Nm (88 ft-lb) + ¼ turn (90°)
   - To loosen and tighten, counter-hold with 3099, 3415, or similar
   - Threads and shoulder must be free of oil and grease
   - Additional quarter turn can be obtained in two $^{1}/_{8}$ turn (45°) stages
2. **Bolt**
   - Always replace
   - Tighten to 40 Nm (30 ft-lb) + ¼ turn (90°)
3. **Bolt**
   - Tighten to 15 Nm (11 ft-lb)
4. **Nut**
   - Tighten to 22 Nm (16 ft-lb)
5. **Timing belt guard, lower section**
6. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
7. **Timing belt guard, middle section**
8. **Bolt**
   - Tighten to 45 Nm (33 ft-lb)
9. **Right engine mount**
10. **Timing belt guard, upper section**
11. **Timing belt**
    - Mark engine direction of rotation before removing
    - Check for wear
    - Do not kink
12. **Idler pulley**
13. **Bolt**
    - Always replace
    - Tighten to 20 Nm (15 ft-lb) + ¼ turn (90°)
14. **Nut**
    - Tighten to 20 Nm (15 ft-lb)
15. **Bolt**
    - Tighten to 20 Nm (15 ft-lb)
16. **Bolt**
    - Tighten to 45 Nm (33 ft-lb)
    - To loosen and tighten bolt, counter-hold using 3036
17. **Camshaft sprocket**
    - Release from camshaft using two-arm puller
18. **Tensioning roller**
    - Semi-automatic timing belt tensioning roller
19. **Idler pulley**
20. **Injection pump sprocket**
    - Two piece construction
21. **Bolt**
    - Tighten to 30 Nm (22 ft-lb)
22. **Timing belt guard, rear**
23. **Coolant pump**
    - Check impeller for ease of movement
24. **Idler pulley**
    - Remove before removing coolant pump
25. **Crankshaft timing belt drive sprocket**
26. **Bushing, threaded**
27. **Diesel injection pump**
28. **Assembly bracket**
    - Mounting for diesel injection pump, generator, power steering pump, and air conditioner compressor
29. **Bolt**
    - Tighten to 45 Nm (33 ft-lb)

Injection pump

The diesel fuel injection pump is controlled by the ECM and performs three primary functions:

- It takes the fuel from the tank and pressurizes it to over 3300 psi.
- It precisely times the delivery of fuel to the injectors.
- It accurately meters the quantity of fuel delivered to the injectors.

The pump is driven by the same toothed drive belt that drives the camshaft at 1/2 crankshaft speed. Internal parts are lubricated and cooled by the diesel fuel. No routine maintenance is required or possible because no internal repair parts are available through the Volkswagen parts system.

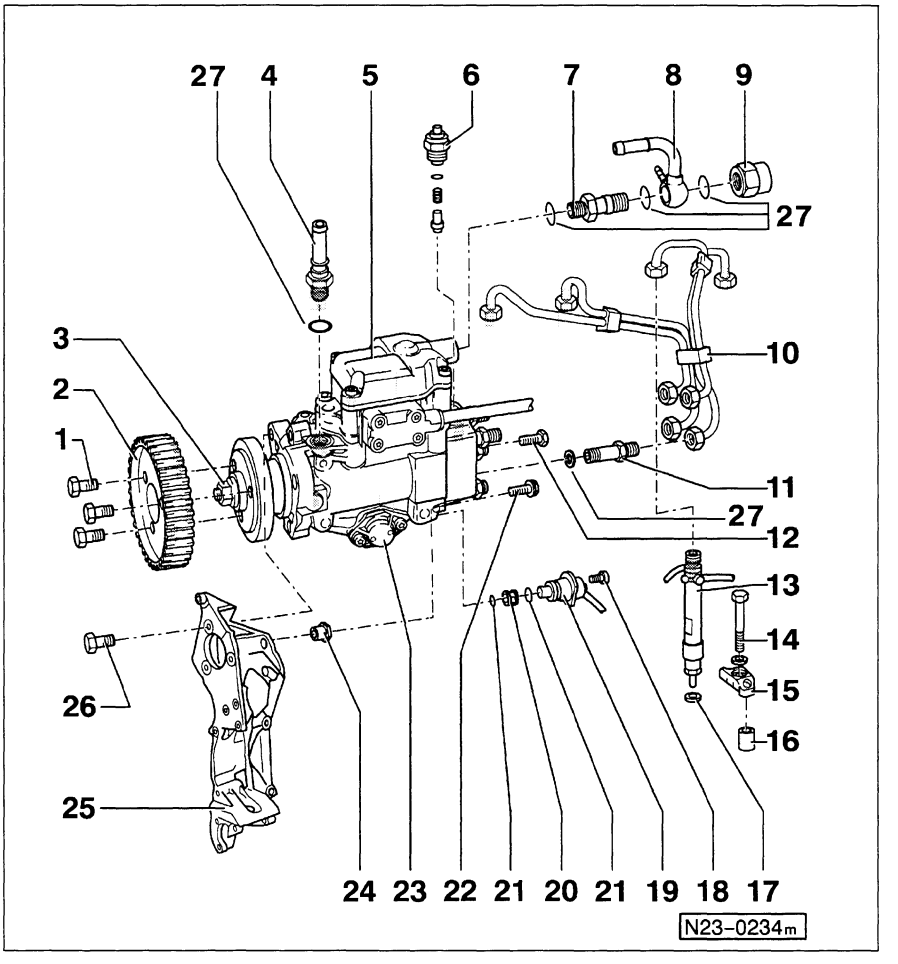
Because the Turbo Direct Injection system is fully electronic, the ECM can detect and store most faults associated with the injection pump. These faults are known as DTCs and are held in the ECM memory. Most DTCs will turn on the malfunction indicator light (MIL) and/or the glow plug light, alerting the driver to this condition. In addition, the ECM has diagnostic capabilities that allow an experienced technician with a scan tool to view certain operating parameters of the injection pump and other parts of the system. These must be investigated before a decision is made to replace an injection pump.

The illustration on the next page shows the diesel injection pump with related components and mounting and attaching hardware.

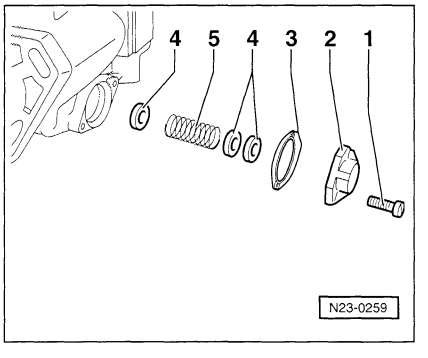
NOTE —

Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed as an aid to electrical troubleshooting.*

Injection pump assembly



1. **Bolts**
   - Tighten to 20 Nm (15 ft-lb) plus ¼ turn (90°)
   - Always replace
2. **Injection pump sprocket**
3. **Injection pump sprocket nut**
   - Do not loosen for any reason!
4. **Union**
   - Supply line from fuel filter
   - Tighten to 25 Nm (18 ft-lb)
5. **Diesel injection pump**
   - With quantity adjuster (N146)
   - With modulating piston displacement sensor (G149)
   - With Fuel Temp Sensor (G81)
6. **Fuel shut off valve (N109)**
   - Tighten to 25 Nm (18 ft-lb)
7. **Union**
   - Return line from diesel injection pump
8. **Return line**
   - To control valve on fuel filter
9. **Cap nut**
   - Tighten to 25 Nm (18 ft-lb)
10. **Fuel injector lines**
    - Tighten to 25 Nm (18 ft-lb)
    - Always remove as a complete assembly
    - Do not bend, kink or alter shape
    - Remove and install with VW special tool 3035
11. **Union**
    - To injector lines
    - With check valve
    - Tighten to 45 Nm (33 ft-lb)
12. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
13. **Fuel injector**
    - Cylinder # 3 with needle lift sensor (G80)
14. **Bolt**
    - Tighten to 20 Nm (15 ft-lb)
15. **Injector retainer**
    - Use special washer only
16. **Injector retainer mounting**
    - Fits into machined hole in cylinder head
17. **Sealing washer**
    - Always replace
18. **Bolt**
    - Bolt
    - Tighten to 10 Nm (7 ft-lb)
19. **Cold Start Injector (N108)**
    - Controls start of injection (timing)
20. **Strainer**
    - Clean as necessary
21. **O-ring**
    - Always replace
22. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
23. **Timing control cover**
    - See below to replace gasket
24. **Rear sleeve nut**
25. **Assembly bracket**
    - For injection pump, generator, power steering pump
    - Shown for vehicles without A/C
26. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
27. **Seals**
    - Always replace



Timing control cover gasket, replacing

– Place clean cloth under injection pump and remove cover screws (**1**) with Torx driver.

– Remove cover (**2**) and clean.

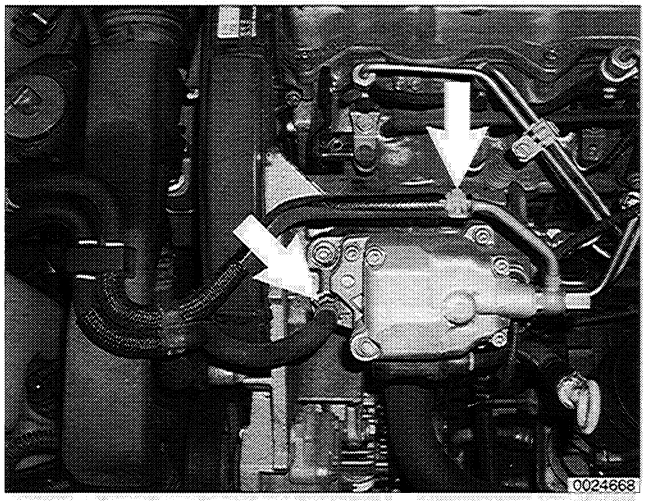
– Replace gasket (**3**) and install cover.

– Tighten cover screws to 12 Nm (9 ft-lb)

Injection pump, removing

Removal of the injection pump requires partial removal of the camshaft timing belt and the injection pump. Special Volkswagen tools including scan tool VAG 1551 or VAG 1552 are required to remove and install the diesel injection pump and properly set it up.

– Remove upper engine cover.



➢ Remove fuel supply (**lower arrow**) and return lines (**upper arrow**) at injector pump.

– Remove injector fuel lines as an assembly using a flair nut wrench (3035) as shown earlier.

> ***WARNING —***
> *Fuel will be expelled. Do not smoke or work near heaters or other fire hazards. Have a fire extinguisher handy.*

NOTE —

- *Always remove two-piece line set as a complete unit. Do not alter the shape of the lines, eventual damage will result.*
- *Cover all open fuel fittings with a clean cloth to prevent contamination.*

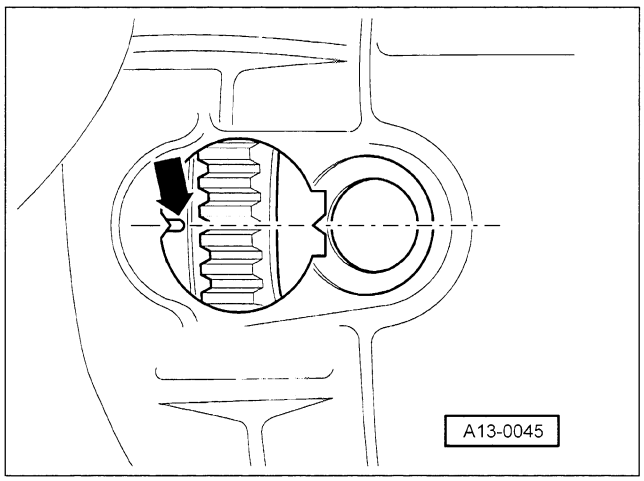
– Remove right side headlight, see **94 Lights, Accessories–Exterior**.

– Remove connecting hose between intercooler and intake manifold, see **21 Turbocharger and Intercooler**.

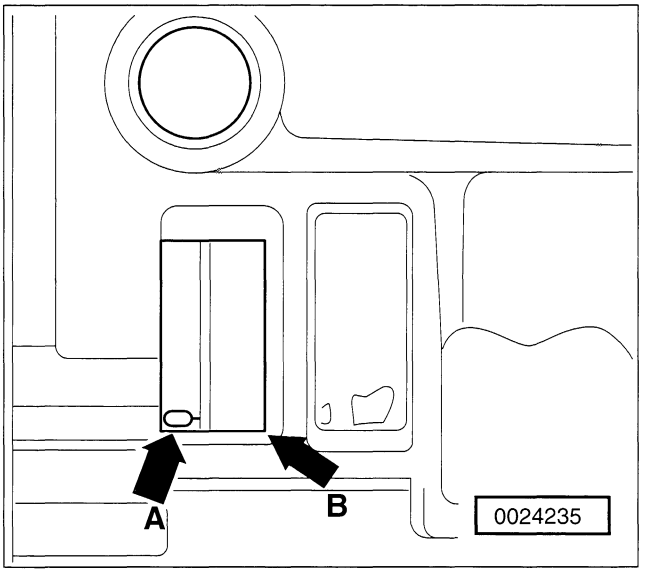
– Remove upper timing belt guard.

– Remove vacuum pump from end of cylinder head.

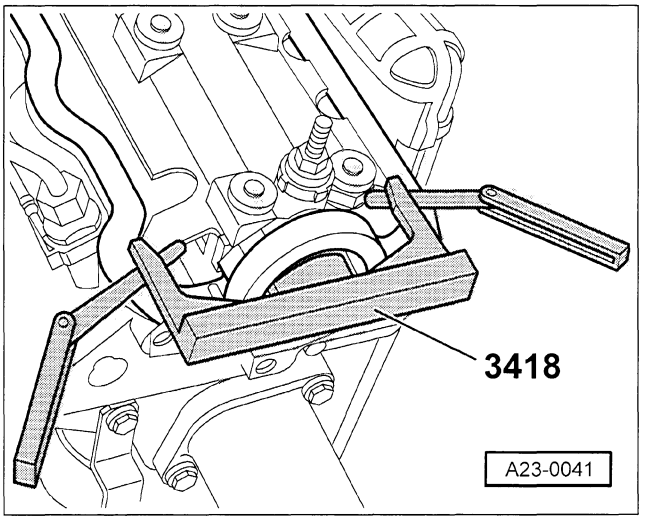
– Remove cylinder head (valve) cover.



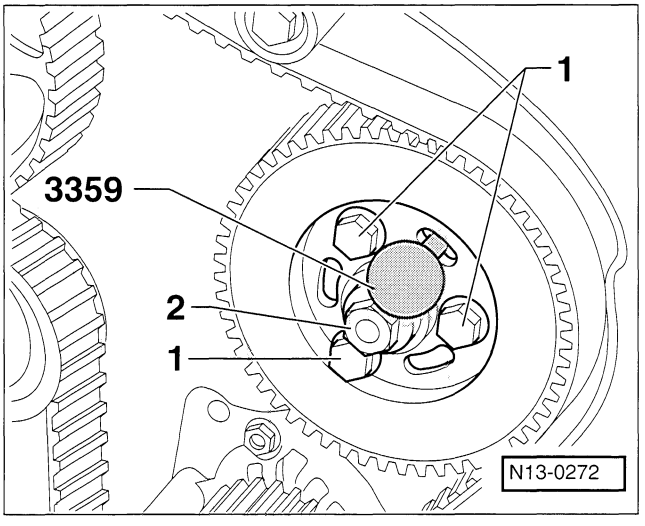
➢ For vehicles with manual transmission set engine to top dead center (TDC), for cylinder #1 by turning crankshaft until timing mark on flywheel (**arrow**) aligns with mark on transmission case.



➢ For vehicles with automatic transmission set engine to top dead center (TDC), for cylinder #1 by turning crankshaft until timing mark on torque converter (**arrow A**) aligns with lower edge of opening on transmission case (**arrow A**).



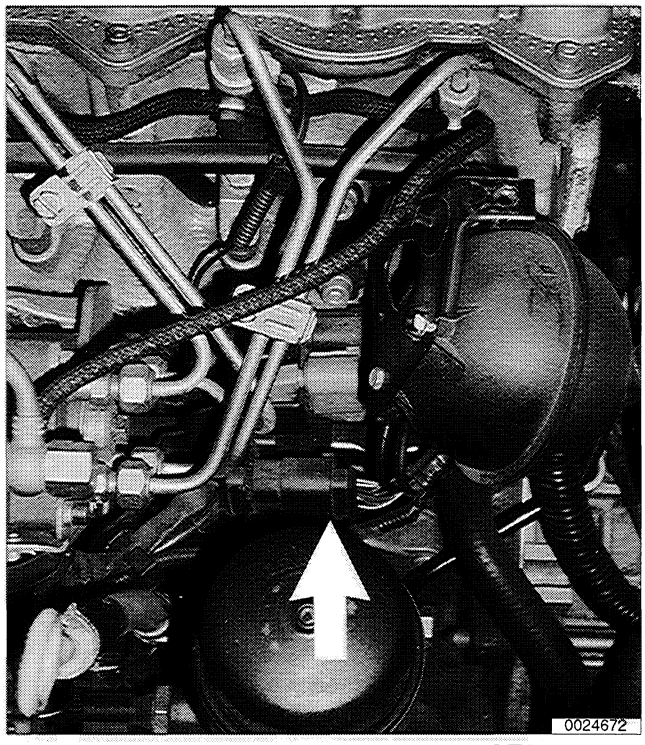
➢ Lock camshaft at TDC with a setting bar such as Volkswagen special tool 3418 and centralize using feeler gauges placed under each end of tool.



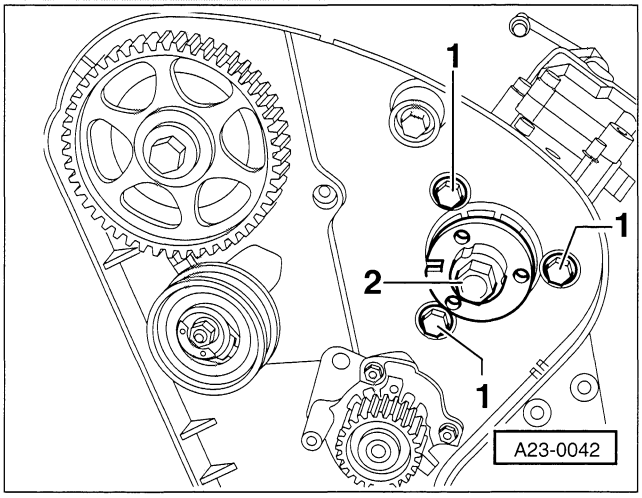
➢ Lock injection pump sprocket with VW special tool 3359 locking pin. Remove injection pump sprocket mounting bolts (**1**). Do not remove hub nut (**2**).

> ***WARNING —***
> *Do not loosen the center sprocket nut for any reason. Loosening this nut will allow the sprocket to move on the shaft resulting in altered basic settings which CANNOT be reset with normal workshop equipment.*

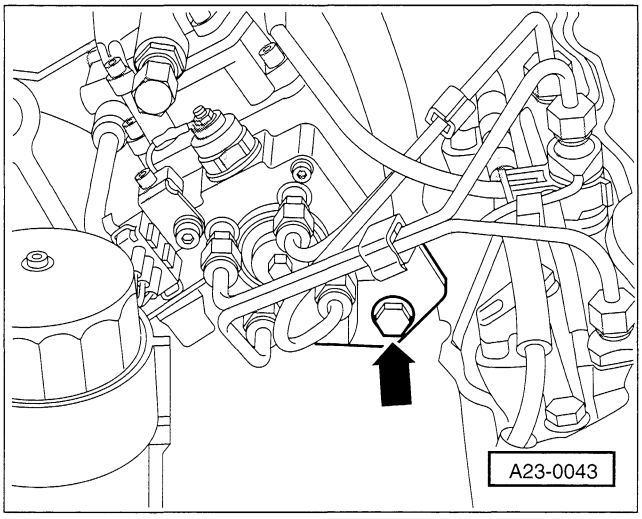
– Release the tensioning roller and slip timing belt off the camshaft sprocket



➢ Disconnect the harness connector (**arrow**) for the diesel pump electronics and unclip the connector from the retaining bracket.



➢ Remove front injection pump mounting bolts (**1**) from assembly bracket. Do not loosen center sprocket nut (**2**).



➢ Remove rear injection pump mounting bolt (**arrow**) from support bracket.

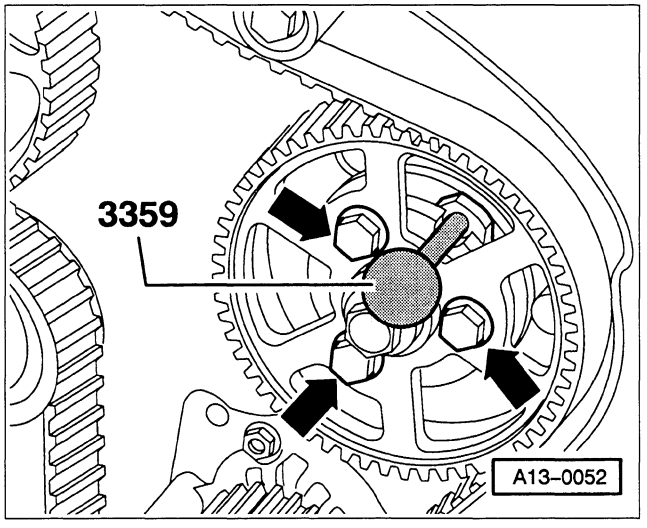
– Carefully slide pump shaft out of assembly bracket and lift pump out.

– If pump will not be immediately reinstalled, take steps to insure that no dirt can get into any of pump openings or injector unions. Store pump so that diesel fuel in the pump will not drain out.

– Be sure to quality check your work, see **Quality Review** at the end of this repair group.

Injection pump, installing

Before installing a new injection pump or if reusing the original, remove all packaging materials and plugs sealing port openings.

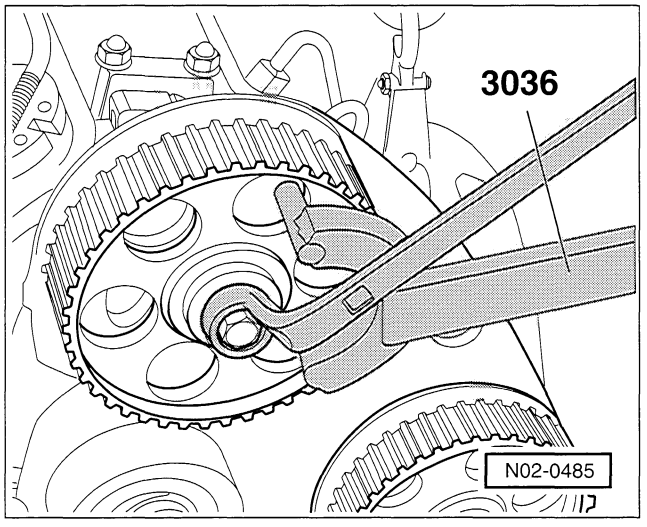


– Install injection pump into assembly bracket and hand tighten rear injection pump mounting bolt shown in illustration #A23-0043 above.

– Position pump in assembly bracket. Install and torque front injection pump mounting bolts and torque rear injection pump mounting bolt.

Tightening torque

- Injection pump bolts, front (M8) . . . . 25 Nm (18 ft-lb)
- Injection pump bolt, rear (M8) . . . . . 25 Nm (18 ft-lb)



➤ Install new bolts (**arrows**) into injection pump sprocket and mount sprocket to injection pump hub. Hand tighten only at this time.

– Position pump sprocket so that bolts are in the middle of the elongated holes

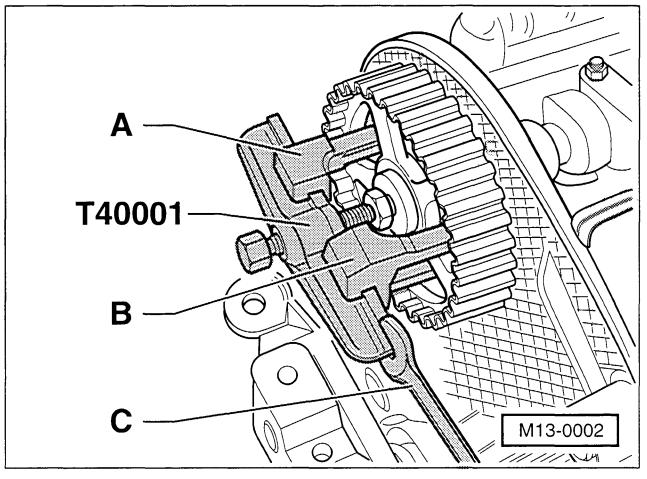
– Lock injection pump sprocket using Volkswagen special tool 3359.

– Ensure that crankshaft is at TDC for cylinder #1 as shown earlier.

– Ensure that camshaft is locked in position with special tool 3418 as shown earlier.

➤ Loosen camshaft sprocket mounting bolt about 1 turn while counter-holding camshaft sprocket with VW special tool 3036.

CAUTION —
Do not use 3418 setting bar by itself to lock camshaft when loosening camshaft sprocket bolt. Hold camshaft sprocket using 3036 retainer, or equivalent. Possible damage to the camshaft could result if only the setting bar is used to lock camshaft.

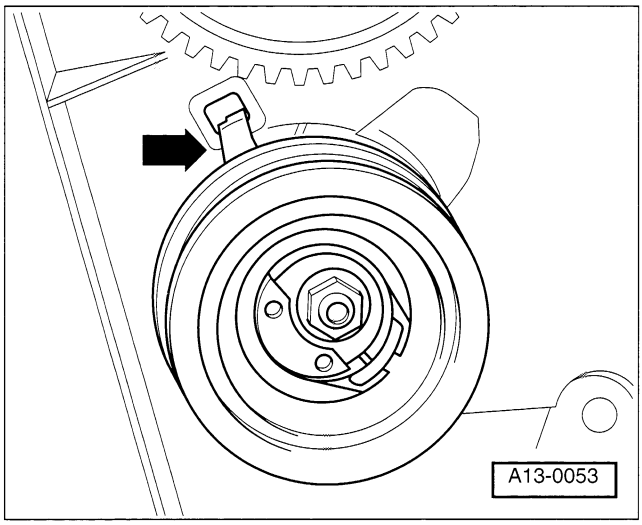


NOTE —
The camshaft end is tapered. Loosening the sprocket will allow the camshaft sprocket to rotate independently of the camshaft. There may be a keyway cut into the end of the camshaft. However, there is no matching keyway cut into the sprocket nor is there a Woodruff key.

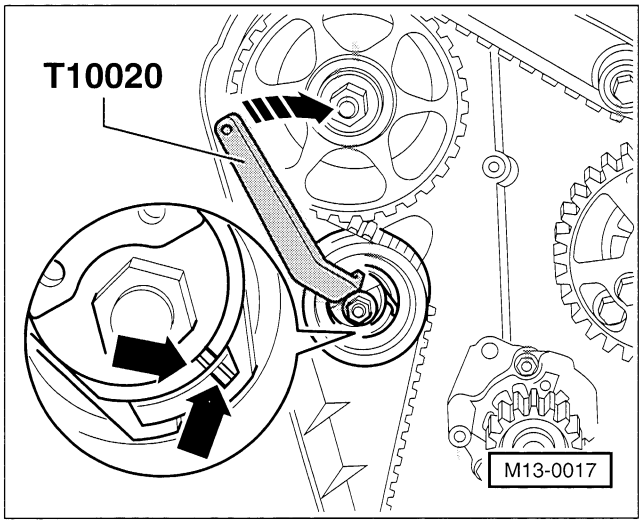
➤ Release camshaft sprocket from camshaft taper with two-arm puller (VW special tool T40001 shown). Center puller arms (**A** and **B**) in camshaft sprocket and counter-hold puller using open-end wrench (**C**).

NOTE —

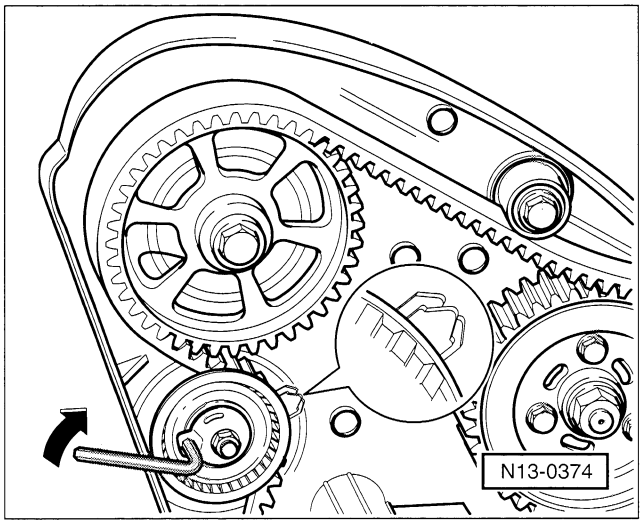
- *Tapping the camshaft sprocket lightly with a soft mallet may help release the sprocket from the tapered end of the camshaft.*
- *The camshaft sprocket must be released from the camshaft taper in order to install the timing belt and properly position the belt tensioner.*



➢ Place timing belt onto injection pump sprocket and tensioning roller and thread under idler roller. Be sure tensioning roller retaining lug (**arrow**) is correctly seated in hole in timing belt guard and cylinder head.



➢ For vehicles with manual transmission tension timing belt using a two-pin spanner (VW special tool T10020 shown) in the center holes of the eccentric belt tensioner. Belt is tensioned properly when notch and raised mark are aligned (**inset, arrows**).

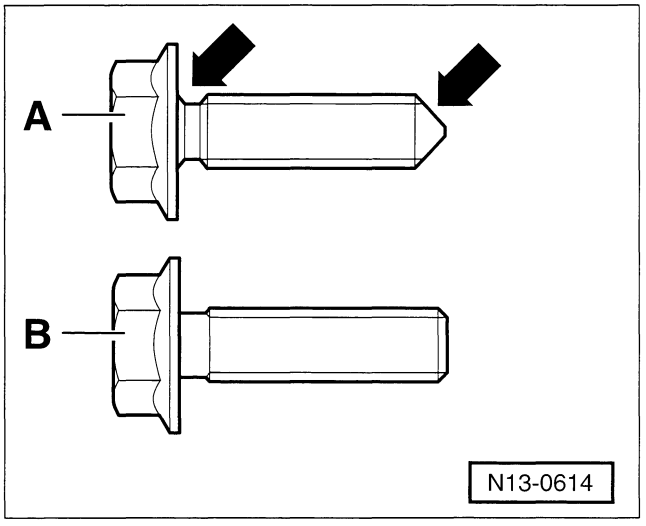


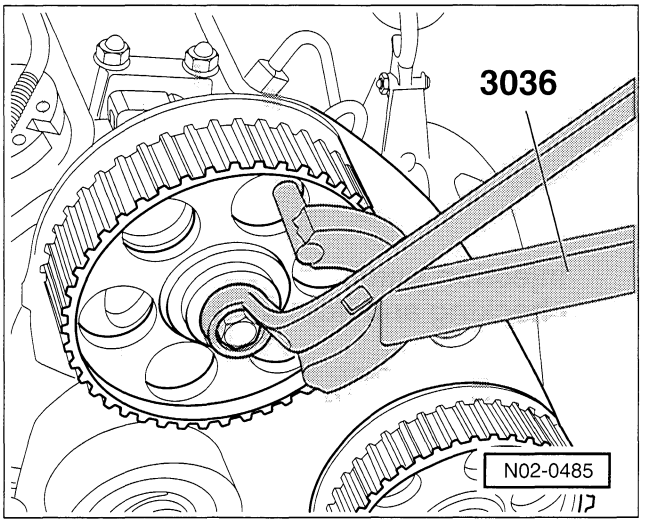
➢ On cars equipped with automatic transmissions, use a hex wrench to position belt tensioner.

– Tighten lock nut on tensioner while maintaining belt tension with two pin spanner or hex wrench.

Tightening torque

- Timing belt tensioner (M8) . . . . . 20 Nm (15 ft-lb)





– Ensure that crankshaft is still at TDC.

➢ Determine which type of injection pump sprocket mounting bolts will be used.

- Version **A** has a chamfer on the shaft (**left arrow**) and a pointed end (**right arrow**). These are stretch bolts and must only be used one time.
- Version **B** has no chamfer and a flat end. These bolts do not need to be replaced.

– Tighten injection pump sprocket mounting bolts to 20 Nm (15 ft-lb).

NOTE —
Tighten the new injection pump sprocket mounting bolts to 20 Nm (15 ft-lb) only at this time. Final torque (stage II) will be done after timing has been dynamically checked/adjusted as described below.

Tightening torque

- Injection pump sprocket bolt (**A**) - always replace
  Stage I . . . . . 20 Nm (15 ft-lb)
  Stage II . . . . . additional ¼ turn (90°)
- Injection pump sprocket bolt (**B**)
  Final torque . . . . . 25 Nm (18 ft-lb)

➢ Tighten camshaft sprocket mounting bolt while counterholding sprocket with special tool 3036.

Tightening torque

- Camshaft sprocket bolt. . . . . 45 Nm (33 ft-lb)

– Remove setting bar and feeler gauges from camshaft.

– Remove locking pin from injection pump sprocket.

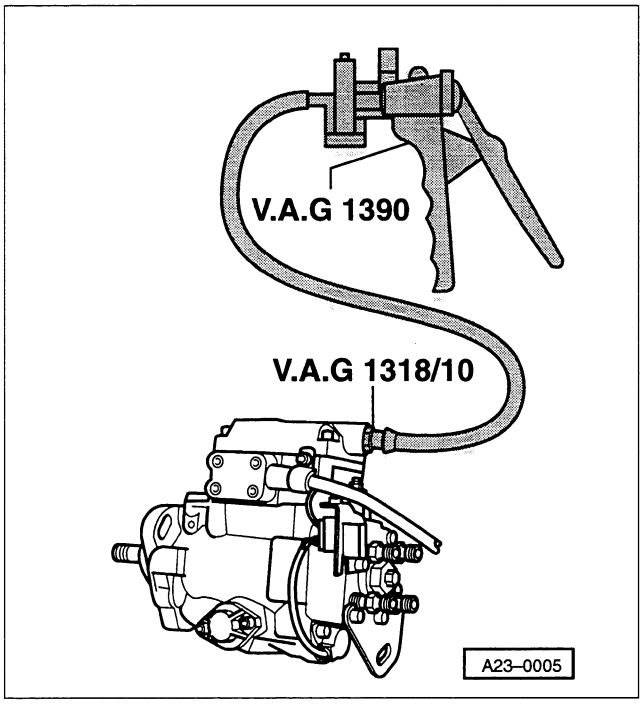
– Turn crankshaft two rotations in the running direction and recheck timing belt tension.

– Connect harness connector for diesel pump electronics and slip connector into retaining bracket.

– Install cylinder head (valve) cover.

– Install vacuum pump.

– Install injector fuel line assembly taking care not to bend, kink, or otherwise damage the assembly.



➤ Install fuel supply line. Fill (prime) diesel injection pump by drawing fuel into pump with a hand operated vacuum pump. Filling pump prevents damage due to lack of lubrication and also makes starting easier.

> ***WARNING —***
> - *Do not draw diesel fuel into hand operated vacuum pump made of plastic!*
> - *Do not attempt to start engine with a dry diesel injection pump, severe damage can result. Always ensure that pump is full of fuel before cranking engine.*

– Install fuel return line.

– Dynamically check diesel injection pump timing as described below.

Injection pump dynamic timing, checking and adjusting

Diesel injection pump timing must be set using Volkswagen scan tool VAG 1551/1552, diagnostic computer VAS 5051/5052 or equivalent scan tool or computer diagnostic program in a mode known as Basic Setting. Injection pump timing is correlated to several factors, including fuel temperature. Failure to properly set injection pump timing will result in hard starting, poor performance, poor fuel economy, excessive noise, smoking and increased emissions. The vehicle may not be drivable.

If timing adjustment is necessary, special adjustment tools and new pump sprocket mounting bolts are required.

The following instructions assume that the individual technician already has a good working knowledge of the operation and use of the VAG 1551/1552 scan tool, or aftermarket equivalent scan tool.

– Connect scan tool to vehicle Data Link Connector (DLC) located in lower left side of the dash panel. The scan tool will be powered up when plugged into the DLC.

– Start the engine and let it idle.

– Follow manufacturers instructions to advance the scan tool to the basic setting function. The following sequence is applicable to the VAG 1551 and the smaller, portable VAG 1552.

– Observe the following sequence in the scan tool display window:

- 1 – Rapid Data
- Address Word 01 – Engine Electronics
- Function 04 – Basic Settings
- Display Group – 000
- The display will show 10 fields (groups) of information.

System in Basic Setting	000
XX XX XX XX XX XX 73 XX XX XX	

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➤ Display field **7** shows coded coolant temperature data. Do not proceed until display field **7** shows a value of at least **73** as shown. 73 corresponds to approximately 85° C and is the minimum coolant temperature required for this procedure.

NOTE —

Data is only available in the format shown at left through use of scan tool VAG 1551 or VAG 1552. Scan tools from other manufacturers may provide the same data, but in a different format.

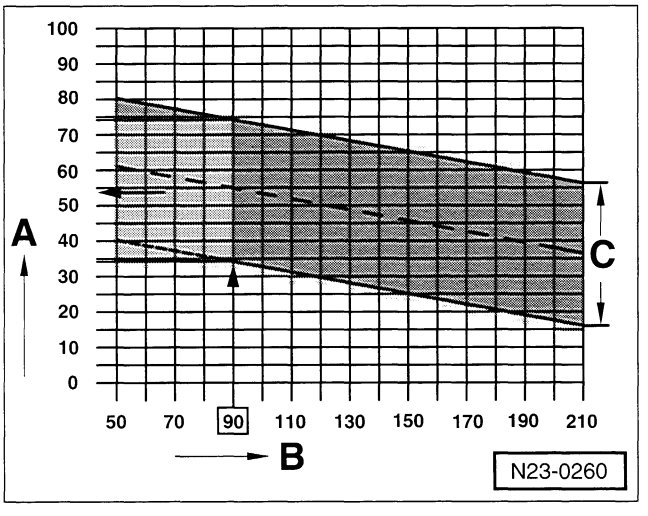
System in Basic Setting	000
XX 53 XX XX XX XX XX XX 90 XX	

0024190

➤ When display field 7 shows 73 or greater, look at the data shown in display fields 2 and 9. Information in field 9 is coded fuel temperature data and must be correlated to information is display field 2, injection pump timing.

NOTE —

"53" is shown in field 2 and "90" is shown in field 9 of scan tool display at left.



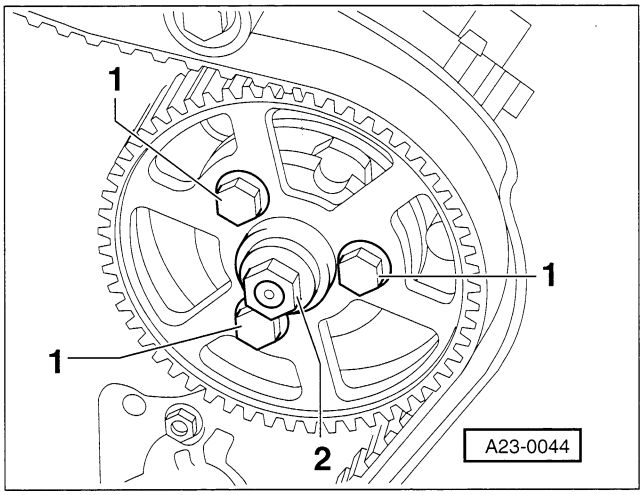
➤ Use the graph to find timing value. Observe the number in field 9 on the scan tool display. This is a fuel temperature value and is assigned **B** in the table. The timing value must fall within shaded area of the table and is assigned the value **A**. If value is within shaded area, no adjustment is needed. When value is obtained, shut off engine.

- If this procedure was done for diagnosis purposes, and timing value is within specification, remove scan tool.
- If this procedure was done as part of injection pump removal and installation, and timing value is not within specification, continue below.

Example:

- This example assumes the engine is running. Note that the fuel temperature value in the scan tool display window, field 9, is 90. This is value **B**. Look on the table along the B axis until you see 90. Follow the line from 90 up into the shaded area. The shaded area is the range of timing values. Find the center of the shaded area and look to the left for the value on the **A** axis. In this case it is 53. Adjust the pump until the value in the scan tool display field 2 reads 53.

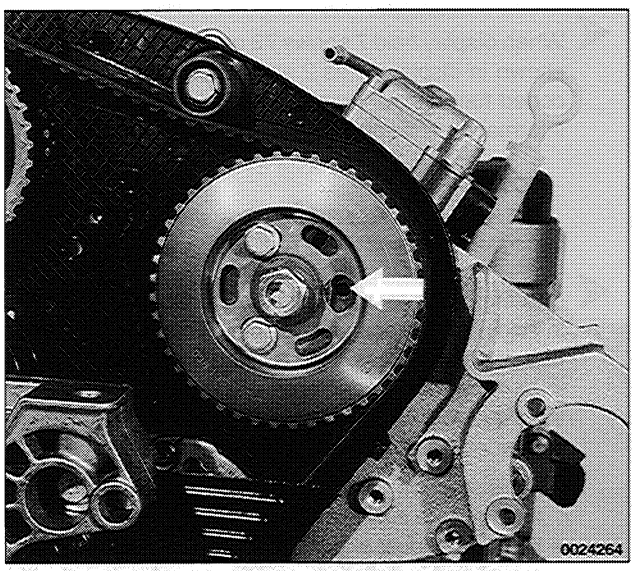
– If timing adjustment is required, access injection pump sprocket. See **Injection pump, removing** given earlier for appropriate steps.



Loosen two of the injection pump sprocket mounting bolts (**1**). Do not loosen center sprocket nut (**2**).

NOTE —
It is permissible to counterhold the pump shaft during loosening (only) using a 22 mm wrench on the center nut. Under no circumstances should the center nut be loosened or used as a counterholder during tightening sequences.

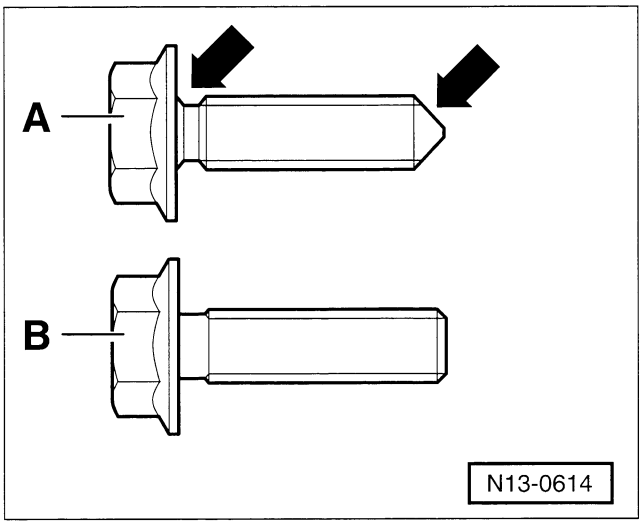
CAUTION —
Do not loosen the center sprocket nut for any reason. Loosening this nut will allow the sprocket to move on the shaft resulting in altered basic settings which CANNOT be reset with normal workshop equipment.



Loosen the third injection pump sprocket mounting bolt only enough to allow movement of the sprocket on the hub. Using a 22mm wrench on the center sprocket nut, move the injection pump shaft to adjust timing. Illustration at left has one sprocket mounting bolt removed (**arrow**) to show elongated hole on sprocket.

Specification

- Advance timing
  (start of injection) . . . . . move pump shaft to right (clockwise)
- Retard timing
  (start of injection) . . . . . move pump shaft to left (counter-clockwise)



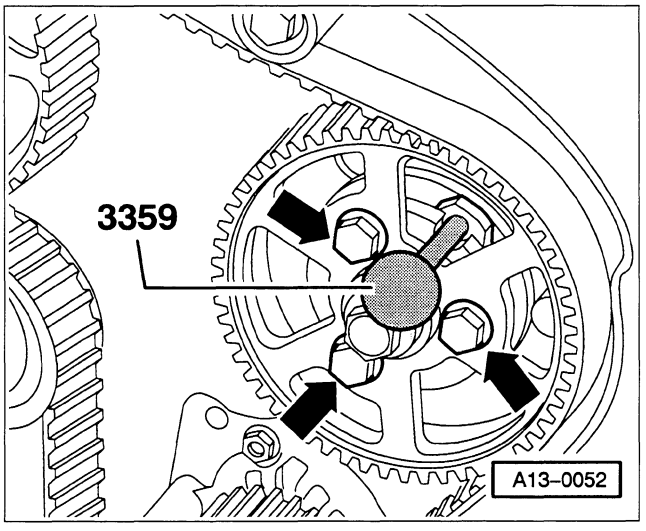
Determine which type of injection pump sprocket mounting bolts are used.

- Version **A** has a chamfer on the shaft (**left arrow**) and a pointed end (**right arrow**). These are stretch bolts and must only be used one time.
- Version **B** has no chamfer and a flat end. These bolts do not need to be replaced.

– Tighten version **A** injection pump sprocket bolts to **stage I** specification only. Version **B** bolts can be tightened to final torque. Start engine and recheck injection timing value as given earlier using a scan tool. Repeat procedure as necessary to obtain correct injection timing value.

Tightening torque

- Injection pump sprocket bolt (**A**) - always replace
  Stage I . . . . . 20 Nm (15 ft-lb)
  Stage II . . . . . additional ¼ turn (90°)
- Injection pump sprocket bolt (**B**)
  Final torque . . . . . 25 Nm (18 ft-lb)



– When a satisfactory timing value is obtained, remove and replace the 3 version **A** pump sprocket mounting bolts with new bolts, one at a time. Version **B** mounting bolts do not need to be replaced.

NOTE —
If bolts were already replaced as part of injection pump installation and/or replacement, it is not necessary to install new bolts as described in the above step.

➢ Lock injection pump sprocket with locking pin 3359. Tighten all injection pump sprocket mounting bolts (**arrows**) to final (**stage II**) torque as applicable.

– Remove all special tools from pump sprocket.

– With scan tool still connected, check for any Diagnostic Trouble Codes (DTCs) that may have been set. Repair and erase as required.

– Disconnect scan tool.

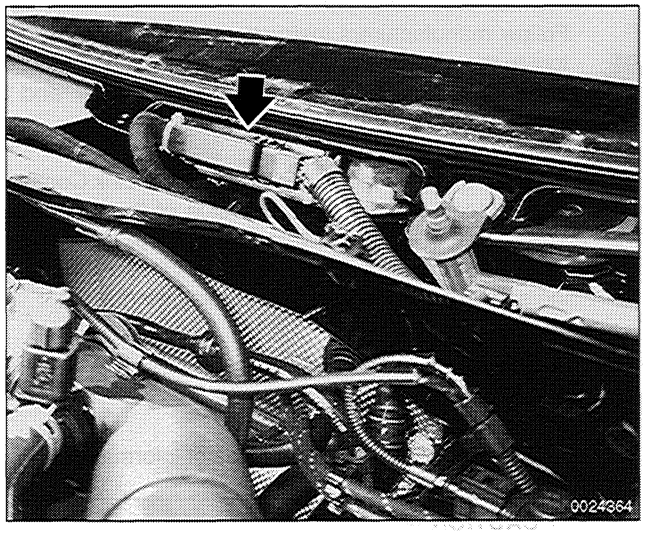
– Install all remaining fasteners, fuel lines, electrical connectors and components that were loosened or removed.

– Verify that all fuel lines are secure and that there are no leaks.

– Install upper sound absorber panel.

– Be sure to quality check your work, see **Quality Review** at the end of this repair group.

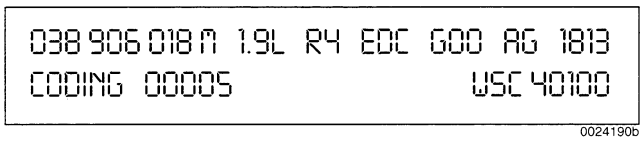
Engine control module



➢ Diesel engine management is controlled by an Engine Control Module (ECM). The ECM (**arrow**) is located in the air plenum near the base of the windshield in the engine compartment. Access to the ECM requires removal of the windshield wiper arms and the air plenum cover.

Engine control module coding

The Engine Control Module must "know" what equipment is installed in the vehicle. This process is known as coding and must be performed whenever the ECM is replaced, as new ECMs are un-coded. If the ECM is moved between vehicles such as might be the case for diagnostic testing, the coding will need to be changed if equipment is different. Coding memory is, however, retained when the battery is disconnected. If a new ECM is installed without being coded, the engine will usually run poorly and the automatic transmission and anti-lock braking system (if equipped) will not function properly. The MIL will be illuminated.



0024190b

This coding process can only be done with Volkswagen scan tool VAG 1551/1552, diagnostic computers VAS 5051/5052 or equivalent scan tool or scan tool computer program. The appropriate code is electronically programmed into the ECM according to instructions provided by the scan tool manufacturer. See **Scan Tool** section at the back of this manual for ECM coding information.

Before replacing the ECM, always connect a scan tool and record (print) the ECM coding data found in Function 01, Check Control Module Version. This will help ensure proper coding of replacement unit and serve as a reference.

NOTE —
Replace any removed wire ties upon completion of repair.

Readiness code, checking

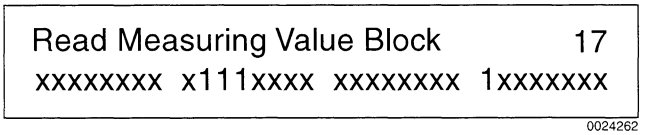
Legislation requires that all auto manufacturers build into their engine management systems the ability to check for proper operation of up to 8 functions. These functions are known collectively as the readiness code. For the TDI system on the 1.9L engine, only the exhaust gas recirculation system code is relevant. Most of the time, the readiness code will set itself after the appropriate conditions have been met. These may include a cold or a hot start, operation at a certain load or speed for a certain period of time, or operation at different temperatures. After repairs, it may be advantageous to verify component operation. Setting the readiness code rather than waiting to see if it sets on it's own can confirm a proper repair. The setting procedure is simple and requires the scan tool VAG 1551/1552, diagnostic computer VAS 5051/5052 or equivalent scan tool or computer diagnostic program to confirm the setting.

Follow manufacturers instructions to advance the scan tool to the readiness code checking function. The following sequence is applicable to the VAG 1551 and the smaller, portable VAG 1552.

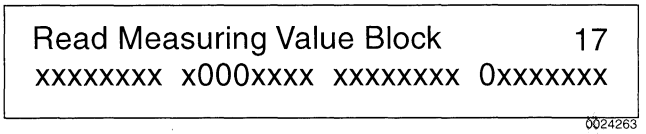
– Connect the scan tool to the vehicle Data Link Connector (DLC) located in the lower left side of the dash panel. The scan tool will be powered up when plugged into the DLC. Start the engine and let it idle. Observe the following sequence in the scan tool display window:

- 1 – Rapid Data
- Address Word 01– Engine Electronics
- Function 08–Measure Value Blocks
- Display Group 017
- The display will show four fields of information

CAUTION —
These instructions assume that the technician already has a good working knowledge of the operation and use of the VAG 1551/1552 scan tool.



The illustration at left shows information as it appears on the VAG 1551/1552 scan tool screen when the readiness code is not set. Disregard information shown as the letter x. These x spaces will have either a 1 or a 0 and do not affect this procedure. The readiness code is the 8 digit number in fields 2 and 4. If scan tool screen displays ones in the indicated fields as shown here, readiness code is not set.



If scan tool screen displays zeros in the indicated fields, readiness code is set and no further action is required.

– If the readiness code is set, disconnect the scan tool.

– If readiness code is not set, unplug scan tool and proceed as follows.

Readiness code, setting

– Start engine and allow to idle for at least 35 seconds.
  - Engine temperature must be over 10° C (50°F)
  - Engine must remain running during test sequence unless directed otherwise.
  - Adhere to test sequence and do not interrupt it.

– Road test vehicle. When conditions allow, accelerate to 2,000 rpm as indicated on the tachometer.

> ***CAUTION —***
> *Observe all applicable traffic and safety laws while road testing to this procedure. Accelerate only where conditions are appropriate.*

– At 2,000 rpm, accelerate to wide open throttle (WOT) in 3rd gear for 5 seconds, and allow engine speed to return to 2,200 rpm.

– At 2,200 rpm, accelerate to WOT in 2nd or 3rd gear for 8 seconds and allow engine to return to idle.

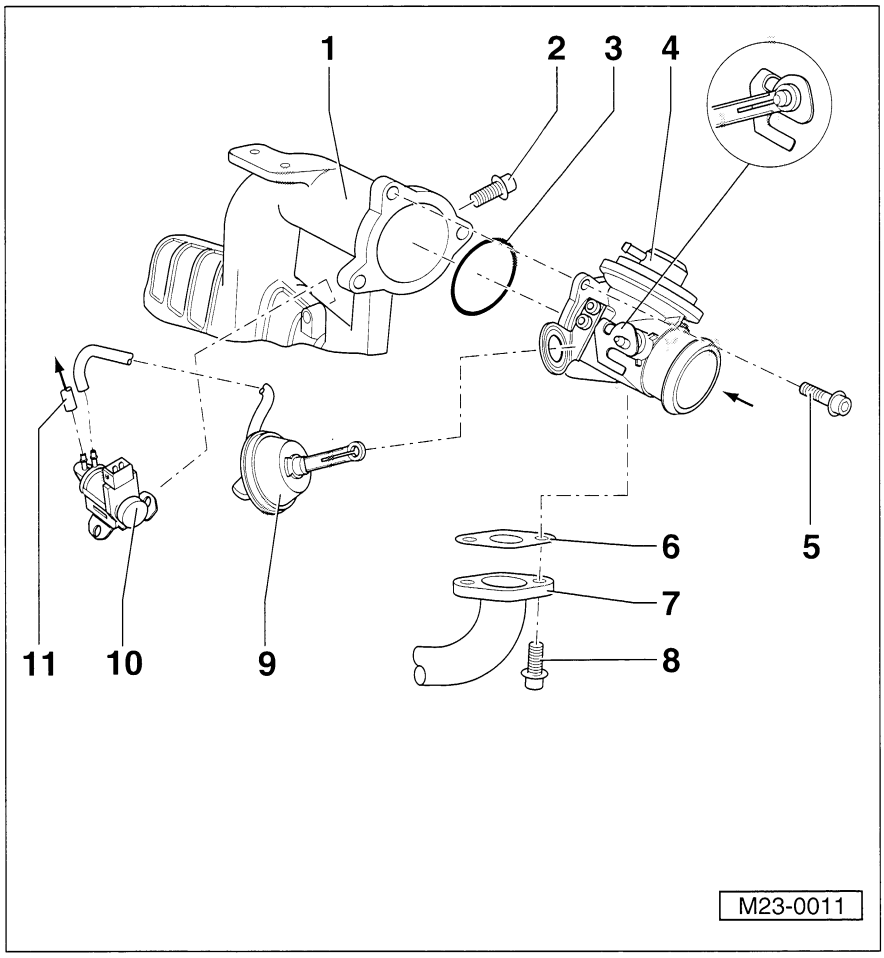
– When conditions permit, switch off engine, wait at least 10 seconds. Repeat steps 1 through 4.

– Check readiness code as previously described.
  - If the scan tool screen displays zeros in the indicated fields, readiness code is set and no further action is required.
  - If the scan tool screen displays ones in the indicated fields, readiness code is not set. Unplug scan tool and repeat from step 1. If the code does not set after a second attempt, it is likely that there is a malfunction in the system. Consult scan tool directions for additional information on checking for DTCs.

Intake manifold change-over valve

The intake manifold change-over valve is a flap valve that closes for approximately 3 seconds when the engine stops, blocking the air to the engine. This reduces the suddenness of the diesel engine shut-down. The valve re-opens once the engine has stopped.

Intake manifold change-over valve, assembly



1. **Intake manifold**
2. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
3. **O-ring**
   - Always replace
4. **Connecting flange**
   - With EGR valve
   - With intake manifold change-over valve
   - Check change-over mechanism for intake manifold flap for ease of movement and function
5. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
6. **Gasket**
   - Always replace
7. **Connecting pipe**
   - From EGR cooler
8. **Bolt**
   - Tighten to 25 Nm (18 ft-lb)
9. **Vacuum servo**
10. **Intake manifold change-over vacuum control valve (N239)**
11. **Vacuum supply**
    - From vacuum source

Fuel injectors

The 1.9L TDI diesel engine uses a two-spring injector that enables the fuel to be injected in two stages for "softer" combustion. In addition, the injectors are a 5-hole design that spray fuel from 5 ports in a more lateral direction rather than in a single conical pattern. Injector opening pressures are approximately 220 to 230 bar (3190-3335 psi). All 4 injectors are functionally the same. However, injector for cylinder #3 carries the needle lift sensor (G80). This injector must always be installed in cylinder #3 to prevent erroneous DTCs or performance problems from occurring.

The signs of injector trouble usually appear as misfiring and knocking noises from one or more cylinders, engine overheating, loss of power, smoky black exhaust, and excessive blue smoke during cold starting.

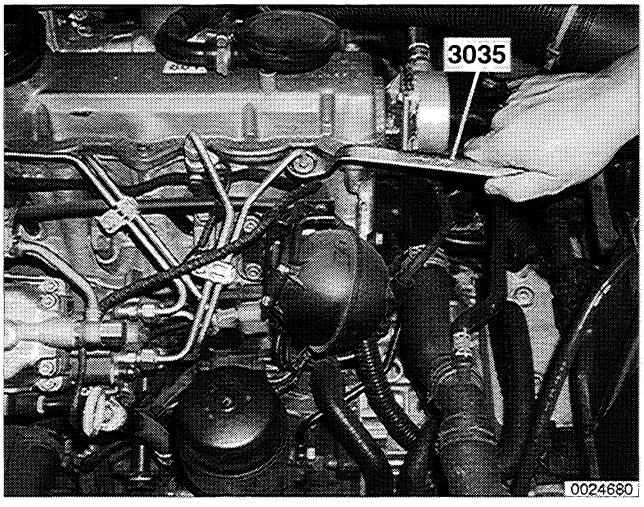
> ***CAUTION —***
> *When working on the injectors, everything must be kept absolutely clean. Clean all pipe unions before disconnecting.*

Fuel injectors, checking

A defective injector (or a weak cylinder) can often be identified by simply "turning it off". This can be done by relieving the fuel pressure so that the injector can not open and inject fuel into the cylinder. Idle speed may not substantially change, however, because the ECM will often be able to compensate for the weak cylinder.

– Clean area around fuel unions where the fuel pipes meet the injectors.

– Start engine and let it run at idle.



➤ Wrap a cloth around the union nut for cylinder #1 fuel injector at the injector. Slightly loosen the nut. Cylinder #1 is closest to the drive belt.

- If a particular cylinder is defective, the noise or smoke will cease when union nut is loosened.
- If the problem was roughness, the roughness will be affected very little or not at all because that cylinder was already malfunctioning. Tighten the union nut.

> ***WARNING —***
> - *Loosen the nut only about one half turn to limit the amount of fuel leakage. The fuel injection system operates at very high pressures. Keep hands and eyes clear. Wear heavy duty gloves and eye protection. Wrap a cloth around the nut when loosening. Fuel will be expelled.*
> - *Do not smoke or work near heaters or other fire hazards.*
> - *Have a fire extinguisher handy.*

– Repeat procedure for other suspected cylinders.

– When finished, verify that all fuel lines are secure and that there are no fuel leaks. Thoroughly clean any spilled fuel.

> ***CAUTION —***
> *Diesel fuel is damaging to rubber. Wipe off any fuel that spills on hoses, wiring, and rubber steering and suspension parts and wash with soap and water. If coolant hoses are contaminated with diesel fuel, they must be replaced.*

Fuel injectors, replacing

– Unscrew fuel pipe union nuts at injection pump and injectors. Remove injector fuel pipes as one assembly taking care not to bend them.

– Remove fuel return hoses from between injectors.

– Unplug harness connector for the needle lift sensor (G80) on the injector for cylinder #3.

– Loosen and remove bolt, special washer and hold down clamp for each injector. Lift out injectors.

– Remove small copper sealing washer from tip of injector or from injector port in head. Discard.

> ***NOTE —***
> *The crush-type sealing washers must always be replaced to prevent compression leaks.*

– Install injector with a new copper sealing washer and torque the bolt to specification.

Tightening torque

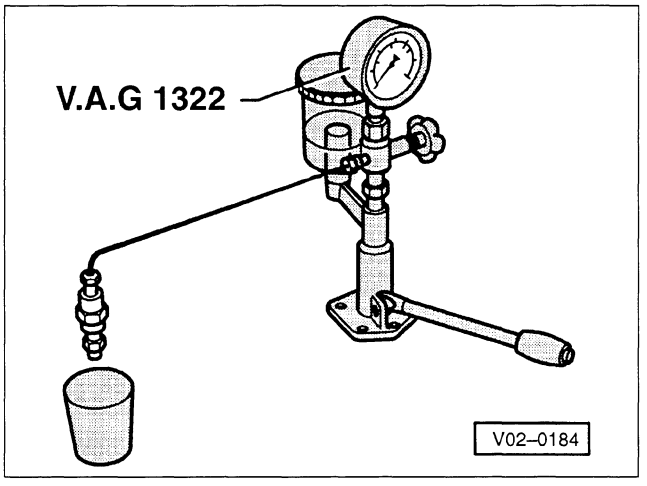
- Injector line union . . . . . 25 Nm (18 ft-lb)
- Injector clamp mounting bolt (M8) . . 20 Nm (15 ft-lb)

– Install metal fuel pipes and fuel return hoses. Due to the higher pressures involved, injectors will seldom need to have air bleed from them. Reconnect harness connector to needle lift sensor.

– When finished, verify that all fuel lines are secure and that there are no fuel leaks.

Fuel injectors, pressure testing

– Remove injector as described previously.



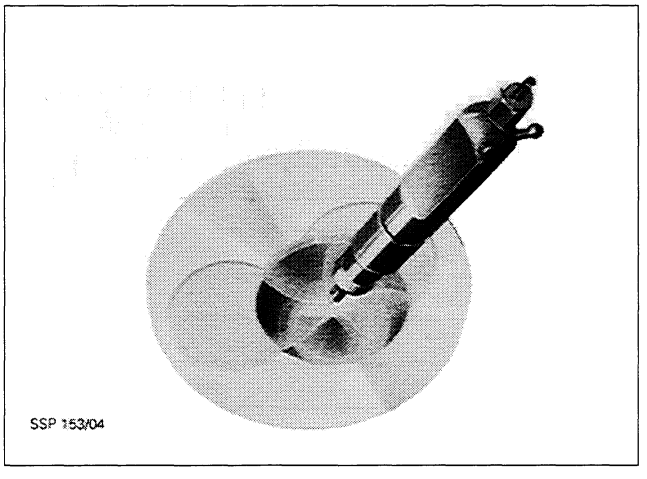
➢ Install fuel injector on pressure tester (VAG 1322 shown) according to manufacturer's directions. Place a suitable container under injector to catch the spray.

> ***WARNING —***
> *When testing fuel injectors, make sure that the high pressure discharge does not contact the hands or any other bare skin. The high pressure spray can be injected directly into the skin causing severe injuries or health complications. Always wear eye protection!*

– Pump lever to increase pressure. Read opening pressure when spray begins.

Injector Opening Pressure

- New . . . . . 220–230 bar (3190–3335 psi)
- Wear limit . . . . . 200 bar (2900 psi)



➢ Fuel spray should discharge evenly from all 5 ports.

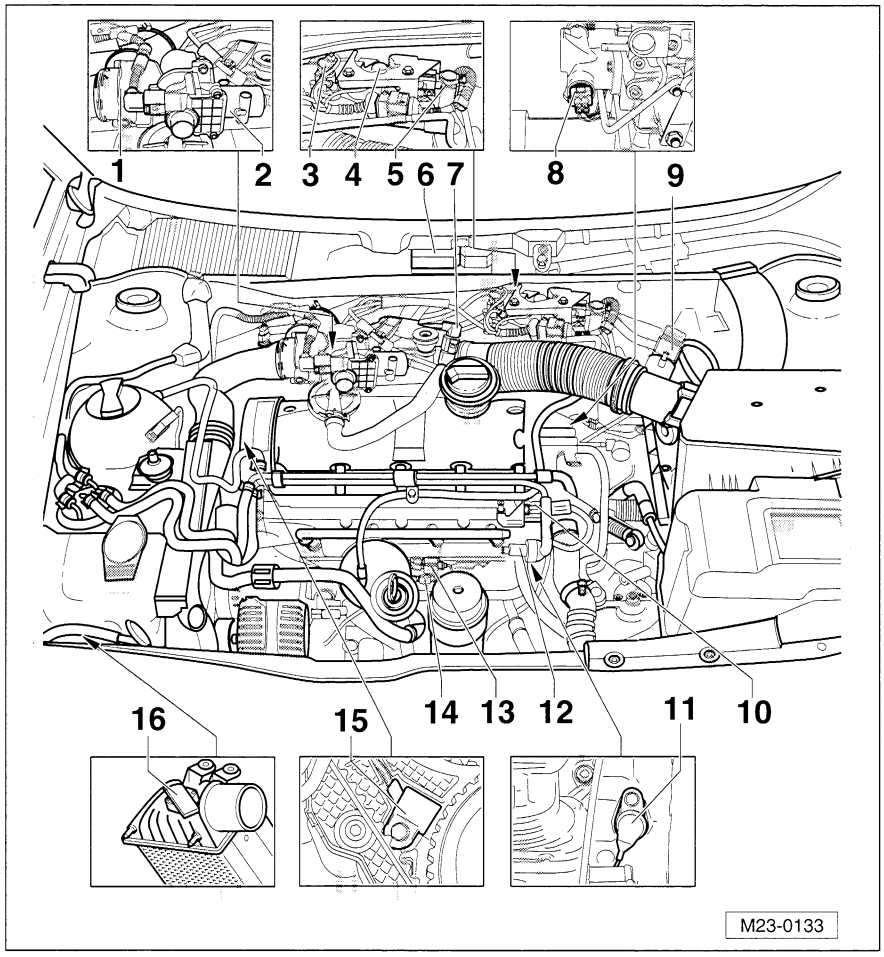
> ***WARNING —***
> *Fire hazard! No smoking! Do not have anything in the area that can ignite the spray discharged by the injectors. This includes overhead heating units and hidden sources such as water heaters with standing pilot lights.*

– Pump lever slowly to a pressure of approximately 150 bar (2175 psi) for 10 seconds. Check for leaks from injector tip. No fuel should leak.

– If any injector fails to meet opening pressure or leak specifications, it should be replaced. No repairs are possible to the fuel injectors.

DIESEL INJECTION SYSTEM (1.9L PD TDI DIESEL)

Diesel injection system, component overview (from 2004 m.y.)



1. **Variable intake manifold flap**
   - With Motor for intake flap (V157)
2. **Exhaust Gas Recirculation (EGR) vacuum regulator solenoid valve (N18)**
3. **Intake Manifold Runner Control (IMRC) valve (N316)**
4. **Exhaust Gas Recirculation (EGR) cooler switch-over valve (N345)**
5. **Wastegate bypass regulator valve (N75)**
6. **Diesel direct injection system ECM (J248)**
   - With BARO (altitude) sensor (F96)
7. **Positive Crankcase ventilation (PCV) heating element (N79)**
8. **Engine coolant temperature sensor (G62)**
   - Release pressure in cooling system before removing
9. **Mass air flow sensor (G70)**
10. **Harness connector**
    - For pump (unit) injectors (N240, N241, N242, N243)
11. **Engine speed sensor (G28)**
12. **Fuel temperature sensor (G81)**
13. **Harness connector**
    - For Camshaft Position (CMP) (G40)
14. **Harness connector**
    - For engine speed sensor (G28)
15. **Camshaft Position (CMP) sensor (G40)**
16. **Manifold absolute pressure sensor (G71) and intake air temperature (IAT) sensor (G72)**

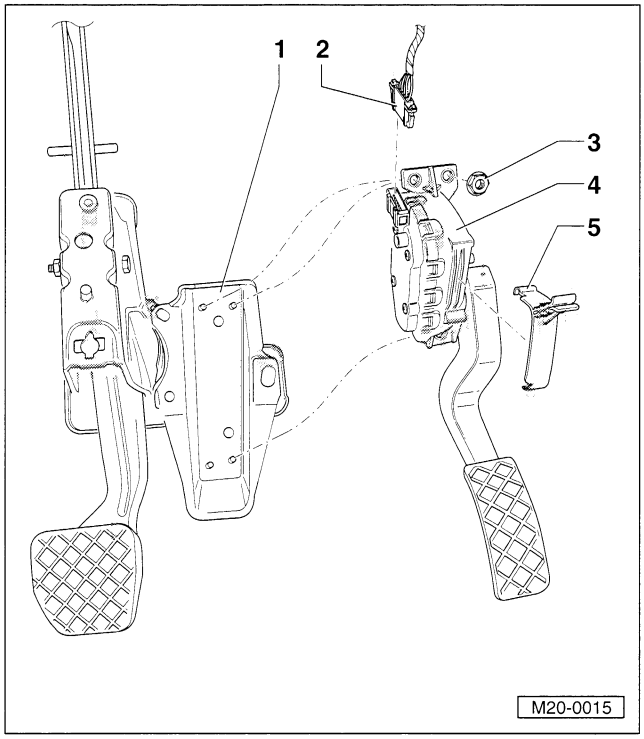
A. **Brake pedal switch (F47) (not shown)**
   - Located in footwell on brake pedal bracket
   - May be in combined housing with brake light switch

B. **Brake light switch (F) (not shown)**
   - Located in footwell on brake pedal bracket
   - May be in combined housing with (F47)

C. **Throttle position sensor (G79) (not shown)**
   - Located in footwell on throttle pedal support bracket

D. **Clutch pedal switch (F36) (not shown)**
   - Located in footwell on clutch pedal support bracket

E. **Malfunction Indicator Light, MIL (K83) and Glow plug warning light (K29)**
   - In instrument cluster



Throttle position sensor

Fuel quantity is controlled by the Engine Control Module (ECM) in PD diesels in the same manner as other TDI equipped vehicles. There is no accelerator cable connection between the pedal and the engine.

The throttle position sensor is part of the electronic accelerator. This system is described as electronic throttle control (EPC) in **2 General Information** as well as in **20 Fuel Storage and Supply**.

1. Pedal mounting bracket
- Bracket supports accelerator and brake pedals

2. Connector
- Black, 6-pin

3. Nut
- Tighten to 10 Nm (7 ft-lb)

4. Throttle Position Sensor (G79)

5. Bracket
- For cover in footwell
- Clipped to throttle position sensor

Testing and adjustment of the throttle position sensor requires the use of a scan tool or diagnostic computer such as VAG 1551/1552, VAS 5051/5052 or equivalent. Faults related to the throttle position sensor will be stored as diagnostic trouble codes (DTCs) in the ECM. If the fault is severe enough, the ECM will ignore the throttle position sensor completely and run the engine at a constant high idle speed. This should enable the driver to reach the nearest workshop.

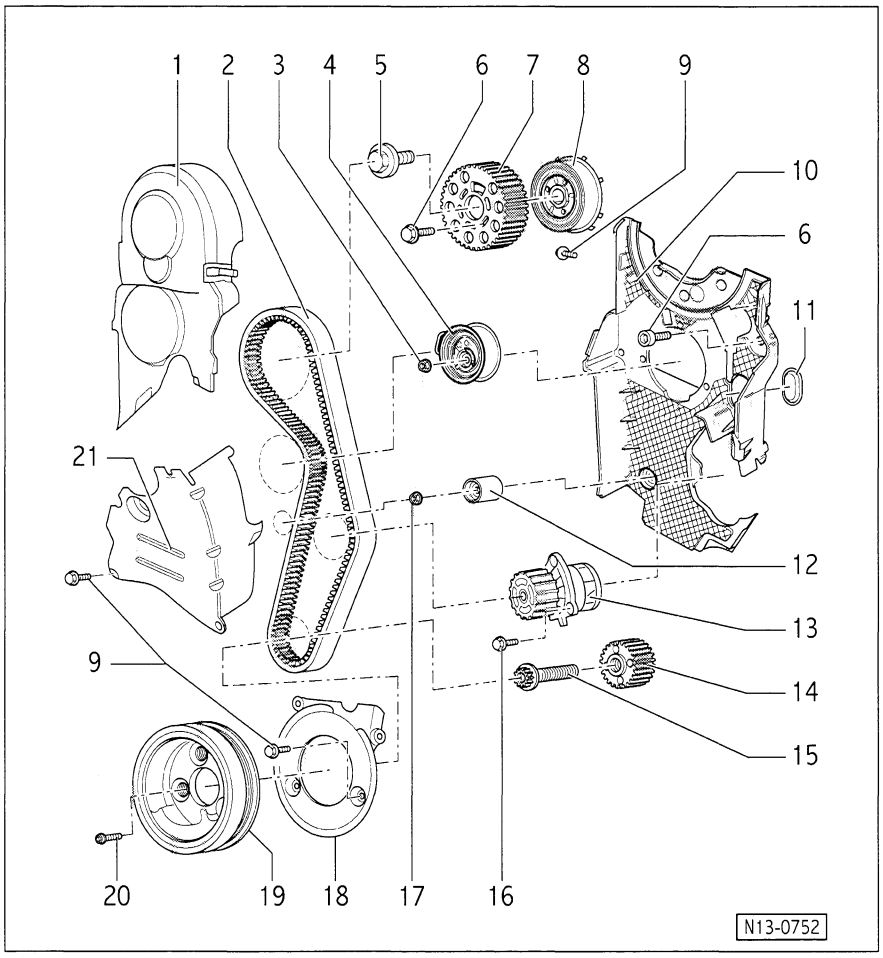
Timing belt, camshaft drive

The timing belt or camshaft drive belt and its related parts are shown below. Required maintenance involves inspection at the specified intervals. The belt and tensioner are to be replaced at different intervals, depending on model year and whether vehicle has a manual or automatic transmission. See **0 Maintenance** for the appropriate inspection and/or replacement intervals listed in the maintenance schedules. Belt and tensioner replacement will help prevent damage to engine due to belt stretch and long term effects of heat. The timing belt is known also as a toothed belt and both terms are used interchangeably.

NOTE —

The PD diesel engine does not use a conventional belt-driven distributor-type injection pump. Individual cylinders each have a separate pump injector that combines the function of a high pressure pump and a fuel injector.

Timing belt, camshaft drive assembly

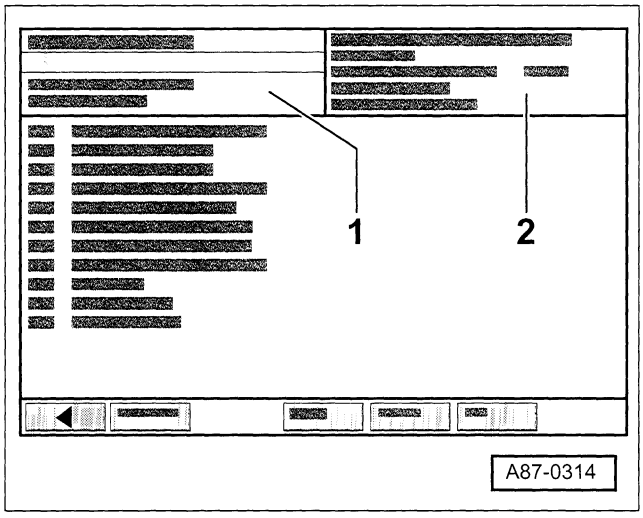


1. **Timing belt guard, upper outer section**
2. **Timing belt**
   - Mark engine direction of rotation before removing
   - Check for wear
   - Do not kink
3. **Nut**
   - Tighten to 20 Nm (15 ft-lb) + 1/8 turn (45°)
4. **Tensioning roller, timing belt**
5. **Bolt**
   - Tighten to 100 Nm (74 ft-lb)
6. **Bolt**
   - Tighten to 25 Nm (18 ft-lb)
7. **Camshaft sprocket, outer**
   - Loosen and remove from camshaft/hub with 2-arm puller T40001
8. **Camshaft sprocket, hub**
   - With sender wheel for camshaft position sensor
   - Counterhold with T10051
   - Remove with puller T10052
   - Removing and installing, see **Camshaft, removing & installing**
9. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
10. **Timing belt guard, rear section**
11. **Sealing grommet**
    - Replace if damaged
12. **Idler pulley**
13. **Coolant pump**
    - Check impeller for ease of movement
14. **Crankshaft timing belt drive sprocket**
15. **Bolt**
    - Always replace
    - Tighten to 120 Nm (88 ft-lb) + ¼ turn (90°)
    - To loosen and tighten, counterhold with 3099
    - Threads and shoulder must be free of oil and grease
    - Additional quarter turn can be obtained in two 1/8 turn (45°) stages
16. **Bolt**
    - Tighten to 15 Nm (11 ft-lb)
17. **Nut**
    - Tighten to 20 Nm (15 ft-lb)
18. **Timing belt guard, lower section**
19. **Belt pulley/vibration damper**
    - Can only be installed in one position, holes are offset
    - Note position when installing timing belt
20. **Bolt**
    - Tighten to 10 Nm (7 ft-lb) + ¼ turn (90°)
21. **Timing belt guard, center outer section**

Engine control module

PD diesel engine management is controlled by an Engine Control Module (ECM). The ECM is located in the air plenum near the base of the windshield in the engine compartment. Before replacing the ECM, always connect a scan tool and record (print) the ECM coding data.

Engine control module, removing and installing

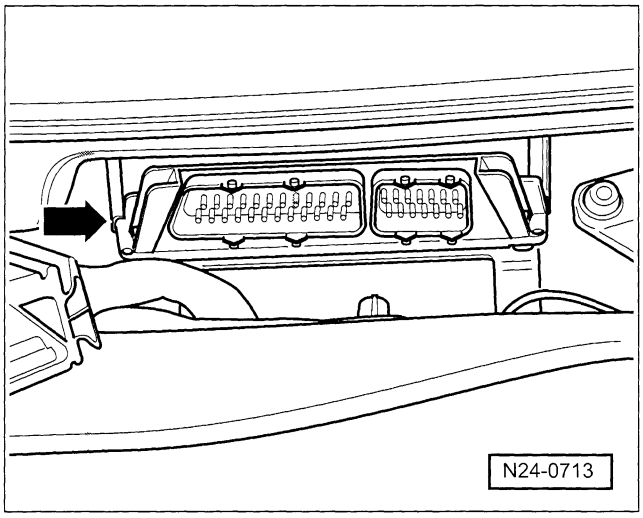


➢ Before replacing the ECM, always connect a scan tool and record (print) the ECM coding data. This will help ensure proper coding of replacement unit and serve as a reference. The control module identification with code (**2**) as well as chassis number and immobilizer identification number (**1**) will be indicated on the display. VAS 5051 display shown.

– Switch off ignition.

– Remove windshield wiper arms and cover for plenum chamber.

– Unlock and separate connector(s) of engine control module.



➢ Slide the control module to the right (**arrow**) and then out.

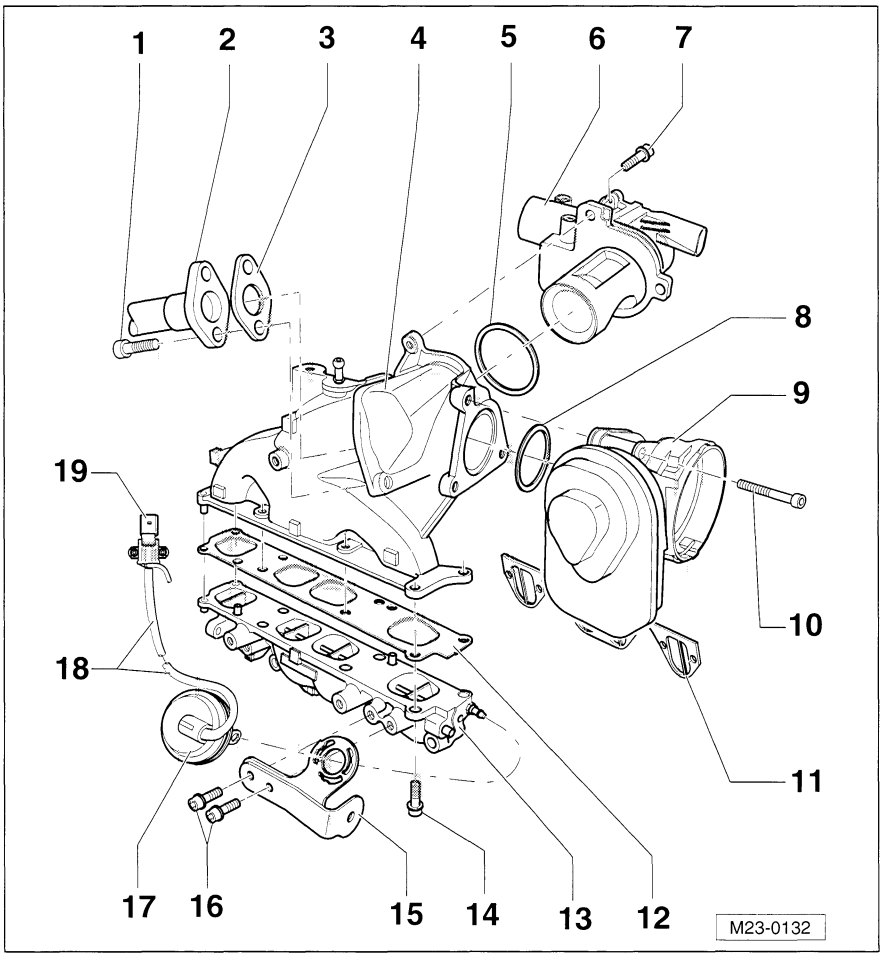
NOTE —
Replace any removed wire ties upon completion of repair.

Engine control module coding

The Engine Control Module must "know" what equipment is installed in the vehicle. This process is known as coding. In some cases, the new ECM will received data from other systems in the vehicle via the CAN-BUS. This will result in the new ECM effectively coding itself. If this does not occur, the coding procedure must be performed with a diagnostic computer such as the VAS 5051/5052 in the Guided Fault finding mode. Proper ECM codes are established and installed by the VAS 5051/5052.

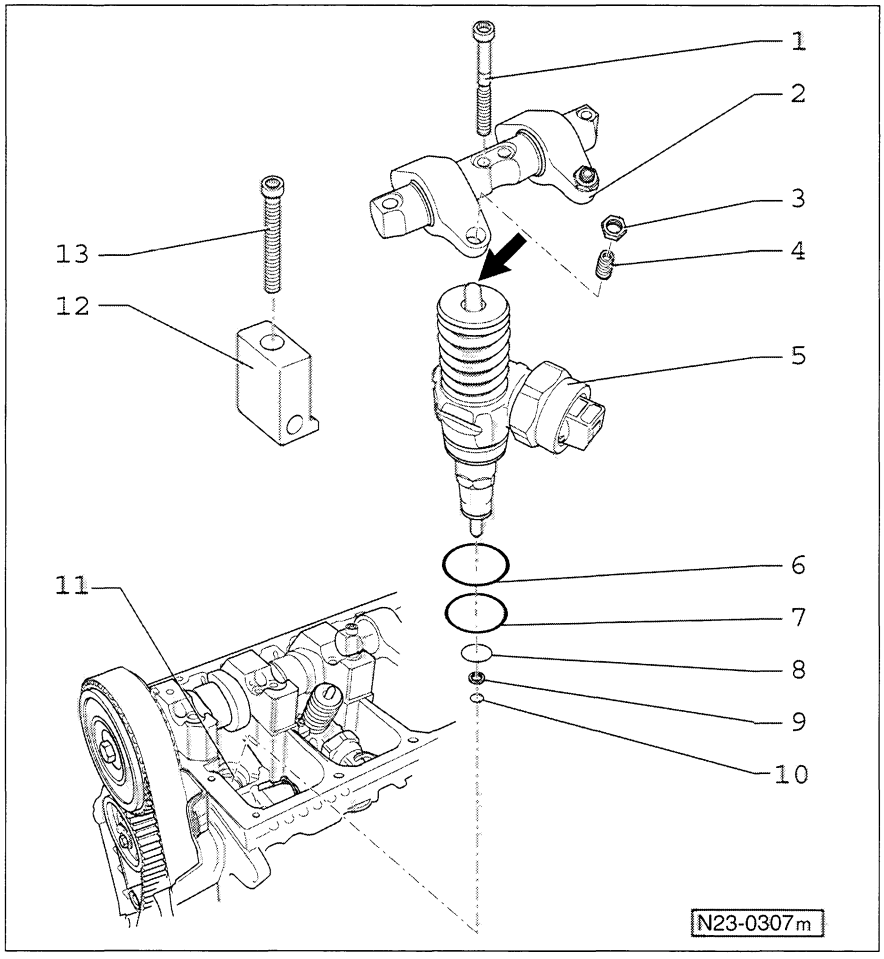
Coding memory is, however, retained when the battery is disconnected. If a new ECM is installed without being coded, the engine will usually run poorly and the automatic transmission and anti-lock braking system (if equipped) will not function properly. The MIL will be illuminated.

Variable intake manifold, assembly



1. **Bolt**
   - Tighten to 22 Nm (16 ft-lb)
2. **Connecting pipe**
   - From EGR cooler
3. **Gasket**
   - Always replace
4. **Intake manifold**
   - Upper section
5. **O-ring**
   - Always replace
6. **Exhaust Gas Recirculation (EGR) vacuum regulator valve (N121)**
7. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
8. **O-ring**
   - Always replace
9. **Variable intake manifold flap**
   - With Motor for intake flap (V157)
10. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
11. **Gasket**
    - Always replace
12. **Gasket**
    - Always replace
13. **Intake manifold**
    - Lower section
    - With change-over shaft
14. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
15. **Mounting bracket**
16. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
17. **Vacuum servo**
    - For intake manifold runner control
18. **Vacuum line**
19. **Intake Manifold Runner Control (IMRC) valve (N316)**

Pump injector (Pump Düse), assembly



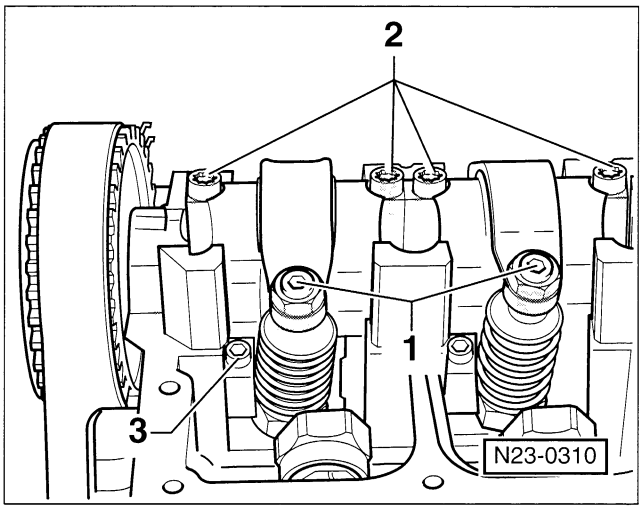
1. **Bolt**
   - Always replace
   - Tighten to 20 Nm (15 ft-lb) + ¼ turn (90°)
   - Always observe loosening and tightening sequence when removing and installing, see **Pump injector, removing and installing**
2. **Rocker arm shaft**
   - Qty. 2
   - Do not interchange; mark with permanent marker before removal, see **Pump injector, removing and installing**
3. **Nut, locking**
   - Tighten to 30 Nm (22 ft-lb)
4. **Adjustment screw**
   - Replace if evidence of wear when installing new pump injector
   - May requires adjustment if pump injector is replaced, see **Pump injector, removing and installing**
5. **Pump injector**
   - Also identified as Unit Injector or Pump Düse
   - Check ball pin (**arrow**) for signs of wear, replace if necessary
   - see **Pump injector, removing and installing**
6. **O-ring**
   - See **Pump injector O-rings, removing and installing**
7. **O-ring**
   - See **Pump injector O-rings, removing and installing**
8. **O-ring**
   - See **Pump injector O-rings, removing and installing**
9. **Heat insulating seal**
   - Always replace
10. **Circlip**
11. **Cylinder head**
12. **Tensioning block**
    - Retains pump injector
13. **Bolt**
    - Always replace
    - Tighten to 12 Nm (9 ft-lb) + ¾ turn (270°)

Pump injector, removing and installing

Removing

– Remove timing belt guard, upper outer section and cylinder head (valve) cover. See **15e Cylinder head and Valvetrain (1.9L PD Engine)**.

– Turn crankshaft until the cam lobe pair for the appropriate pump injector cylinder point upward.



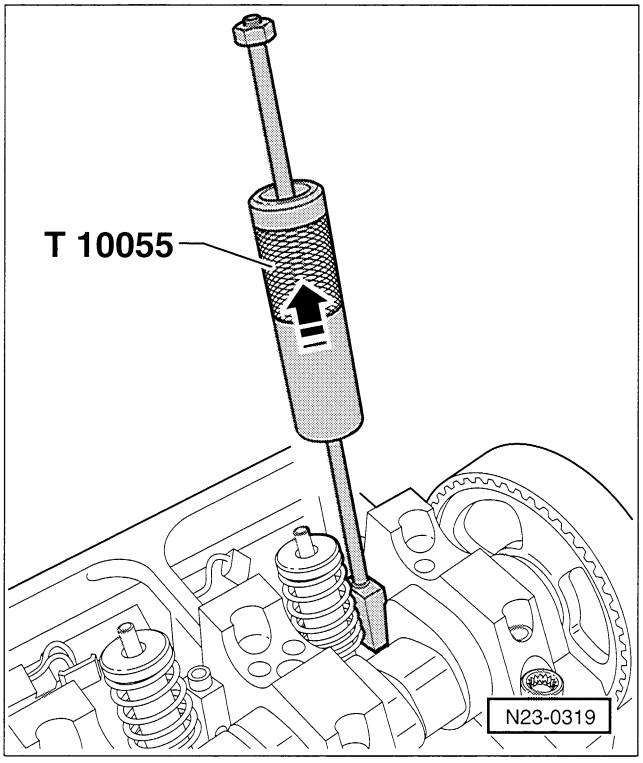
➤ Loosen lock nut of adjustment screw (**1**) and unscrew until appropriate rocker arm lies against plunger spring of the pump injector.

– Remove rocker arm securing bolts (**2**) in an outward-to-inward pattern with socket 3410 or equivalent and remove rocker arm shaft.

– Remove tensioning block securing bolts (**3**) with socket T10054 or equivalent and remove tensioning block.

– Remove harness connector from pump injector by gently prying with a screwdriver. Support opposite side of connector using light finger pressure to prevent connector from becoming wedged.

– Seat puller T10055 into slot on side of pump injector. Puller fits into slot where tensioning block retains pump injector.



➤ Pull pump injector out of cylinder head seat (**arrow**) with gentle taps.

Installing

NOTE —

- *If a new pump injector is installed, the appropriate adjustment screw in the rocker arm must also be replaced.*
- *Any time that work is performed which requires the pump injector to be adjusted, the adjustment screw in the rocker arm and also the pump injector ball pin must be cleaned and checked for signs of wear. If wear is evident the ball pin and the adjustment screw must be replaced.*
- *New pump injectors, as supplied by Volkswagen, have O-rings and heat shield seals supplied.*

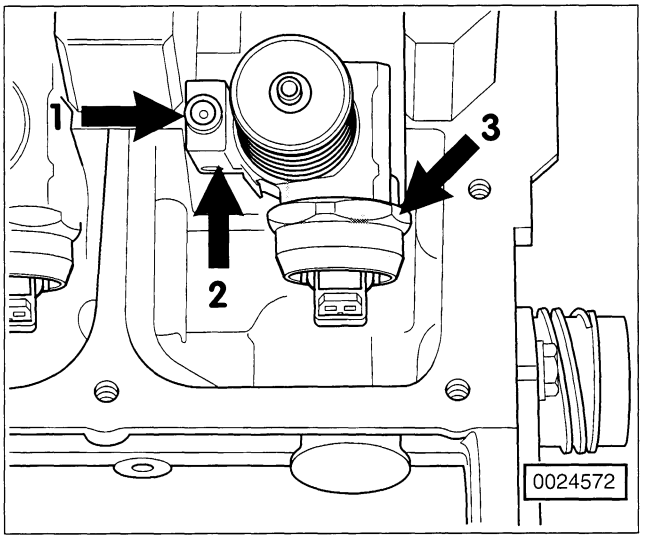
– Replace heat shield seal and O-rings if old pump injector is reused.

– Check that the three O-rings, heat shield seal and circlip are seating correctly before installing pump injector.

NOTE —

The seals must not be twisted.

– Oil all three seals and install pump injector down into cylinder head with great care.

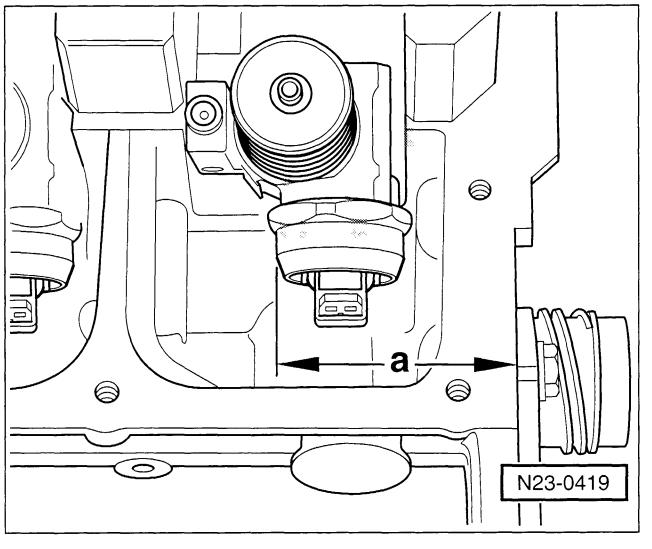


➢ Push pump injector (**3**) evenly and squarely into cylinder head as far as possible.

– Install tensioning block (**2**) into slot on side of pump injector.

NOTE —
If the pump injector is not at right angles (square) to the tensioning block, the securing bolt may loosen. This can damage the pump injector and/or the cylinder head.

– Preliminarily align the pump injector (**3**) in the position shown by screwing a new securing bolt (**1**) into the tensioning block (**2**) until pump injector can still just be turned easily.

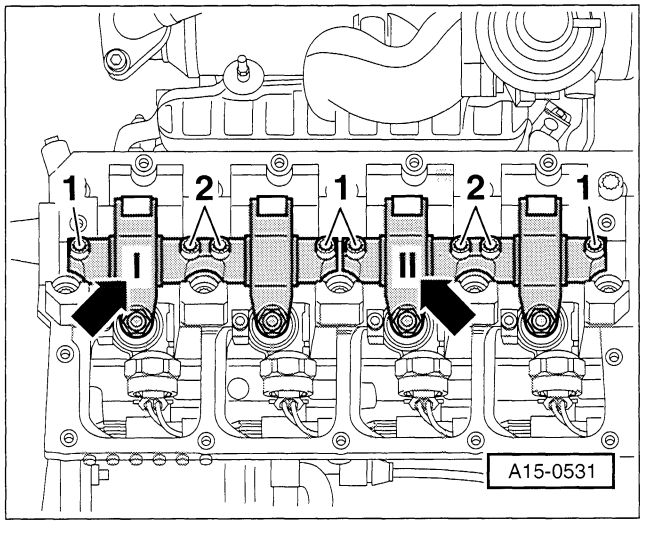


➢ Align pump injector at right angles with camshaft bearing caps. Check dimension **a** from outer edge of cylinder head to rounded edge of appropriate pump injector with a vernier caliper with a measuring range of at least 400 mm (16 in.). Cylinder number 4 is shown.

– Adjust and align pump injector position for each cylinder, as required, according to specification table.

Table b. Pump Injector Positions

Cylinder	Dimension a
1	333.0 mm ± 0.8 mm (13.110 in. ± 0.031 in)
2	245.0 mm ± 0.8 mm (9.646 in. ± 0.031 in)
3	153.6 mm ± 0.8 mm (6.047 in. ± 0.031 in)
4	65.6 mm ± 0.8 mm (2.583 in. ± 0.031 in)

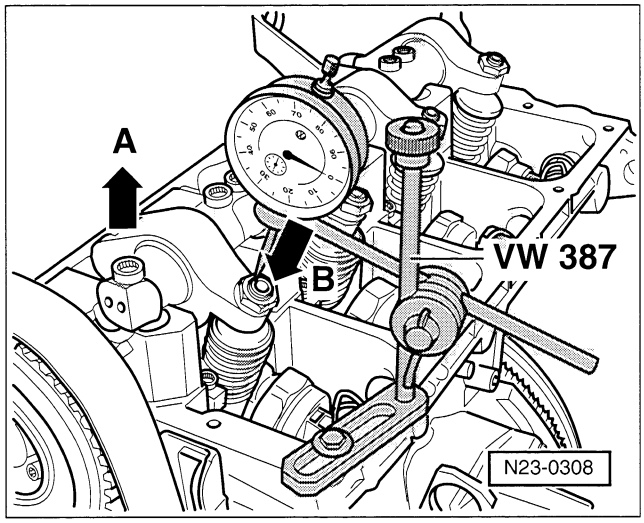


– When pump injector is properly aligned, tighten new securing bolt in tensioning block.

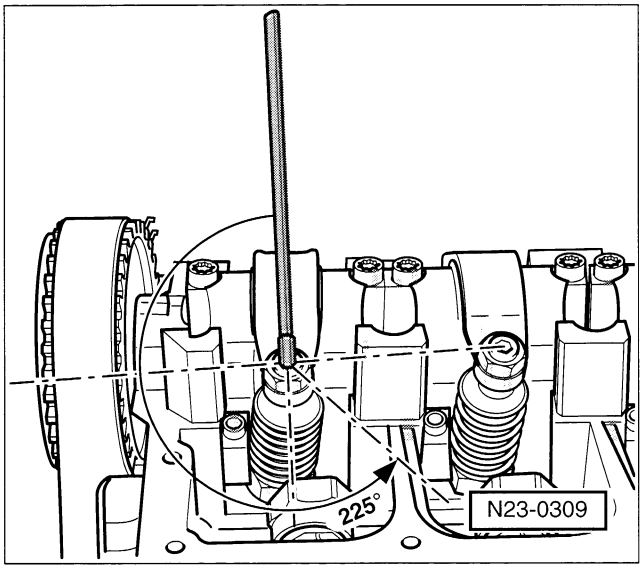
Tightening torque
- Pump injector bolt to tensioning block in cylinder head always replace . . . . . 12 Nm (9 ft-lb) + ¾ turn (270°)
- Rocker arm shaft to cylinder head, in sequence always replace . . . . . 20 Nm (15 ft-lb) + ¼ turn (90°)

➢ Install rocker arm shaft (**arrows**, as required) with new securing bolts and tighten in sequence.

- Step 1:
  Hand tighten inner bolts (**2**), and then outer bolts (**1**).
- Step 2:
  Torque inner bolts (**2**) and outer bolts (**1**) to specification.

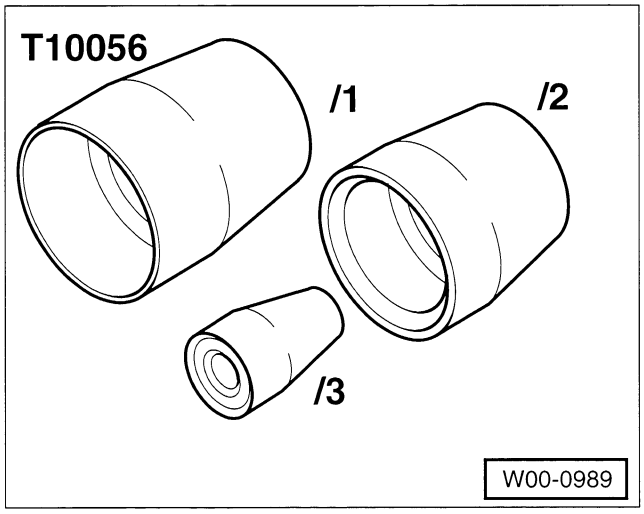


- Mount dial gauge support (VW 387) to cylinder head as shown and place dial gauge against adjustment screw of pump injector.
- Turn crankshaft in engine running direction until roller of rocker arm is positioned at the highest point of the cam lobe (**arrow A**) which will position dial gauge at the lowest point (**arrow B**).
- When this position is attained, remove dial gauge and support.
- Without disturbing positioning, turn adjustment screw inward towards rocker arm until a firm resistance is felt (pump injector positioned at limit stop). Be sure that locking nut remains free to move.



- Turn adjustment screw back 225° (5/8 turn) off of limit stop.
- Hold adjustment screw in this position and tighten lock nut to 30 Nm (22 ft-lb).
- Repeat procedure for any/all pump injectors that have been removed.
- Connect pump injector harness connector(s).
- Install cylinder head (valve) cover.
- Balance of installation is reverse of removal.

Pump injector O-rings, removing and installing



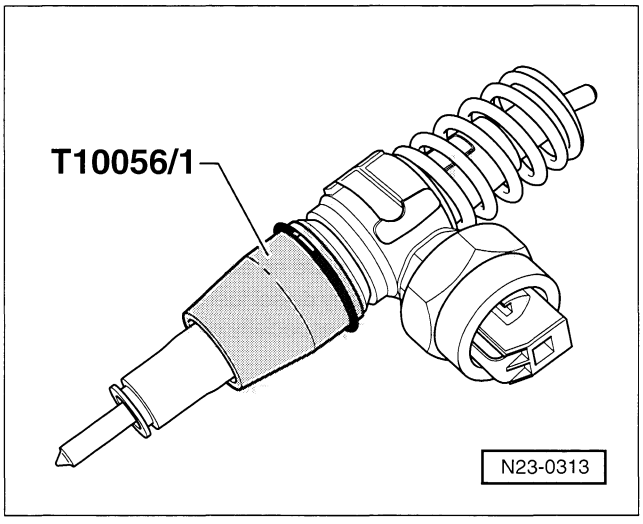
- Assembly sleeve set T10056 is required to properly service pump injector O-rings.
- Remove pump injectors as previously described.
- Carefully pry old O-rings off of pump injector.

NOTE —

- *Ensure that seat for O-rings is clean and does not have any burrs.*
- *Always use the assembly sleeves to install the O-rings. There is a danger of damaging the O-rings if the sleeves are not used.*
- *There has been a gradual introduction of O-rings with no colored markings. Ensure that the O-rings are allocated correctly to their respective grooves: Ring size decreases towards nozzle.*
- *Prevent the O-rings from rolling when sliding them on. The O-rings must not be twisted when seated in the pump injector.*

– Pull heat insulating shield and circlip off end of pump injector.

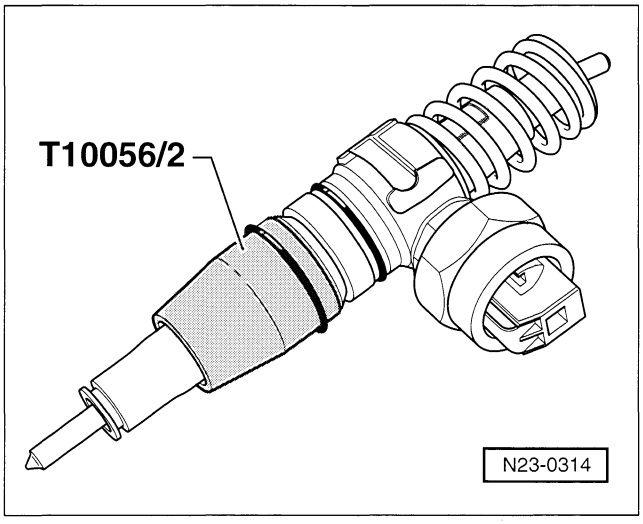
– Clean O-ring seating surfaces on pump injector very carefully.



➤ Slide assembly sleeve T10056/1 as far as possible onto pump injector.

– Slide upper, thicker O-ring carefully onto assembly sleeve and into seat on pump injector.

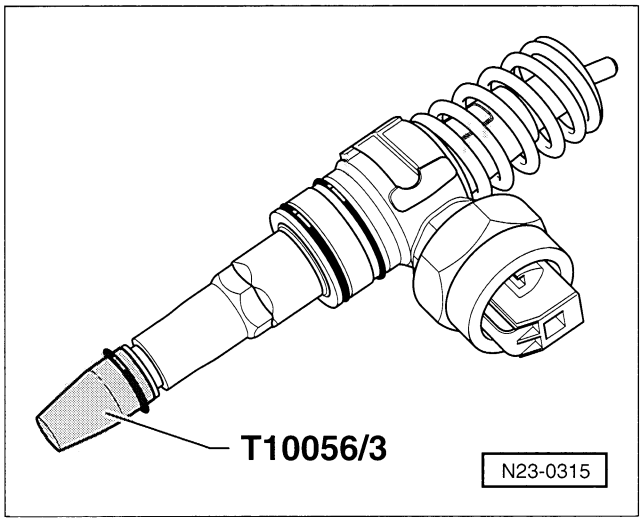
– Remove assembly sleeve.



➤ Slide assembly sleeve T10056/2 as far as possible onto pump injector.

– Slide the middle, thinner O-ring carefully onto assembly sleeve and into seat on pump injector.

– Remove assembly sleeve.



➤ Slide assembly sleeve T10056/3 as far as possible onto pump injector.

– Slide the lower, O-ring carefully onto assembly sleeve and into seat on pump injector.

– Remove assembly sleeve.

– Install new heat insulating shield and circlip on end of pump injector.

– Repeat procedure for any/all pump injectors that as required.

– Install pump injector as previously described.

QUALITY REVIEW

When you have finished working under the hood and around other areas of the vehicle, it is advisable to take a moment to quality check or review your work. This helps to insure that the operation or repair has been completed properly with all affected systems functioning within normal parameters. These may include the following:

- Make sure that there are no air, fuel, or vacuum leaks.
- Be sure to wipe up any diesel fuel spills, using soap and water as necessary, especially on any rubber or painted surfaces.
- Make sure that all components involved in the repair are positioned correctly and function properly.
- Make sure all tools and shop cloths are removed.
- Road test vehicle to confirm proper engine operation.

24a Fuel Injection–Motronic (1.8L engine)

GENERAL 24a-1
Safety Precautions 24a-2

ON BOARD DIAGNOSTICS 24a-3
Adaptation 24a-4
Readiness codes 24a-4
Engine control module coding 24a-5

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Fuel rail and injector assembly 24a-12
Engine Control Module (ECM) 24a-13
Engine speed (RPM) sensor 24a-13

TABLES
a. Readiness code values 24a-4

GENERAL

This repair group covers fuel injection/engine management system for the 1.8 liter turbo gasoline engine. Operation of the Bosch Motronic ME7.5 engine management system is described in **2 Fuel, Ignition and Exhaust Systems.**

Special testing equipment may be necessary for some of the tests and repair procedures given here.

Engine Code	
• AWD, AWW, AWP	Motronic ME 7.5

NOTE —

- *1.8L engines are equipped with versions of the Bosch Motronic ME7.5 engine management system which is OBD II compliant. It is recommended that fault diagnosis and troubleshooting be carried out using Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program.*
- *Fuel pump and fuel tank testing and repair along with EVAP information is covered in* **20 Fuel Storage and Supply**.
- *Ignition system testing and repair is covered in* **28a Ignition System–Gasoline.**
- *Related systems such as Exhaust Gas Recirculation (EGR) and catalytic converters are covered in* **26 Exhaust System and Emission Controls**.

The Motronic ME7.5 system combines ignition, fuel injection and electronic accelerator pedal functions into one system managed by a single Engine Control Module (ECM). The system is fully adaptive and features built-in diagnostics that are capable of detecting and storing coded fault information. There are no basic adjustments or settings that can be made to the system without specialized equipment.

Safety precautions

The following warnings should be adhered to whenever working on the engine management system.

WARNING —

- *Fuel may be discharged during fuel system repairs. Do not smoke or work near heaters or other fire hazards. Have a fire extinguisher handy. Work only in a well-ventilated area.*
- *Wear suitable hand and eye protection when working with gasoline. Prolonged contact with fuel can cause illness and skin disorders.*
- *Fuel hoses in engine compartment must only be secured with spring-type clips. The use of clamp or screw-type clips will damage fuel lines and cause fuel leaks.*
- *Connect and disconnect wires and test equipment only with the ignition switched off.*
- *Before making any electrical tests that require the engine to be cranked using the starter, disable the ignition system as described in* **28a Ignition System–Gasoline.**
- *Do not use sealants containing silicones. Particles of silicone drawn into the engine will not be burned in the engine and will damage the heated oxygen sensor. Use only sealants and engine chemicals marked as safe for oxygen sensors.*
- *During testing, it is possible for the Engine Control Module to recognize and store a diagnostic trouble code (DTC) that was due solely to the testing procedure. Therefore, after completing repairs, the DTC memory must be checked and erased as necessary with Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program.*
- *Cleanliness is essential when working on the fuel system. Thoroughly clean fuel line connections and surrounding areas before loosening. Avoid the use of compressed air. Avoid moving the vehicle. Only install clean components.*
- *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program.*

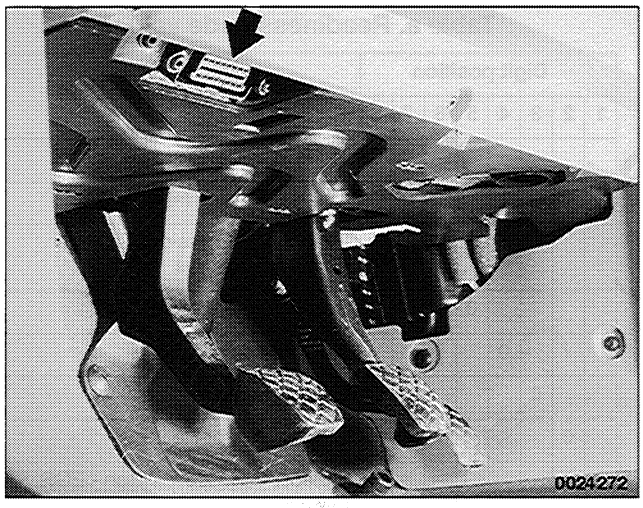
ON BOARD DIAGNOSTICS (OBD)

On Board Diagnostics, found on the Bosch Motronic ME7.5 Engine Management Systems monitor most aspects of engine operation. The current generation OBD II is integrated into all North American market Volkswagen gasoline engines. For a description of the system and an overview of operation, see **2 Fuel, Ignition, and Exhaust Systems.**Because of the large number of operating parameters monitored and the vast quantity of data available, fault diagnosis can only be properly carried out using a suitable scan tool such as the Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program. The engine control module or ECM also supports certain limited functions in a government-mandated generic scan tool mode. These functions are standardized for all OBD II compliant vehicles, but are not as comprehensive as those found by using the Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program in the proprietary mode of operation.

During repairs where the battery must be disconnected, consideration must be given to the effect that this will have on the vehicle in general and the engine management system in particular.

- Diagnostic Trouble Codes may be erased.
- Readiness codes may be erased.
- Fault counters that monitor certain functions will be reset to zero.
- Adaptive leaning values will be set to default.

Because the ignition, fuel injection, accelerator system and emission control functions are even more inter-related than on previous Motronic versions, it is difficult, if not impossible to isolate general driveability problems by examining individual components of the system. For this reason, a suitable scan tool must be used for diagnosis if driveability problems occur or if the malfunction indicator light (MIL) or E-Gas System lights (EPC) are illuminated.



Access for the scan tool is through the Data Link Connector (DLC) (**arrow**) under the lower left side of the instrument panel.

Adaptation

The Motronic ME7.5.1 engine management system is adaptive. Idle speed, ignition timing, injection timing and quantity automatically compensate and adapt to changes in the engine due to wear and operating conditions. Minor problems such as mixture changes due to small vacuum leaks can be eliminated. As a result, idle speed, fuel mixture (CO%) and ignition timing are non-adjustable.

NOTE —

Beginning in 1994 (1993 in California) automakers are required by law to apply uniform terminology, words and terms for certain components according to SAE standard J1930. These standardized terms are used throughout this section.

Readiness Codes

Federal and state legislation requires that all auto manufacturers build into their engine management systems the ability to check for proper operation of up to 8 functions. For the ME7.5 engine management system, the exact number depends on the equipment level of each particular vehicle. Most of the time, the readiness code will set itself after the appropriate conditions have been met. These may include a cold or a hot start, operation at a certain load or speed for a certain period of time, or operation at different temperatures. After repairs, it may be advantageous to confirm repairs rather than wait to see if they set on their own. Other than waiting, the only other method of setting the readiness codes on the Motronic ME7.5 system is with a scan tool. This method requires Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program. and extensive knowledge of the operation and capabilities. Readiness codes are then generated according to instructions provided by the scan tool manufacturer. For the significance of the 8 digit readiness code, see **Table a**.

Table a. Readiness code values

Digit position								Diagnostic Function
1	2	3	4	5	6	7	8	
							0	Three Way Catalyst
						0		Catalyst Heating (always 0)
					0			Evaporative Emissions System (Fuel tank vent system)
				0				Secondary Air Injection System
			0					Air Conditioning
		0						Oxygen Sensor
	0							Oxygen Sensor Heater
0								Exhaust Gas Recirculation - EGR (always 0)

The readiness code can be displayed in any of several areas within the ECM's diagnostic memory depending on the individual scan tool. It will always have a format consisting of 8 digits. If the 8 digit code contains characters other than the number 0, such as 10100110, than the readiness code is NOT set. When the code displays all zeros, i.e. 00000000, the readiness code IS set and no further action is required. The specifics of **Table a** apply to the 1.8L engine only. While the format is required to be the same for all engines, certain equipment may not be used on each engine. For example, the 1.8L engine does not use EGR and as such, digit number 8 will always show 0. Other engines that use EGR, such as the 1.9L diesel, will show either a 1 or a 0 as appropriate.

Engine control module coding

The engine control module (ECM) must be supplied with appropriate power sources and grounds to function properly. Also, the engine control module must "know" what equipment is installed in the vehicle. This process is known as coding and must be performed whenever the ECM is replaced as new ECM's are un-coded. If an ECM is moved between vehicles such as might be the case for diagnostic testing, the coding will need to be changed if equipment is different. Coding memory is, however, retained when the battery is disconnected. If a new ECM is installed without being coded, the engine will usually run poorly and the automatic transmission and anti-lock braking system (if equipped) will not function properly. The MIL will be illuminated.

In some cases, this coding process can be done with Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program. Most later vehicle ECMs can only be coded with the diagnostic computer VAS 5051/5052. The appropriate code is electronically programmed into the ECM according to instructions provided by the scan tool manufacturer. See the **Scan Tool** section at the back of this manual for ECM coding information.

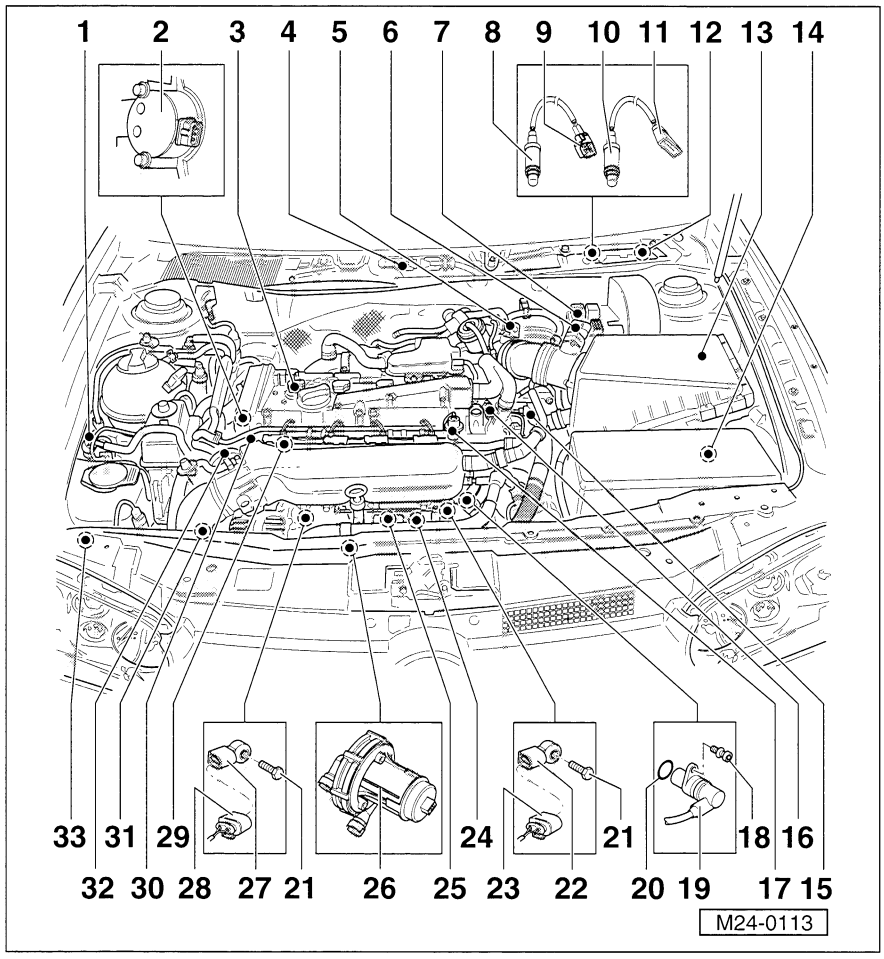
MOTRONIC ENGINE MANAGEMENT COMPONENTS

The following pages show assembly views of the major underhood fuel injection components.

NOTE —

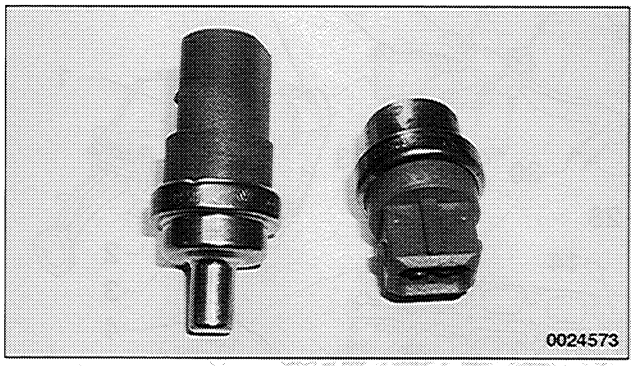
Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*

Fuel injection system component locations, overview

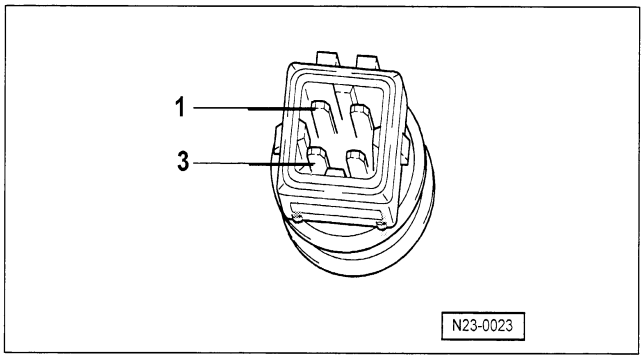


1. **Evaporative Emissions (EVAP) Canister purge regulator valve 1 (N80)**
2. **Camshaft Position (CMP) sensor 2 (G163)**
3. **Ignition coils with power output stage (N70, N127, N291, N292)**
   - Individual coil for each cylinder
4. **Engine Control Module (ECM) (J220)**
5. **Wastegate bypass regulator valve (N75)**
6. **Mass Air Flow (MAF) sensor (G70)**
7. **Secondary Air Injection (AIR) pump relay (J299)**
8. **Heated oxygen sensor (HO2S) (G39)**
   - Before catalyst, B1S1
9. **Harness connector (black)**
   - For Oxygen sensor and O2S heater before (pre) catalyst
   - Engine code AWD: 4-pin
   - Engine code AWW, AWP: 6-pin
10. **Heated oxygen sensor (HO2S) (G130)**
    - After catalyst, B1S2
11. **Harness connector (4-pin)**
    - AWD, brown
    - AWW, AWP, black
    - For Oxygen sensor and O2S heater after (post) catalyst
12. **Clutch pedal position switch (F36), brake light switch (F) and brake pedal position switch**
13. **Air cleaner assembly**
14. **Battery cover**
15. **Engine Coolant Temperature (ECT) sensor (G62)**
    - See **Engine coolant temperature (ECT) sensor, measuring resistance**
16. **Camshaft adjustment valve 2 (N208)**
    - Engine code AWW, AWP only
17. **Fuel pressure regulator**
    - Location: on fuel rail
18. **Screw**
    - Tighten to 10 Nm (7 ft-lb)
19. **Engine Speed (RPM) sensor (G28)**
20. **O-ring**
    - Always replace
21. **Bolt**
    - Tighten to 20 Nm (15 ft-lb)
    - Tightening torque influences function of knock sensor
22. **Knock Sensor (KS) 2 (G66)**
23. **Harness connector, knock sensor 2**
    - Engine code AWD: 3-pin
    - AWD engine has both knock sensor connectors (square) and engine rpm sensor connector (grey, oval shaped) mounted together
    - Engine code AWW, AWP: 2-pin
24. **Recirculation valve for turbocharger (N249)**
25. **Secondary Air Injection (AIR) solenoid valve (N112)**
26. **Secondary Air Injection (AIR) pump motor (V101)**
27. **Knock Sensor (KS) 1 (G61)**
28. **Harness connector, knock sensor 1**
    - Engine code AWD: 3-pin
    - AWD engine has both knock sensor connectors (square) and engine rpm sensor connector (grey, oval shaped) mounted together
    - Engine code AWW, AWP: 2-pin
29. **Fuel injectors (N30, N31, N32, N33)**
30. **Intake Air Temperature (IAT) sensor (G42)**
31. **Power steering pressure switch (F88)**
32. **Throttle Valve (TV) control module (J338)**
    - For Electronic Pedal Control, EPC, (E-Gas System)
33. **Charge air (boost) pressure sensor (G31)**

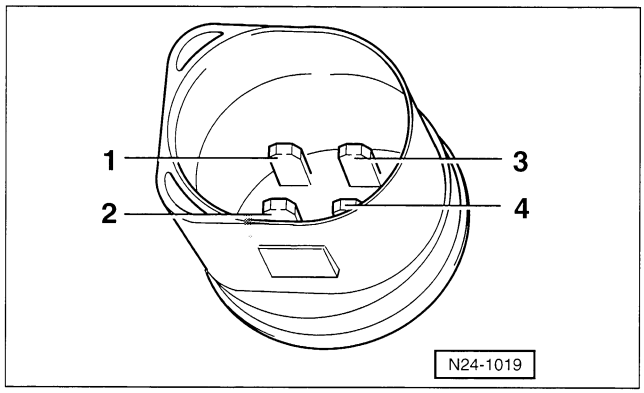
Engine coolant temperature (ECT) sensor, measuring resistance



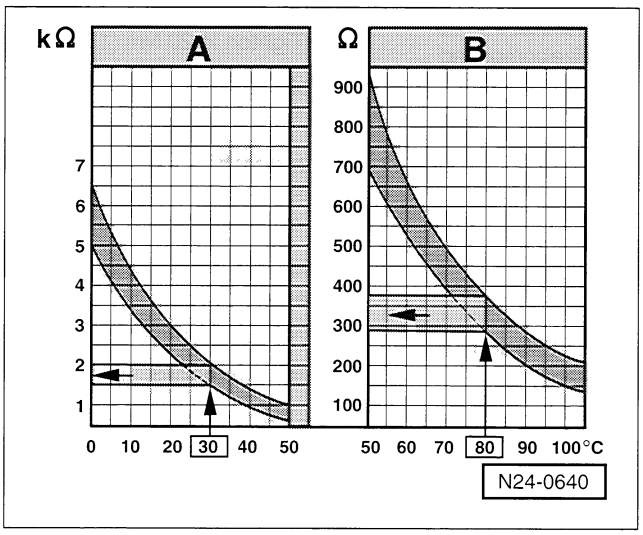
➢ Several different version engine coolant temperature sensors were installed in 1.8L engines. The early style sensor (**right**) was blue and square shaped. The later style sensor (**left**) is longer, oval shaped, and either green or black. Use the illustrations below to determine which style sensor is installed.



➢ Measure resistance at terminals **1** and **3** on early style ECT sensor.



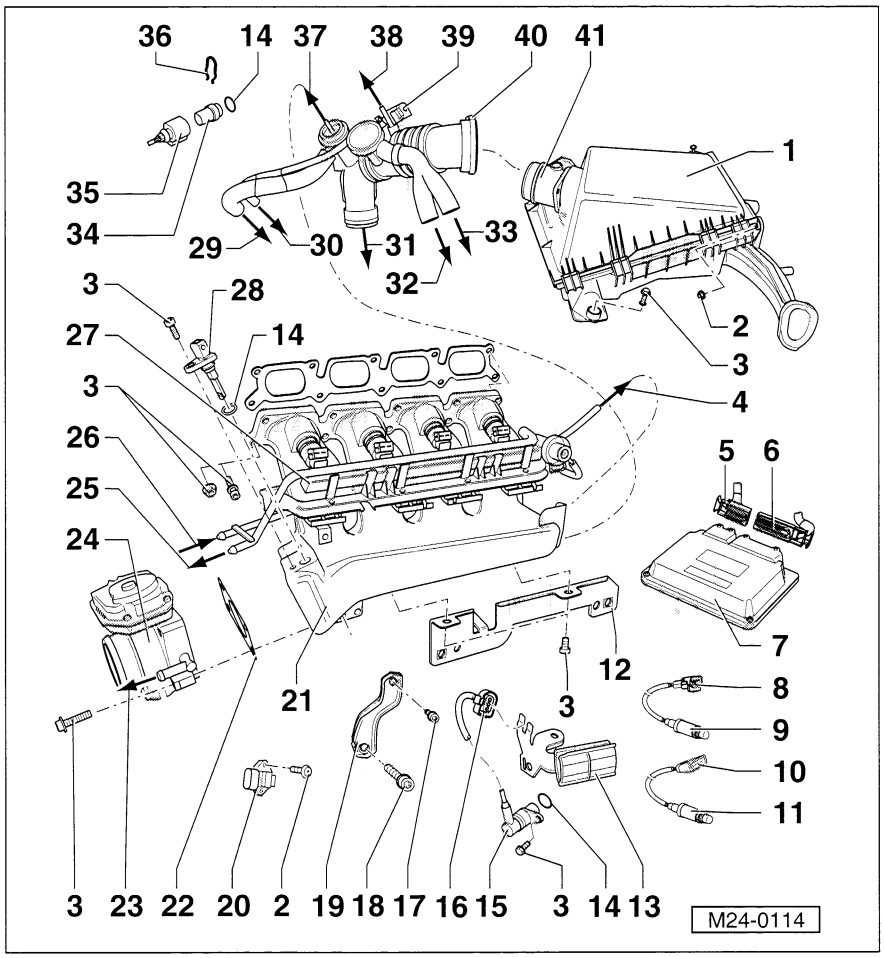
➢ Measure resistance at terminals **3** and **4** on later style sensor.



➢ Compare ECT resistance reading to graph at left.

- Scale **A** shows resistance for coolant temperature range 0-50°C (32-122°F)
- Scale **B** shows resistance for coolant temperature range 50-100°C (122-212°F)
- Example:
  30°C corresponds to 1500-2000 Ω
  80°C corresponds to 275-375 Ω

Fuel injection system components, removing and installing



1. **Air filter assembly**
   - See assembly view given later
2. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
3. **Bolt**
   - Tighten to 6 Nm (52 in-lb)
4. **Vacuum connection**
   - To intake manifold
5. **ECM harness connector (40-pin)**
   - Terminals 82 to 121
   - Only disconnect or connect with ignition switched OFF
6. **ECM harness connector (81-pin)**
   - Terminals 1 to 81
   - Only disconnect or connect with ignition switched OFF
7. **Engine control module (ECM) (J220)**
   - Location: in air plenum at forward part of instrument panel near base of the windshield on driver's side
   - Must be matched to throttle valve control module (J338) with a scan tool if replaced
8. **Harness connector (black)**
   - For Oxygen sensor and O2S heater before (pre) catalyst
   - Engine code AWD: 4-pin
   - Engine code AWW, AWP: 6-pin
   - For pre-catalyst heated oxygen sensor (G39) and oxygen sensor heater (Z19)
   - Right underside of vehicle in plastic shield
9. **Oxygen sensor, pre-catalyst (G39) (B1S1)**
   - Use VW special tool set 3337, or equivalent to remove
   - Monitors combustion efficiency
   - Location: Threaded into front exhaust pipe
   - Tighten to 50 Nm (37 ft-lb)
   - Coat threads only with high temperature anti-seize G 052 112 A3
   - Do not allow anti-seize compound into the slots on the sensor body
10. **Harness connector, 4-pin**
    - For post-catalyst heated oxygen sensor (G130) and oxygen sensor heater (Z29)
    - Right underside of vehicle in plastic shield
11. **Oxygen sensor, post-catalyst (G130) (B1S2)**
    - Use VW special tool set 3337, or equivalent to remove
    - Monitors catalytic converter efficiency
    - Location: threaded into rear of catalytic converter
    - Tighten to 50 Nm (37 ft-lb)
    - Coat threads only with high temperature anti-seize G 052 112 A3
    - Do not allow anti-seize compound into the slots on the sensor body
12. **Bracket**
    - For recirculation valve for turbocharger (N249)
    - For engine speed (RPM) sensor (G28) harness connector AWD engine only
13. **Bracket**
    - For engine speed (RPM) sensor (G28) harness connector AWW, AWP engine only
14. **O-ring**
    - Always replace
15. **Engine speed (RPM) sensor (G28)**
    - See **Engine speed sensor**, given later
    - Inductive type sensor
16. **Harness connector, 3-pin**
    - Grey
    - For engine speed (RPM) sensor
17. **Bolt**
    - Tighten to 20 Nm (15 ft lb)
18. **Bolt**
    - Tighten to 45 Nm (34 ft lb)
19. **Support bracket**
    - Between intake manifold and cylinder block
20. **Charge air pressure (boost) sensor (G31)**
    - Mounted to intercooler
21. **Intake manifold**
22. **Gasket**
    - Always replace

(continued on following page)

Fuel injection system components, removing and installing (continued)

23. Hose connection
- From evaporative emissions (EVAP) canister purge regulator valve (N80)

24. Throttle valve (TV) control module (J338)
- For Electronic Power Control, EPC, (E-Gas System)
- Must be matched to Motronic ME7.5.1 engine control module (J220) with a scan tool if replaced

25. Fuel return line
- Secure with spring clips only
- Ensure coupling is securely seated
- To fuel delivery unit in fuel tank

26. Fuel supply line
- Secure with spring clips only
- Ensure coupling is securely seated
- From fuel filter

27. Fuel rail, with fuel injectors (N30-N33) and fuel pressure regulator

28. Intake air temperature (IAT) sensor (G42)
- Location: mounted in intake manifold just behind throttle valve control module
- See **Intake air temperature (IAT) sensor, measuring resistance**

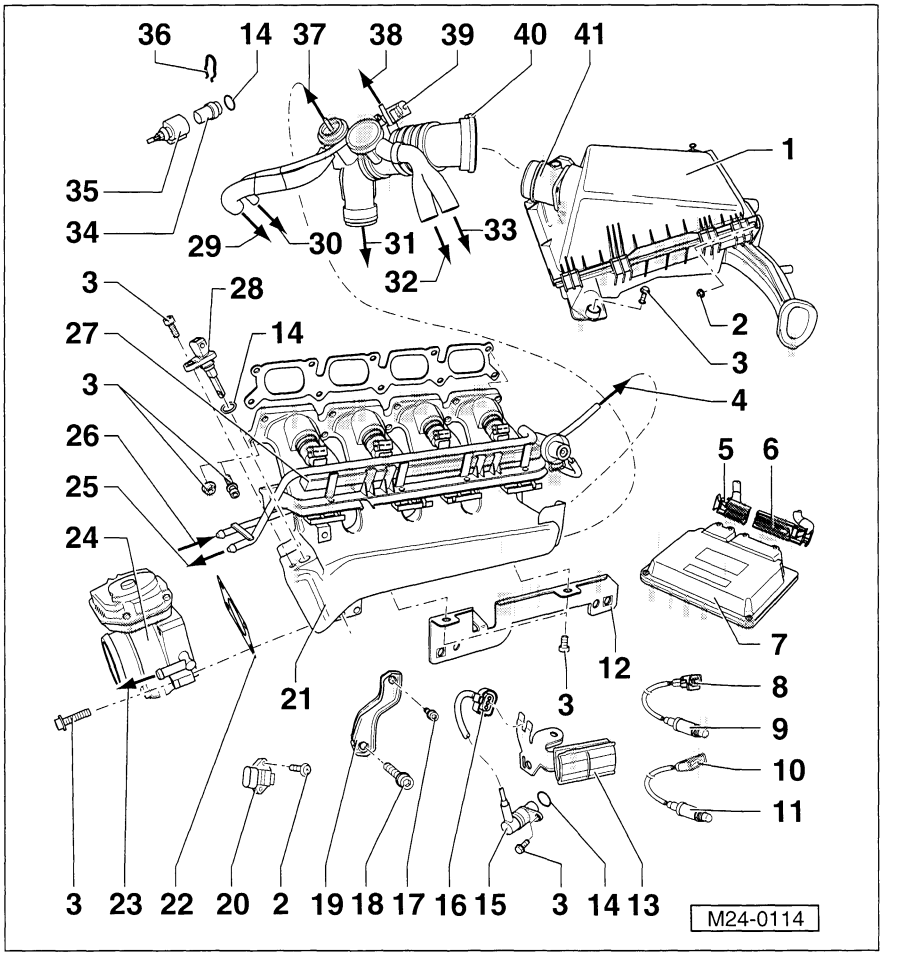
29. Air flow
- To pipe between turbocharger and intercooler

30. Air flow
- To pipe between turbocharger and intercooler

31. Air flow
- To turbocharger

32. Air flow
- From crankcase breather

33. Air flow
- From crankcase breather
- AWW, AWP engine only



34. Engine coolant temperature (ECT) sensor (G62) with gauge sensor (G2)
- 4-pin
- For engine control module
- Combined with coolant temperature gauge sender (G2) for instrument panel warning light

35. Harness connector, 4-pin
- Black
- For engine coolant temperature sensor (G62/G2)

36. Retaining clip
- Ensure clip is securely seated

37. Air flow
- To recirculation valve for turbocharger (N249)

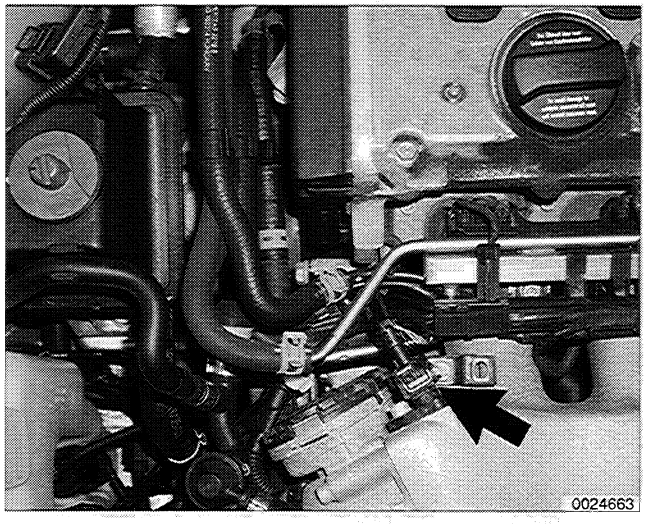
38. To pressure unit (servo) on turbocharger wastegate
- From turbocharger to intercooler connecting pipe
- To wastegate bypass regulator valve (N75)

39. Wastegate bypass regulator valve (N75)

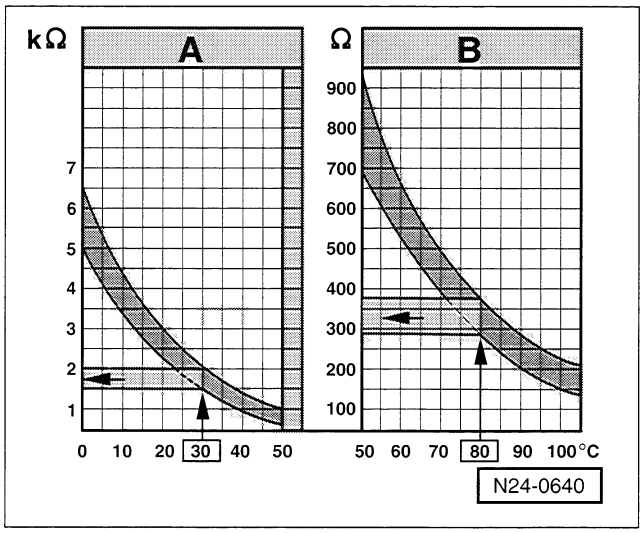
40. Intake hose

41. Mass air flow (MAF) sensor (G70)
- 5-pin harness connector
- Terminal 1 position not used

Intake air temperature (IAT) sensor, measuring resistance

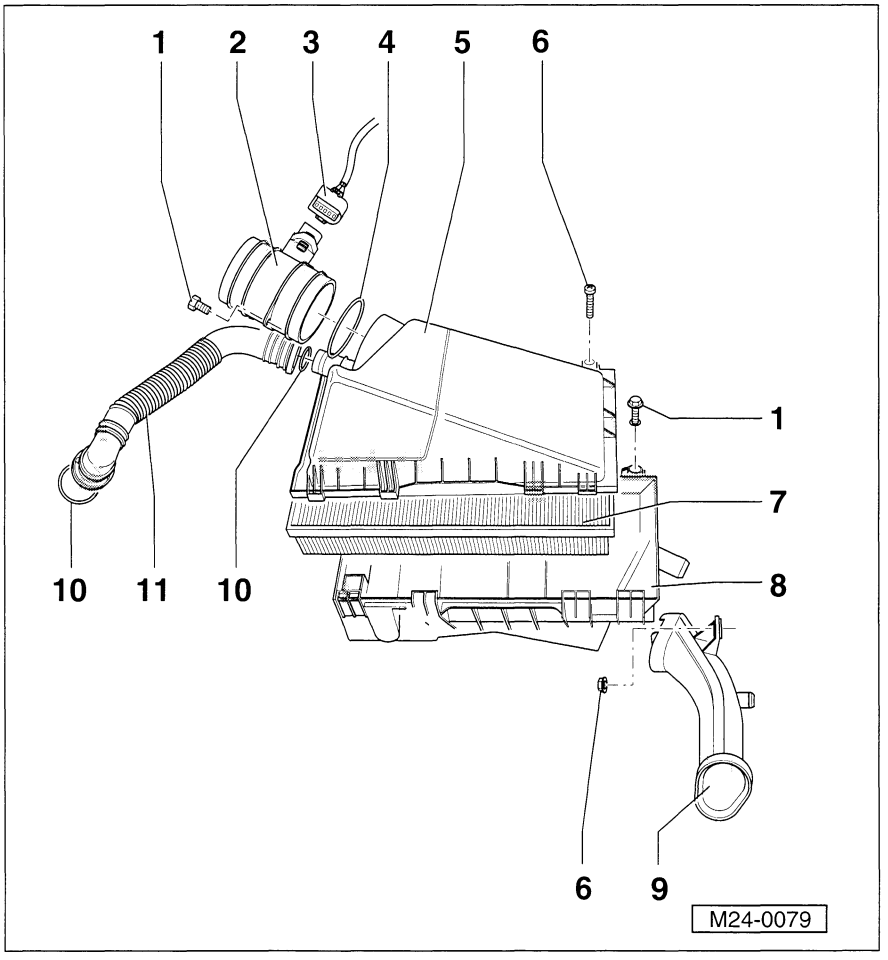


- Disconnect harness connector and measure resistance across two terminals of IAT sensor (**arrow**).



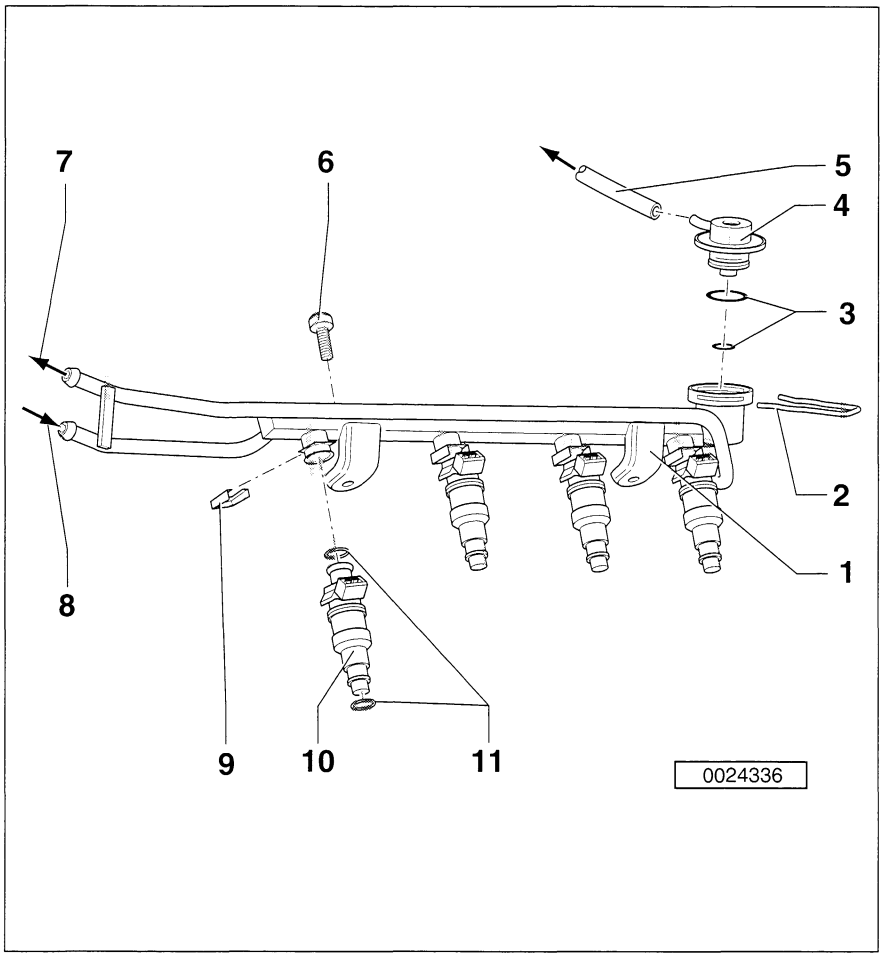
- Compare reading to graph (bottom):
  - Scale **A** shows resistance for intake air temperature range 0-50°C (32-122°F)
  - Scale **B** shows resistance for intake air temperature range 50-100°C (122-212°F)
  - Example:
    30°C corresponds to 1500-2000 Ω
    80°C corresponds to 275-375 Ω

Air cleaner assembly

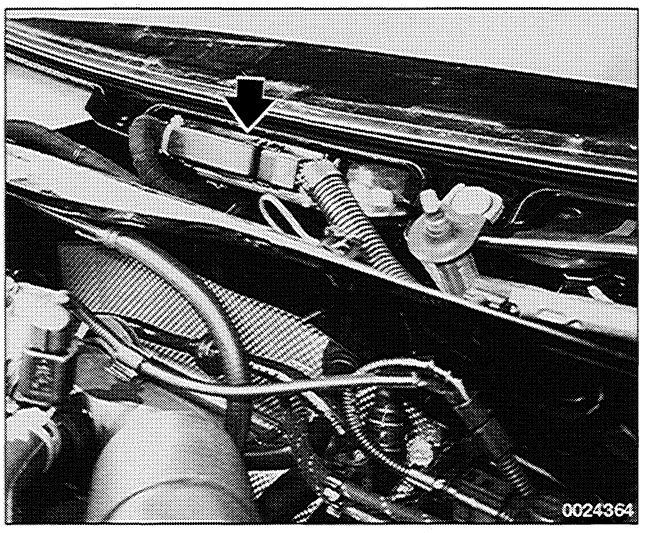


1. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
2. **Mass Air Flow (MAF) sensor (G70)**
   - Terminal 1 position not used
   - All contacts gold plated
3. **Harness connector, 5-pin**
   - All contacts gold plated
4. **Seal**
   - Replace if damaged
5. **Air cleaner housing, upper section**
6. **Bolt**
   - Tighten to 6 Nm (52 in-lb)
7. **Filter element**
   - Pleated, treated paper
8. **Air cleaner housing, lower section**
9. **Duct, intake air**
10. **O-ring**
    - Replace if damaged
11. **Intake hose**
    - From air cleaner housing upper section to secondary air injection pump intake
    - Ensure hose is seated tightly
    - Press together at front to release

Fuel rail and injector assembly



1. **Fuel rail**
2. **Retaining clip**
   - Ensure it is securely seated
3. **O-ring**
   - Replace if damaged
4. **Fuel pressure regulator**
   - Fuel pressure regulator with residual check valve
5. **Connecting hose**
   - To intake manifold
6. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
7. **Fuel return line/hose**
   - Secure with spring clips only
   - Ensure coupling is securely seated
   - To fuel delivery unit in fuel tank
8. **Fuel supply line/hose**
   - Secure with spring clips only
   - Ensure coupling is securely seated
   - From fuel filter
9. **Retaining clip**
   - Ensure it is securely seated
10. **Fuel injectors (N30, N31, N32, N33)**
    - 2-pin harness connector
11. **O-ring**
    - Always replace
    - Moisten with clean engine oil or fuel before installing



Engine Control Module (ECM)

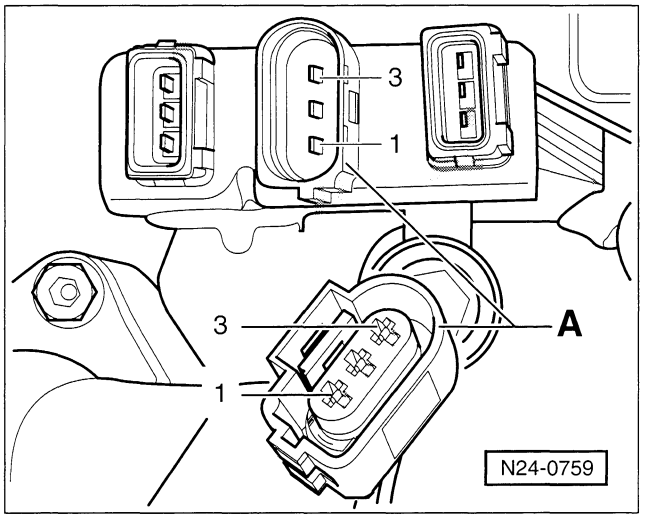
The engine control module (**arrow**) is located in the air plenum near the base of the windshield in the engine compartment. Access to the ECM requires removal of the windshield wiper arms and the air plenum cover.

Engine speed (RPM) sensor

Operation of the engine management system depends on a wide variety of input sensors. Failure of most of these sensors will allow the engine to continue to run, albeit poorly. One major exception to this is the engine speed sensor (G28). Failure of this sensor will prevent the engine from starting and running and will set a diagnostic trouble code in the ECM.

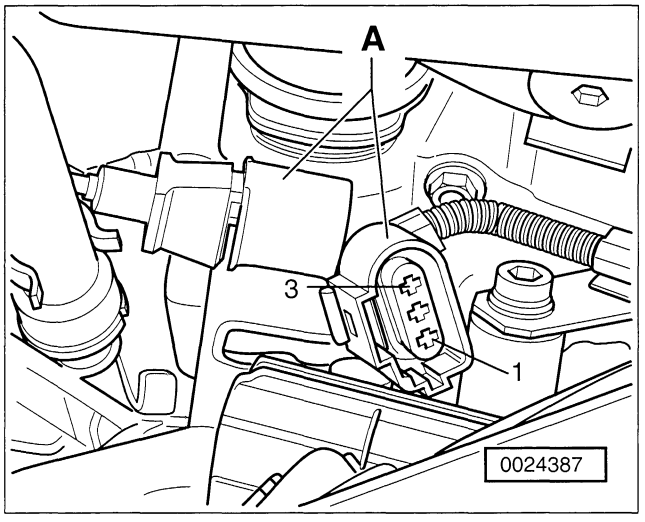
Note that most diagnostic functions require the use of a scan tool such as the Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program, however a quick check can be accomplished as follows:

– Disconnect grey 3-pin harness connector from the engine speed sensor plug near the secondary air injection pump.



Engine code AWD

- Engine speed sensor harness connector (**A**), with terminal identification, shown unplugged at multiple harness connector. Oxygen sensor connectors are on left and right.



Engine code AWW, AWP

- Engine speed sensor and harness connector (**A**), with terminal identification, shown unplugged.

– Connect an accurate ohmmeter between terminals **2** and 3 on sensor and measure resistance.

– Measure resistance between terminals **1** and **3**, and between terminals **1** and **2** as well. Compare readings to specification.

Specification

- Engine speed sensor resistance values, (1.8L engine)
  Between terminals 2 and 3 . . . . . 730 to 1000 Ω
  Between terminals 1 and 2 . . . . . .infinity Ω
  Between terminals 1 and 3 . . . . . .infinity Ω

– If specification is not obtained, replace engine speed sensor.

– If specification is obtained, and engine will not start, additional testing with a suitable scan tool will be required.

24b Fuel Injection–Motronic (2.0L engine)

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a. Readiness code values 24b-4

GENERAL

This repair group covers fuel injection/engine management systems on the 2.0L gasoline engine. Operation of the Bosch Motronic M5.9 and ME7 engine management systems is described in **2 Fuel, Ignition and Exhaust Systems.**

Special testing equipment may be necessary for some of the tests and repair procedures given here.

Engine Codes

- AEG . . . . . Motronic M5.9
- AVH, AZG, BBW, BEV . . . . . Motronic ME7

NOTE —

- *2.0L engines are equipped with versions of Motronic M5.9 and ME7 engine management systems which are OBD II compliant. It is recommended that fault diagnosis and troubleshooting be carried out using Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program.*
- *Fuel pump and fuel tank testing and repair along with EVAP information is covered in* **20 Fuel Storage and Supply**.
- *Ignition system testing and repair is covered in* **28a Ignition System–Gasoline.**
- *Related systems such as Exhaust Gas Recirculation (EGR) and catalytic converters are covered in* **26 Exhaust System and Emission Controls**.

The Motronic ME7 system combines ignition, fuel injection and electronic accelerator pedal functions into one system managed by a single Engine Control Module (ECM). The system is fully adaptive and features built-in diagnostics that are capable of detecting and storing coded fault information. There are no basic adjustments or settings that can be made to the system without specialized equipment.

Safety precautions

The following warnings should be adhered to whenever working on the engine management system.

WARNING —

- *Fuel may be discharged during fuel system repairs. Do not smoke or work near heaters or other fire hazards. Have a fire extinguisher handy. Work only in a well-ventilated area.*
- *Wear suitable hand and eye protection when working with gasoline. Prolonged contact with fuel can cause illness and skin disorders.*
- *Fuel hoses in engine compartment must only be secured with spring-type clips. The use of clamp or screw-type clips will damage fuel lines and cause fuel leaks.*
- *Connect and disconnect wires and test equipment only with the ignition switched off.*
- *Before making any electrical tests that require the engine to be cranked using the starter, disable the ignition system as described in* **28a Ignition System–Gasoline.**
- *Do not use sealants containing silicones. Particles of silicone drawn into the engine will not be burned in the engine and will damage the heated oxygen sensor. Use only sealants and engine chemicals marked as safe for oxygen sensors.*
- *During testing, it is possible for the Engine Control Module to recognize and store a diagnostic trouble code (DTC) that was due solely to the testing procedure. Therefore, after completing repairs, the DTC memory must be checked and erased as necessary with Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program.*
- *Cleanliness is essential when working on the fuel system. Thoroughly clean fuel line connections and surrounding areas before loosening. Avoid the use of compressed air. Avoid moving the vehicle. Only install clean components.*
- *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program.*

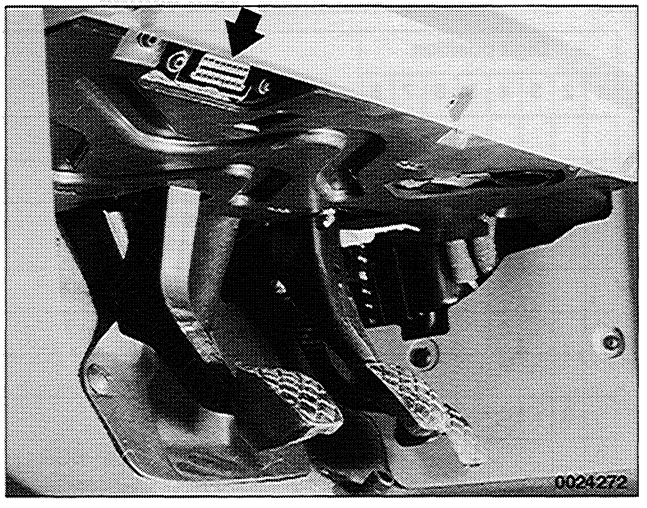
ON BOARD DIAGNOSTICS (OBD)

On Board Diagnostics, found on the Bosch Motronic M5.9 and ME7 Engine Management Systems monitor most aspects of engine operation. The current generation OBD II is integrated into all North American market Volkswagen gasoline engines. For a description of the system and an overview of operation, see **2 Fuel, Ignition, and Exhaust Systems.**Because of the large number of operating parameters monitored and the vast quantity of data available, fault diagnosis can only be properly carried out using a suitable scan tool such as the Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program. The engine control module or ECM also supports certain limited functions in a government-mandated generic scan tool mode. These functions are standardized for all OBD II compliant vehicles, but are not as comprehensive as those found by using the Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program in the proprietary mode of operation.

During repairs where the battery must be disconnected, consideration must be given to the effect that this will have on the vehicle in general and the engine management system in particular.

- Diagnostic Trouble Codes may be erased.
- Readiness codes may be erased.
- Fault counters that monitor certain functions will be reset to zero.
- Adaptive leaning values will be set to default.

Because the ignition, fuel injection, accelerator system and emission control functions are even more inter-related than on previous Motronic versions, it is difficult, if not impossible to isolate general driveability problems by examining individual components of the system. For this reason, a suitable scan tool must be used for diagnosis if driveability problems occur or if the malfunction indicator light (MIL) or E-Gas System lights (EPC) are illuminated.



Access for the scan tool is through the Data Link Connector (DLC) (**arrow**) under the lower left side of the instrument panel.

Adaptation

The Motronic M5.9 and ME7 engine management systems are adaptive. Idle speed, ignition timing, injection timing and quantity automatically compensate and adapt to changes in the engine due to wear and operating conditions. Minor problems such as mixture changes due to small vacuum leaks can be eliminated. As a result, idle speed, fuel mixture (CO%) and ignition timing are non-adjustable.

NOTE —
Beginning in 1994 (1993 in California) automakers are required by law to apply uniform terminology, words and terms for certain components according to SAE standard J1930. These standardized terms are used throughout this section.

Readiness Codes

Federal and state legislation requires that all auto manufacturers build into their engine management systems the ability to check for proper operation of up to 8 functions. For the M5.9 and ME7 engine management systems, the exact number depends on the equipment level of each particular vehicle. Most of the time, the readiness code will set itself after the appropriate conditions have been met. These may include a cold or a hot start, operation at a certain load or speed for a certain period of time, or operation at different temperatures. After repairs, it may be advantageous to confirm repairs rather than wait to see if they set on their own. Other than waiting, the only other method of setting the readiness codes on the Motronic ME7.5 system is with a scan tool. This method requires Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program. and extensive knowledge of the operation and capabilities. Readiness codes are then generated according to instructions provided by the scan tool manufacturer. For the significance of the 8 digit readiness code, see **Table a**.

Table a. Readiness code values

Digit position								Diagnostic Function
1	2	3	4	5	6	7	8	
							0	Three Way Catalyst
						0		Catalyst Heating (always 0)
					0			Evaporative Emissions System (Fuel tank vent system)
				0				Secondary Air Injection System
			0					Air Conditioning
		0						Oxygen Sensor
	0							Oxygen Sensor Heater
0								Exhaust Gas Recirculation - EGR (always 0)

The readiness code can be displayed in any of several areas within the ECM's diagnostic memory depending on the individual scan tool. It will always have a format consisting of 8 digits. If the 8 digit code contains characters other than the number 0, such as 10100110, than the readiness code is NOT set. When the code displays all zeros, i.e. 00000000, the readiness code IS set and no further action is required. The specifics of **Table a** apply to the 2.0L engine only. While the format is required to be the same for all engines, certain equipment may not be used on each engine. For example, the 2.0L engine does not always use EGR and as such, digit number 8 will always show 0. Other engines that use EGR, such as the 1.9L diesel, will show either a 1 or a 0 as appropriate.

Engine control module coding

The engine control module (ECM) must be supplied with appropriate power sources and grounds to function properly. Also, the engine control module must "know" what equipment is installed in the vehicle. This process is known as coding and must be performed whenever the ECM is replaced as new ECM's are un-coded. If an ECM is moved between vehicles such as might be the case for diagnostic testing, the coding will need to be changed if equipment is different. Coding memory is, however, retained when the battery is disconnected. If a new ECM is installed without being coded, the engine will usually run poorly and the automatic transmission and anti-lock braking system (if equipped) will not function properly. The MIL will be illuminated.

In some cases, this coding process can be done with Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program. Most later vehicle ECMs can only be coded with the diagnostic computer VAS 5051/5052. The appropriate code is electronically programmed into the ECM according to instructions provided by the scan tool manufacturer. See the **Scan Tool** section at the back of this manual for ECM coding information.

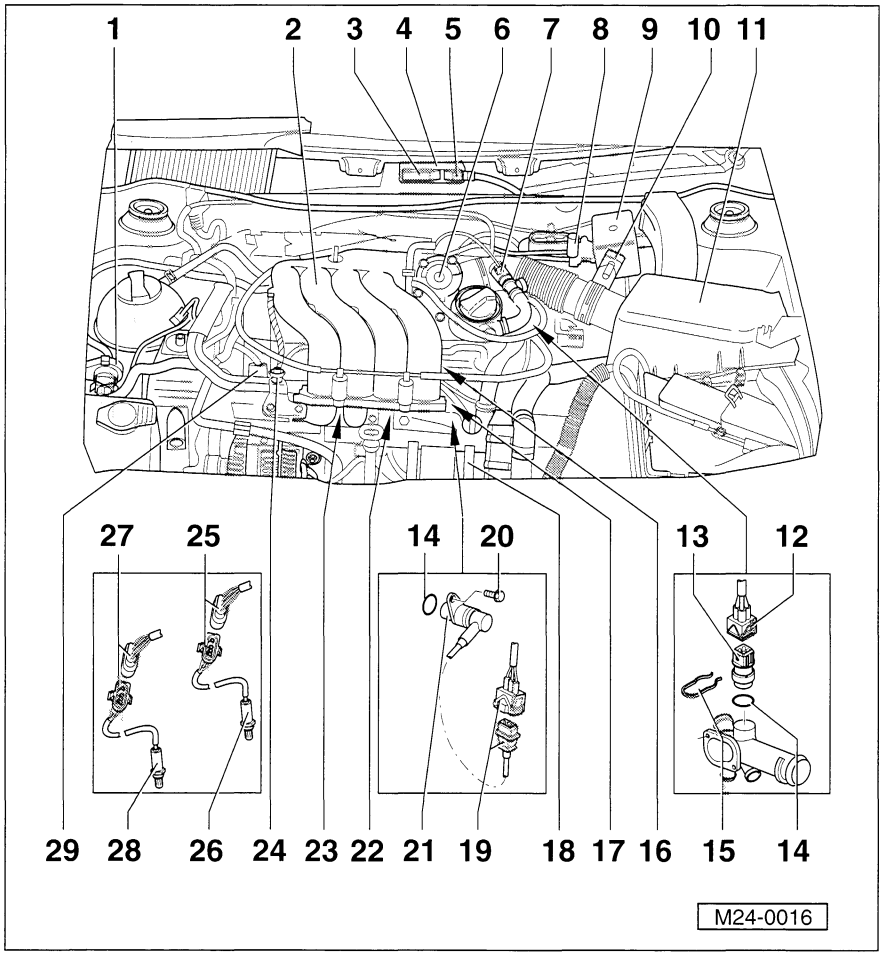
MOTRONIC ENGINE MANAGEMENT COMPONENTS

The following pages show the various components of the Motronic engine management fuel injection systems on the various 2.0L engines.

NOTE —

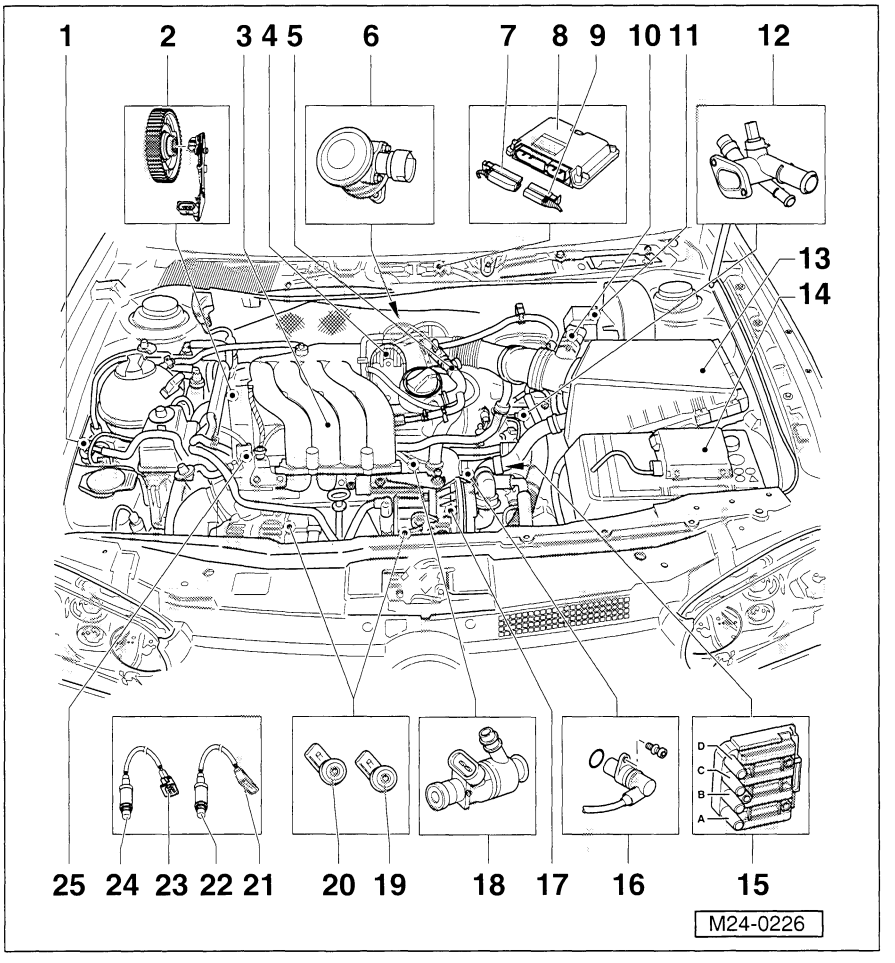
Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*

Fuel injection system components, overview (AEG engine)



1. **Evaporative Emissions (EVAP) Canister purge regulator valve (N80)**
2. **Intake Manifold, upper section**
3. **ECM harness connector, 52-pin**
   - Only disconnect or connect with ignition switched OFF
4. **Engine Control Module (ECM) (J220)**
5. **ECM harness connector, 28-pin**
   - Only disconnect or connect with ignition switched OFF
6. **Throttle Valve (TV) control module (J338)**
   - Must be matched to ECM module (J220) with a scan tool if replaced
7. **Positive Crankshaft Ventilation (PCV) heating element (N79)**
8. **Secondary Air Injection (AIR) solenoid valve (N112)**
9. **Secondary Air Injection (AIR) pump relay**
10. **Mass Air Flow (MAF) sensor (G70), with Intake Air Temperature (IAT) sensor (G42)**
11. **Air cleaner assembly**
12. **Harness connector, 4-pin**
    - For ECT (G62) and (G2)
13. **Engine Coolant Temperature (ECT) sensor (G62) and (G2)**
    - Terminals 2 and 4 for coolant temperature gauge sensor (G2)
    - Gold plated terminals 1 and 3 for ECT sensor
14. **O-ring**
    - Always replace
15. **Retaining clip**
16. **Fuel injectors (N30, N31, N32, N33)**
    - Location: under intake manifold in fuel rail
    - Air shrouded
17. **Ignition coils 1 and 2 (N, N128)**
    - Combined with power output stage (N122)
18. **Secondary Air Injection (AIR) pump motor (V101)**
19. **Harness connector, 3-pin gray**
    - For engine speed sensor (G28)
20. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
21. **Engine Speed (RPM) sensor (G28)**
    - Inductive-type sensor
22. **Knock Sensor (KS) 2 (G66)**
    - Brown connector
23. **Knock Sensor (KS) 1 (G61)**
    - Black connector
24. **Fuel pressure regulator**
    - Location: on end of fuel rail
25. **Harness connector, 4-pin black**
    - For heated oxygen sensor (G39) before catalytic converter
    - Location: right side, under vehicle
26. **Heated Oxygen (HO2S) sensor before (pre) catalytic converter (G39) (B1S1)**
    - Tighten to 50 Nm (37 ft-lb)
    - Location: in exhaust manifold
    - Oxygen sensor heater voltage via fuel pump relay (J17) and ECM
    - When installing, grease threads, do not let grease get into the slots on probe body
    - Remove and install with VW special tool 3337, or equivalent
27. **Harness connector, 4-pin brown**
    - For oxygen sensor (G130) behind catalytic converter and heater for Lambda probe (Z29)
    - Location: right side, under vehicle
28. **Heated Oxygen (HO2S) sensor behind (post) catalytic converter (G130) (B1S2)**
    - Tighten to 50 Nm (37 ft-lb)
    - Location: in outlet side of catalytic converter
    - Oxygen sensor heater voltage via fuel pump relay (J17) and ECM
    - When installing, grease threads, do not let grease get into the slots on probe body
29. **Camshaft Position (CMP) sensor (G40)**
    - Below upper timing belt guard

Fuel injection system components, overview (AVH, AZG engine)



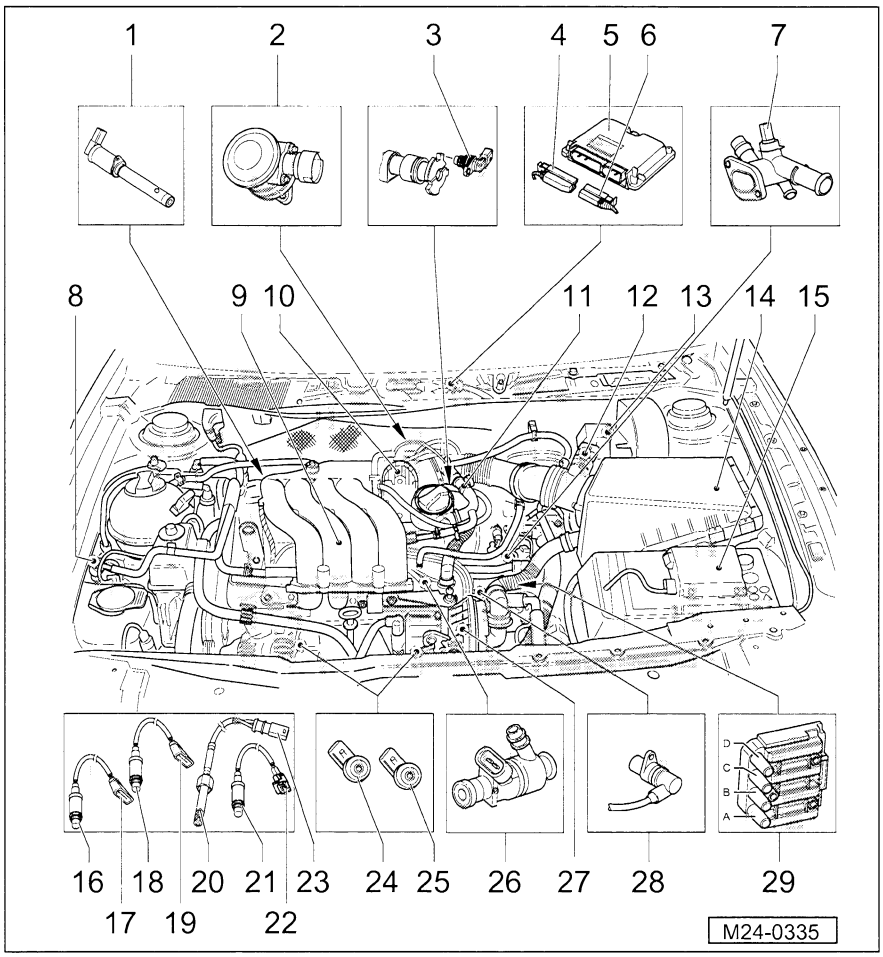
1. **Evaporative Emissions (EVAP) Canister purge regulator valve (N80)**
2. **Camshaft Position (CMP) sensor (G40)**
   - Below upper timing belt guard
3. **Intake manifold, upper section**
4. **Throttle Valve (TV) control module (J338)**
   - Must be matched to ECM module (J220) with a scan tool if replaced
5. **Positive Crankshaft Ventilation (PCV) heating element (N79)**
6. **Combi-valve**
   - For secondary air injection system
7. **ECM harness connector, 81-pin**
   - Only disconnect or connect with ignition switched OFF
8. **Engine Control Module (ECM) (J220)**
9. **ECM harness connector, 40-pin**
   - Only disconnect or connect with ignition switched OFF
10. **Mass Air Flow (MAF) sensor (G70), with Intake Air Temperature (IAT) sensor (G42)**
11. **Protective housing for relays**
    - AIR relay (J299), marked with control number 100
    - ECM power supply relay (J271) marked with control number 428
    - Relay locations may vary, check **Electrical wiring diagrams**
12. **Engine Coolant Temperature (ECT) sensor (G62)**
    - Release pressure in cooling system before removing
    - See **Engine coolant temperature (ECT) sensor, measuring resistance**
13. **Air cleaner assembly**
14. **Cover for supplementary fuses**
15. **Ignition coils with power output stage (N70, N127, N291, N292)**
16. **Engine speed sensor (G28)**
    - See **Engine Speed Sensor**
    - Inductive type sensor
    - Tighten to 10 Nm (7 ft-lb)
17. **Secondary Air Injection (AIR) pump motor (V101)**
18. **Fuel injectors (N30, N31, N32, N33)**
    - Location: under intake manifold in fuel rail
    - Air shrouded
19. **Knock Sensor (KS) 2 (G66)**
    - Brown connector
20. **Knock sensor (KS) 1 (G61)**
    - Black connector
21. **Harness connector, 4-pin brown**
    - For heated oxygen sensor (G130) after catalytic converter
    - Location: right side, under vehicle
22. **Heated Oxygen (HO2S) sensor behind (post) catalytic converter (G130) (B1S2)**
    - Tighten to 50 Nm (37 ft-lb)
    - Location: in outlet side of catalytic converter
    - Oxygen sensor heater voltage via fuel pump relay (J17) and ECM
    - When installing, grease threads, do not let grease get into the slots on probe body
23. **Harness connector, 6-pin black**
    - For heated oxygen sensor (G39)
    - Location: right side, under vehicle
24. **Heated Oxygen (HO2S) sensor before (pre) catalytic converter (G39) (B1S1)**
    - Tighten to 50 Nm (37 ft-lb)
    - Located in exhaust manifold
    - When installing, grease threads, do not let grease get into the slots on probe body
    - Remove/install w/VW special tool 3337, or equivalent
    - Oxygen sensor heater voltage via fuel pump relay and ECM
25. **Fuel pressure regulator**

A. **Brake Pedal Position (BPP) switch (F47) and brake light switch (F) (not shown)**
   - Located in combined housing in footwell on brake pedal bracket

B. **Throttle Position (TP) sensor (G79) with Accelerator Pedal Position (APP) sensor (G185) (not shown)**
   - Located in footwell on throttle pedal support bracket

C. **Clutch Pedal Position (CPP) switch (F36) (not shown)**
   - Located in footwell on clutch pedal support bracket

Fuel injection system components, overview (BBW, BEV engines)



1. **Valve 1 for camshaft adjuster (N205)**

2. **Secondary Air Injection (AIR) solenoid valve (N112)**

3. **Camshaft Position (CMP) sensor (G40)**
   - Below upper timing belt guard

4. **ECM harness connector, 81-pin**
   - Only disconnect or connect with ignition switched OFF

5. **Engine Control Module (ECM) (J220)**

6. **ECM harness connector, 40-pin**
   - Only disconnect or connect with ignition switched OFF

7. **Engine Coolant Temperature (ECT) sensor (G62)**
   - Release pressure in cooling system before removing

8. **Evaporative Emissions (EVAP) Canister purge regulator valve (N80)**

9. **Intake manifold, upper section**

10. **Throttle Valve (TV) control module (J338)**
    - Must be matched to ECM module (J220) with a scan tool if replaced

11. **Positive Crankshaft Ventilation (PCV) heating element (N79)**

12. **Mass Air Flow (MAF) sensor (G70), with Intake Air Temperature (IAT) sensor (G42)**

13. **Protective housing for relays**
    - AIR relay (J299), marked with control number 100
    - ECM power supply relay (J271) marked with control number 428
    - Relay locations may vary, check **Electrical wiring diagrams**

14. **Air cleaner assembly**

15. **Cover for supplementary fuses**

16. **Heated Oxygen (HO2S) sensor behind (post) catalytic converter (G130) (B1S2)**
    - Tighten to 50 Nm (37 ft-lb)
    - Location: in outlet side of catalytic converter
    - Oxygen sensor heater voltage via fuel pump relay (J17) and ECM
    - When installing, grease threads, do not let grease get into the slots on probe body

17. **Harness connector, 4-pin brown**
    - For heated oxygen sensor (G130) after catalytic converter
    - Location: right side, under vehicle

18. **Heated Oxygen (HO2S) sensor, center, catalytic converter (G465) (B1S3)**
    - Tighten to 50 Nm (37 ft-lb)
    - Location: in center of catalytic converter
    - Oxygen sensor heater voltage via fuel pump relay (J17) and ECM
    - When installing, grease threads, do not let grease get into the slots on probe body

19. **Harness connector,4-pin black**
    - For center heated oxygen sensor (G465)
    - Location: right side, under vehicle

20. **Exhaust Gas Temperature (EGT) sensor 1 (G235)**
    - Location: in exhaust pipe

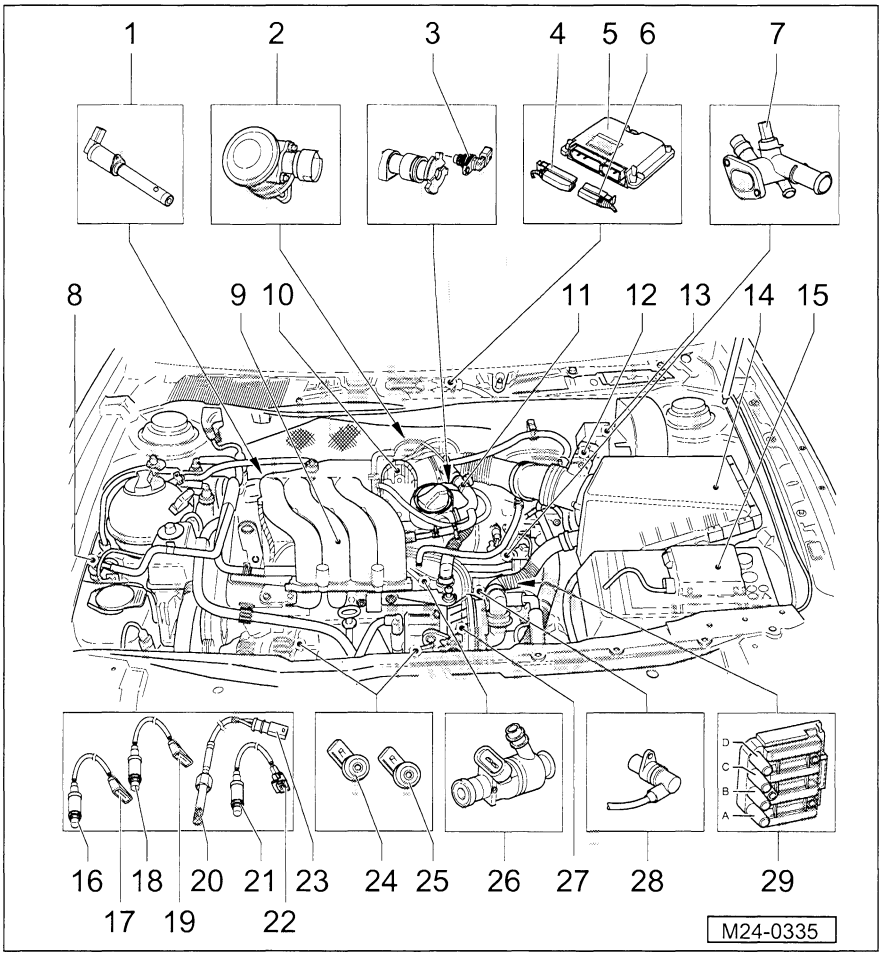
21. **Heated Oxygen (HO2S) sensor before (pre) catalytic converter (G39) (B1S1)**
    - Tighten to 50 Nm (37 ft-lb)
    - Located in exhaust manifold
    - When installing, grease threads, do not let grease get into the slots on probe body
    - Oxygen sensor heater voltage via fuel pump relay and ECM

22. **Harness connector, 6-pin black**
    - For oxygen sensor (G39) before catalytic converter and heater for Lambda probe (Z19)
    - Location: right side, under vehicle

23. **Harness connector, 2-pin black**
    - For exhaust gas temperature (EGT) sensor (G235) before catalytic converter
    - Location: right side, under vehicle

(continued on following page)

Fuel injection system components, overview (BBW, BEV engines continued)



24. Knock Sensor (KS) 2 (G66)
- Brown connector

25. Knock sensor (KS) 1 (G61)
- Black connector

26. Fuel injectors (N30, N31, N32, N33)
- Location: under intake manifold in fuel rail
- Air shrouded

27. Secondary Air Injection (AIR) pump motor (V101)

28. Engine Speed (RPM) sensor (G28)
- Inductive-type sensor

29. Ignition coils with power output stage (N70, N127, N291, N292)

A. Brake Pedal Position (BPP) switch (F47) and brake light switch (F) (not shown)
- Located in combined housing in footwell on brake pedal bracket

B. Throttle Position (TP) sensor (G79) with Accelerator Pedal Position (APP) sensor (G185) (not shown)
- Located in footwell on throttle pedal support bracket

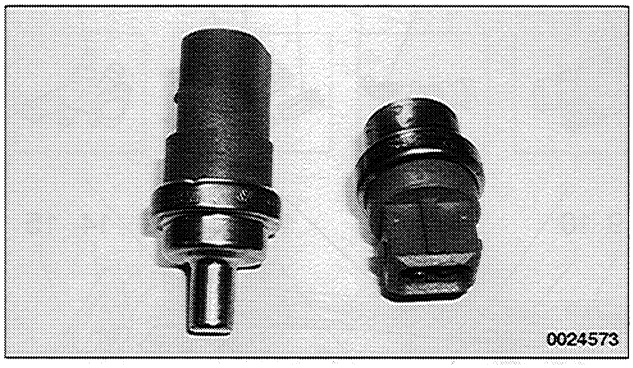
C. Clutch Pedal Position (CPP) switch (F36) (not shown)
- Located in footwell on clutch pedal support bracket

D. Fuel pressure regulator (not shown)
- Located in fuel tank on fuel filter bracket.

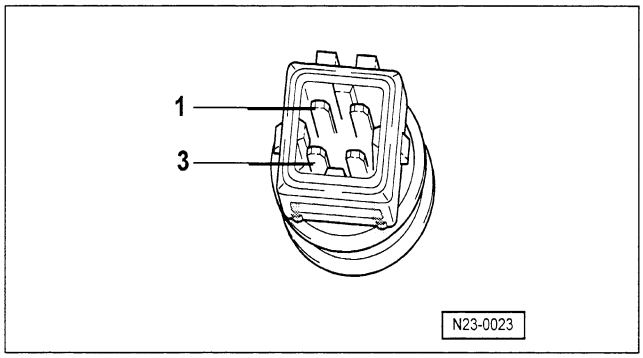
E. Malfunction Indicator Light (MIL) (K83)
- Located in instrument cluster (engine codes AEG, AVH, AZG, BBW, BEV)

F. Electronic Power Control (EPC) warning light (K132)
- "Drive-by-wire" warning light
- Located in instrument cluster (engine codes AVH, AZG, BBW, BEV)

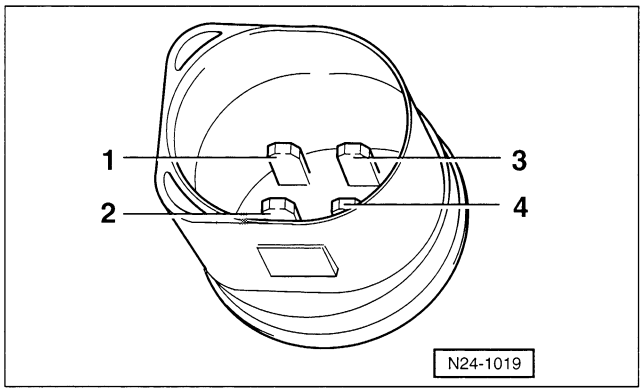
Engine coolant temperature (ECT) sensor, measuring resistance



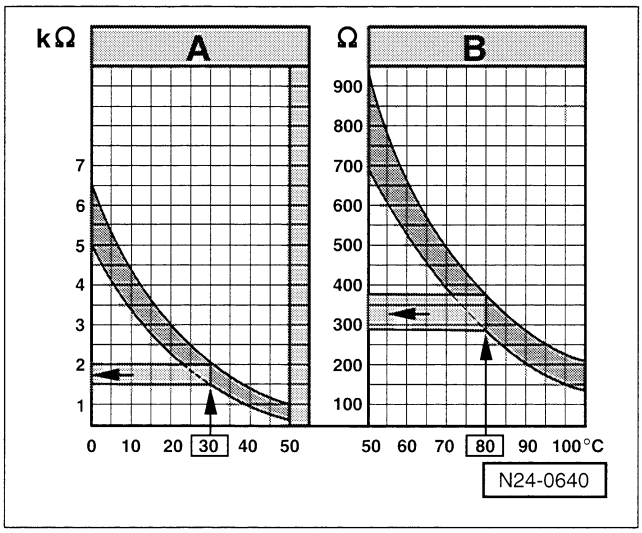
Several different version engine coolant temperature sensors were installed in 2.0L engines. The early style sensor (**right**) was blue and square shaped. The later style sensor (**left**) is longer, oval shaped, and either green or black. Use the illustrations below to determine which style sensor is installed.



Measure resistance at terminals **1** and **3** on early style ECT sensor.



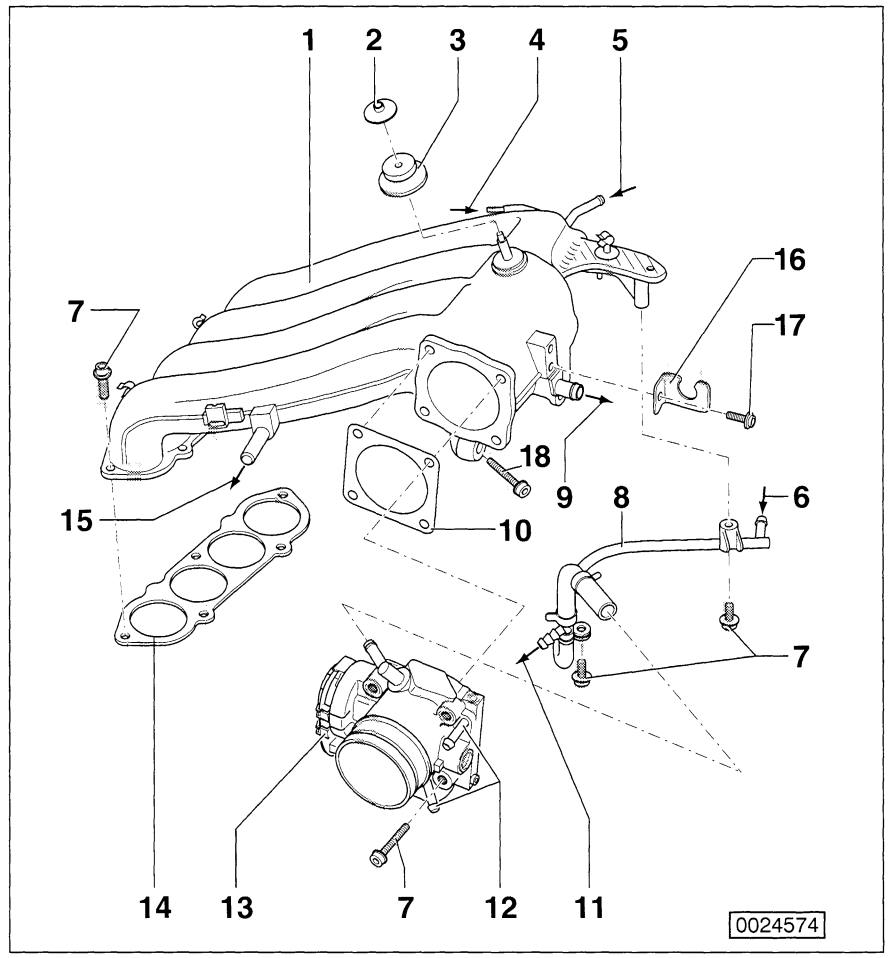
Measure resistance at terminals **3** and **4** on later style sensor.



Compare ECT resistance reading to graph at left.

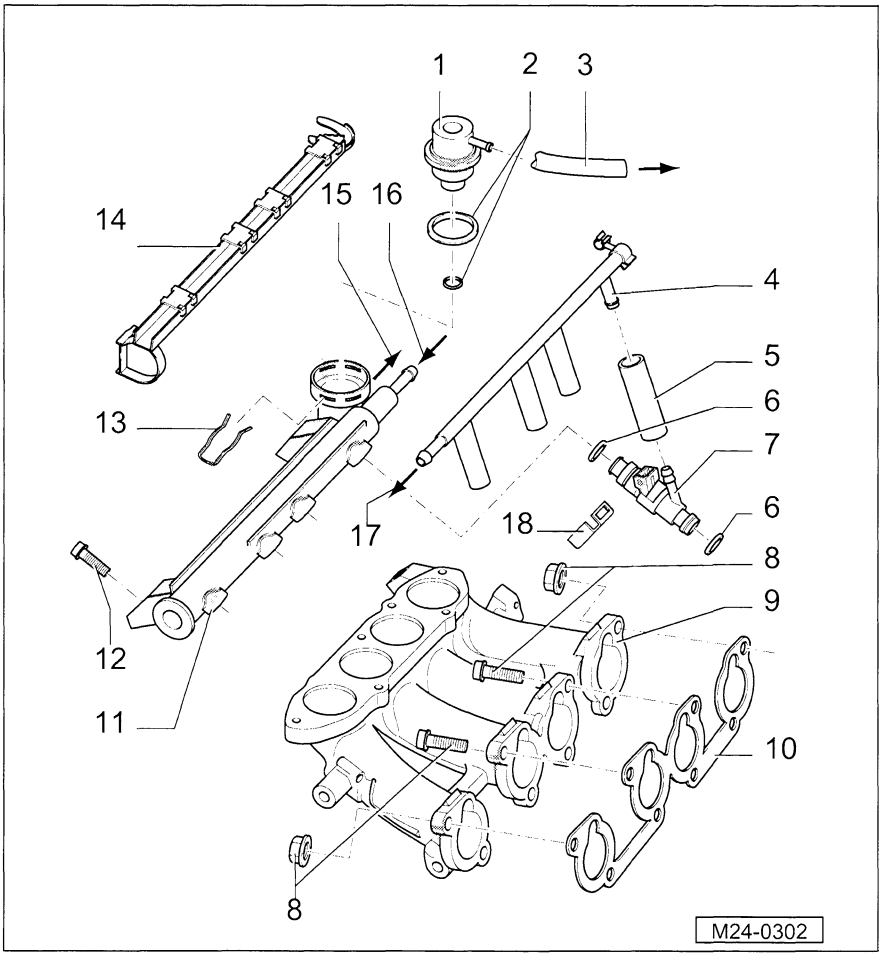
- Scale **A** shows resistance for coolant temperature range 0-50°C (32-122°F)
- Scale **B** shows resistance for coolant temperature range 50-100°C (122-212°F)
- Example:
  30°C corresponds to 1500-2000 Ω
  80°C corresponds to 275-375 Ω

Upper intake manifold section, assembly



1. **Intake manifold, upper section**
2. **Nut, retaining**
   - Tighten to 6 Nm (53 in-lb)
3. **Rubber insulator bushing**
   - For engine cover
4. **Vacuum connection**
   - To fuel pressure regulator (except BBW and BEV)
5. **Vacuum connection**
   - From leak detection pump (LDP) as applicable
6. **Flow**
   - From EVAP canister purge regulator valve (N80)
7. **Bolt**
   - Tighten to 10 Nm (7 ft lb)
8. **Connecting pipe**
9. **Flow**
   - Vacuum connection to power brake servo
10. **Gasket**
    - Always replace
11. **To intake hose**
12. **Coolant connection**
    - Positions vary slightly between different engine codes
    - For heated throttle valve control valve coolant hoses
13. **Throttle Valve (TV) Control module (J338)**
    - Styles and configurations vary between different engine codes
    - When replacing, adapt ECM using diagnostic scan tool
14. **Gasket**
    - Always replace
    - Note installed position
15. **Vacuum connection**
    - As applicable
    - From m.y. 2002
    - To cylinder head cover or specially formed intake hose
16. **Support bracket, accelerator cable**
    - AEG engine only
    - Not installed on ME7 systems due to drive-by wire EPC system
17. **Bolt**
    - AEG engine only
    - Tighten to 10 Nm (7 ft lb)
18. **Bolt**
    - Tighten to 25 Nm (18 ft lb)
    - As applicable

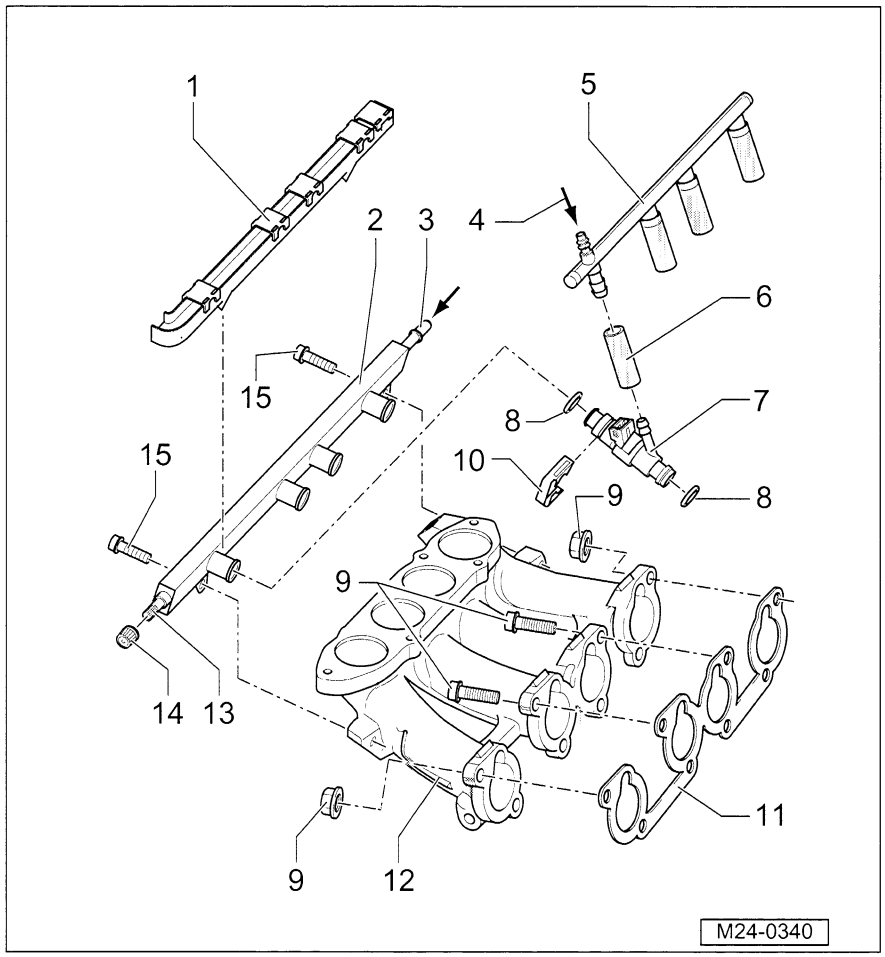
Lower intake manifold section and fuel rail, assembly (AEG, AVH, AZG engines)



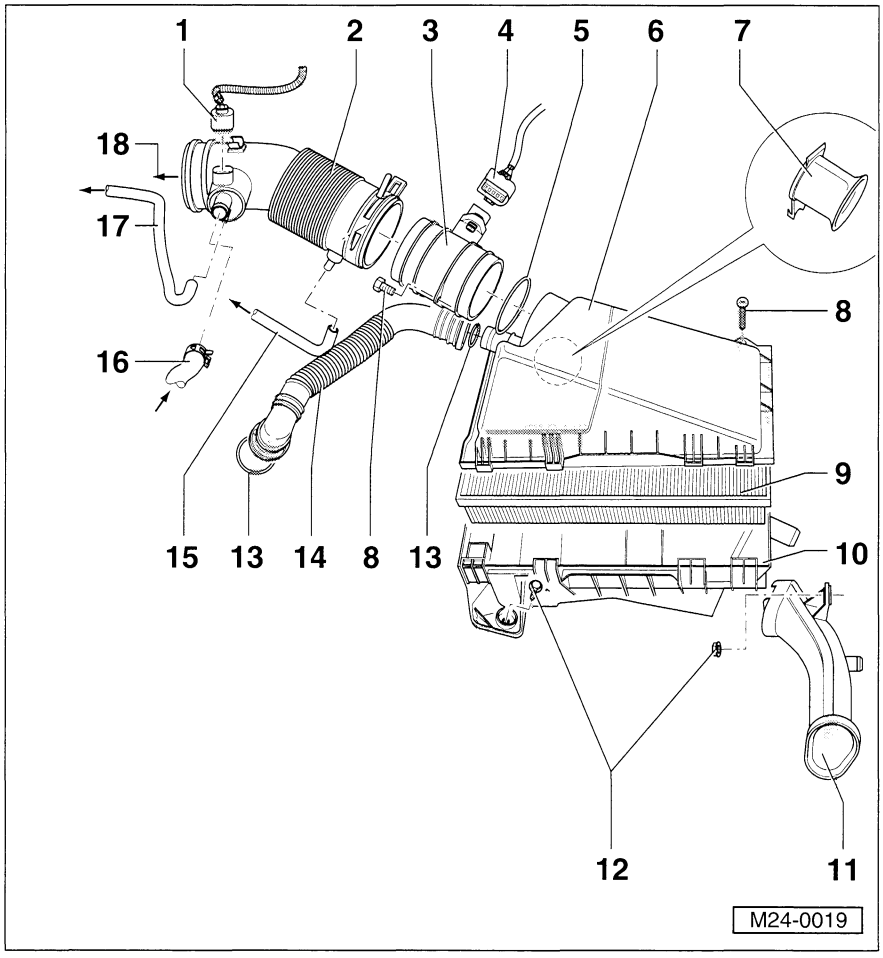
1. **Fuel pressure regulator**
   - With residual check valve
2. **O-rings**
   - Replace if damaged
3. **Vacuum hose**
   - To upper intake manifold section
4. **Air shrouded injector manifold**
5. **Connecting hose, air shrouded manifold to injector**
6. **O-ring**
   - Always replace
   - Moisten with clean engine oil before installing
7. **Fuel injectors (N30, N31, N32, N33)**
8. **Bolt/Nut**
   - Tighten to 20 Nm (15 ft-lb)
9. **Intake manifold, lower section**
10. **Gasket**
    - Always replace
11. **Fuel rail**
    - Ensure correct securely seating
12. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
13. **Retaining clip**
    - Ensure correct seating
14. **Spark plug wire cable guide**
15. **Connection**
    - Fuel return flow
    - Return hose blue or marked with blue
16. **Connection**
    - Fuel supply
    - Supply hose white or marked with white
17. **Connection**
    - To intake hose
18. **Retaining clip**
    - For fuel injectors
    - Observe installation position

Lower intake manifold section and fuel rail, assembly (BBW, BEV engines)

1. **Spark plug wire cable guide**
2. **Fuel rail**
   - Ensure correct securely seating
3. **Connection**
   - Fuel supply
   - Supply hose white or marked with white
   - No fuel return used with this system
4. **Connection**
   - To intake hose
5. **Air shrouded injector manifold**
6. **Connecting hose, air shrouded manifold to injector**
7. **Fuel injectors (N30, N31, N32, N33)**
8. **O-rings**
   - Replace if damaged
9. **Bolt/Nut**
   - Tighten to 20 Nm (15 ft-lb)
10. **Retaining clip**
    - For fuel injectors
    - Observe installation position
11. **Gasket**
    - Always replace
12. **Intake manifold, lower section**
13. **Breather valve**
    - Connection for fuel system bleeding when fuel lines have been opened
14. **Sealing cap**
    - For breather valve
15. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)

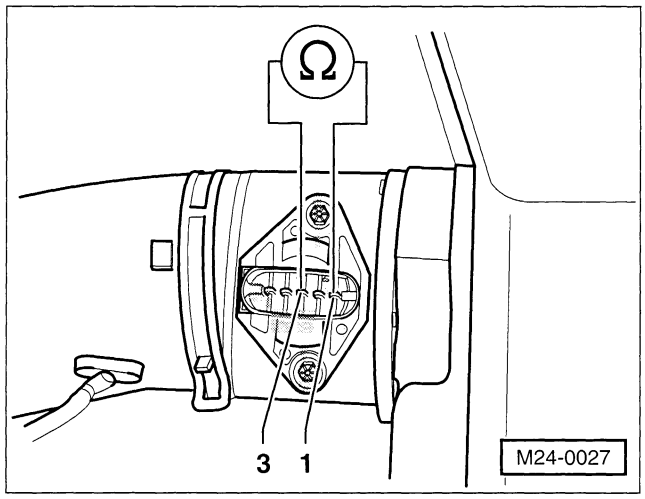


Air cleaner assembly

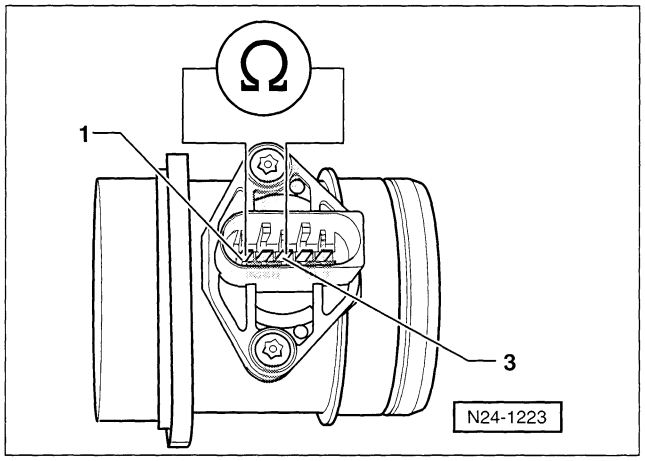


1. **Harness connector, 2-pin black**
   - For PCV heating element (N79)
   - Check heating element voltage supply between terminals 1 and 2 with engine running: at least 11.5 V
2. **Intake hose**
   - With PCV heating element for crankcase breather
3. **Mass Air Flow (MAF) sensor (G70) with Intake Air Temperature (IAT) sensor (G42)**
   - See **Intake air temperature sensor, checking resistance**
4. **Harness connector, 5-pin black**
   - MAF sensor and harness connector contacts are gold-plated
5. **O-ring**
   - Replace if damaged
6. **Air cleaner housing, upper section**
7. **Air duct (velocity stack)**
   - Inside air cleaner housing, upper section
   - Incorrect positioning or removal can result in poor running due to disrupted flow through MAF.
8. **Bolt**
   - Tighten to 6 Nm (53 in-lb)
9. **Filter element**
10. **Air cleaner housing, lower section**
11. **Intake air duct (air snorkel)**
12. **Bolt/nut**
    - Tighten to 10 Nm (7 ft-lb)
13. **O-ring**
    - Replace if damaged
14. **Intake hose**
    - Press together at front to release
    - Filtered air to secondary air injection (AIR) pump motor
15. **Connecting hose**
    - To air lines for air shrouded injectors
16. **Connecting hose**
    - Integral with intake hose (item 2) on some engines
    - To air lines for air shrouded injectors
17. **Connecting hose**
    - Note different versions
    - Integral with intake hose (item 2) on some engines
    - For crankcase breather
    - From breather housing on cylinder head cover
18. **Connecting hose**
    - Note different versions
    - For crankcase breather
    - From breather housing on cylinder head cover
19. **To Throttle Valve (TV) Control module (J338)**

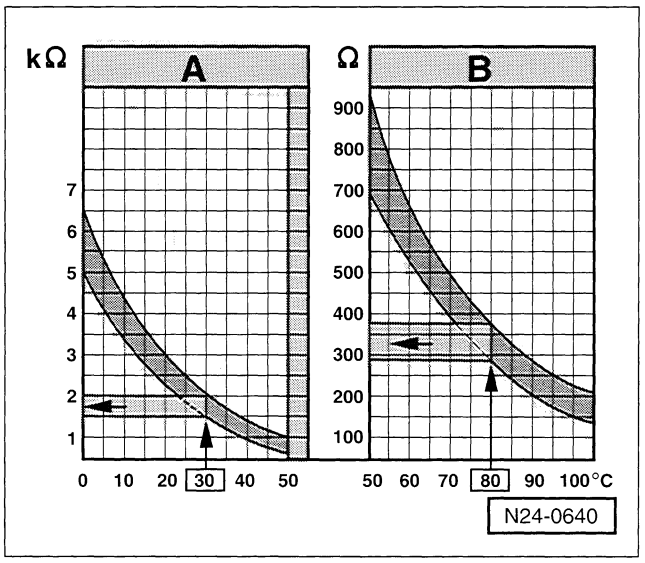
Intake air temperature (IAT) sensor, measuring resistance



➤ Engine code **AEG:**
Measure resistance at terminals **1** and **3**.

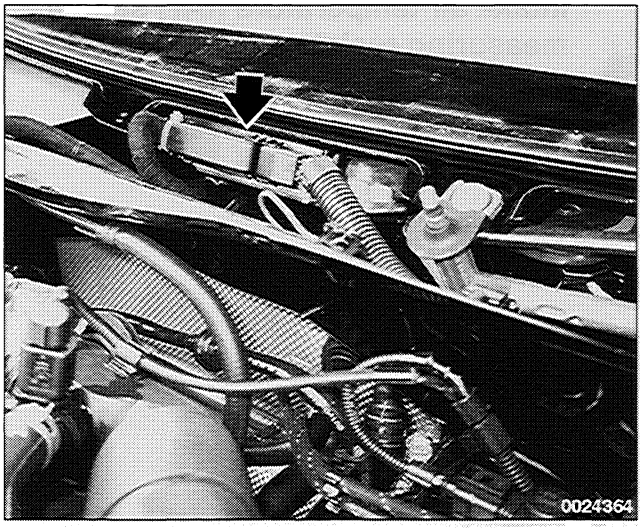


➤ Engine code **AVH, AZG, BBW, BEV:**
Measure resistance at terminals **1** and **3**.



➤ Compare resistance reading to graph:

- Scale **A** shows resistance for intake air temperature range 0-50°C (32-122°F)
- Scale **B** shows resistance for intake air temperature range 50-100°C (122-212°F)
- Example:
  30°C corresponds to 1500-2000 Ω
  80°C corresponds to 275-375 Ω



Engine Control Module (ECM)

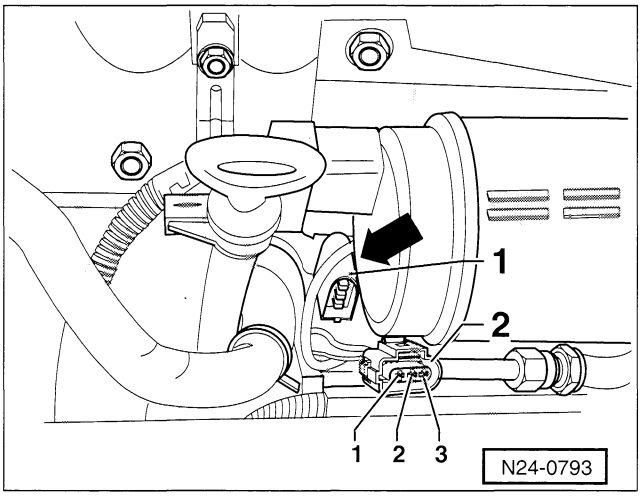
The engine control module (**arrow**) is located in the air plenum near the base of the windshield in the engine compartment. Access to the ECM requires removal of the windshield wiper arms and the air plenum cover.

Engine speed (RPM) sensor

Operation of the engine management system depends on a wide variety of input sensors. Failure of most of these sensors will allow the engine to continue to run, albeit poorly. One major exception to this is the engine speed sensor (G28). Failure of this sensor will prevent the engine from starting and running and will set a diagnostic trouble code in the ECM.

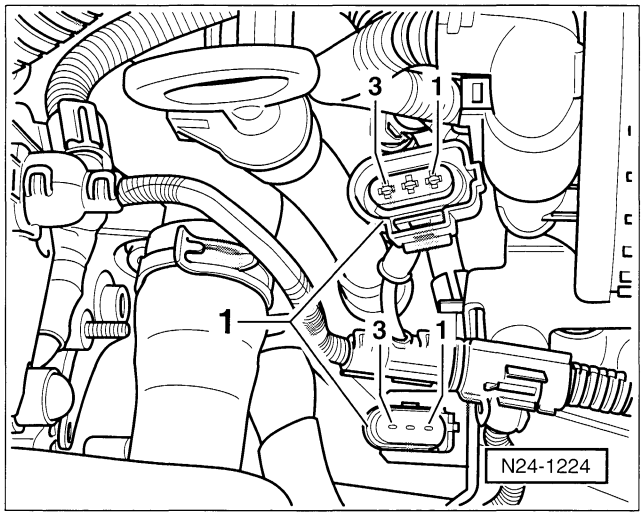
Note that most diagnostic functions require the use of a scan tool such as the Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program, however a quick check can be accomplished as follows:

– Disconnect the 3-pin harness connector from the engine speed sensor plug near the secondary air injection pump.



Engine code AEG

- Engine speed (RPM) sensor (G28) harness connector (**1**) with terminal identification shown unplugged near secondary air injection pump.



Engine codes AVH, AZG, BBW, BEV

- Engine speed (RPM) sensor (G28) harness connector (**1**) with terminal identification shown unplugged near secondary air injection pump.

– Connect an accurate ohmmeter between terminals 2 and 3 of the engine speed sensor and measure resistance.

– Measure resistance between terminals 1 and 3, and between terminals 1 and 2.

Specification

- Engine speed sensor resistance values

Between terminals 2 and 3

AEG engine . . . . . 480 to 1000 Ω

AVH, AZG, BBW, BEV engines. . . . . 730 to 1000 Ω

Between terminals 1 and 2 . . . . . .infinity Ω

Between terminals 1 and 3 . . . . . .infinity Ω

– If value is not obtained, replace engine speed sensor.

– If specification is obtained, and engine will not start, remove sensor and inspect sensor wheel. Additional testing with a suitable scan tool may be required.

24c Fuel Injection–Motronic (2.8L engine)

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Safety precautions 24c-2

ON BOARD DIAGNOSTICS (OBD) 24c-3
Adaptation 24c-4
Readiness codes 24c-4
Engine control module coding 24c-5

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Air cleaner assembly (AFP engine) 24c-12

MOTRONIC ENGINE MANAGEMENT COMPONENTS (BDF ENGINE) 24c-13
Fuel injection system component locations, overview (BDF engine) 24c-14
Fuel injection system components, removing and installing (BDF engine) 24c-16
Intake manifold assembly (BDF engine) 24c-18
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Intake Air Temperature (IAT) sensor, measuring resistance 24c-21
Engine Coolant Temperature sensor (ECT), measuring resistance 24c-22
Engine Control Module (ECM) 24c-23
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Throttle Valve (TV) control module 24c-24

TABLES
a. Readiness code values 24c-4

GENERAL

This repair group covers fuel injection/engine management systems on the 2.8L gasoline engine. Operation of the Bosch Motronic ME7 engine management system is described in **2 Fuel, Ignition and Exhaust Systems.**

Special testing equipment may be necessary for some of the tests and repair procedures given here.

Engine Codes

- AFP . . . . . Motronic ME7.1
- BDP . . . . . Motronic ME7.1.1

NOTE —

- *2.8L engines are equipped with Motronic ME7 engine management systems which is OBD II compliant. It is recommended that fault diagnosis and troubleshooting be carried out using Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program.*
- *Fuel pump and fuel tank testing and repair along with EVAP information is covered in* **20 Fuel Storage and Supply**.

NOTE —

- *Ignition system testing and repair is covered in* **28a Ignition System–Gasoline.**
- *Related systems such as Exhaust Gas Recirculation (EGR) and catalytic converters are covered in* **26 Exhaust System and Emission Controls**.

The Motronic ME7 system combines ignition, fuel injection and electronic accelerator pedal functions into one system managed by a single Engine Control Module (ECM). The system is fully adaptive and features built-in diagnostics that are capable of detecting and storing coded fault information. There are no basic adjustments or settings that can be made to the system without specialized equipment.

Safety precautions

The following warnings should be adhered to whenever working on the engine management system.

WARNING —

- *Fuel may be discharged during fuel system repairs. Do not smoke or work near heaters or other fire hazards. Have a fire extinguisher handy. Work only in a well-ventilated area.*
- *Wear suitable hand and eye protection when working with gasoline. Prolonged contact with fuel can cause illness and skin disorders.*
- *Fuel hoses in engine compartment must only be secured with spring-type clips. The use of clamp or screw-type clips will damage fuel lines and cause fuel leaks.*
- *Connect and disconnect wires and test equipment only with the ignition switched off.*
- *Before making any electrical tests that require the engine to be cranked using the starter, disable the ignition system as described in* **28a Ignition System–Gasoline.**
- *Do not use sealants containing silicones. Particles of silicone drawn into the engine will not be burned in the engine and will damage the heated oxygen sensor. Use only sealants and engine chemicals marked as safe for oxygen sensors.*
- *During testing, it is possible for the Engine Control Module to recognize and store a diagnostic trouble code (DTC) that was due solely to the testing procedure. Therefore, after completing repairs, the DTC memory must be checked and erased as necessary with Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program.*
- *Cleanliness is essential when working on the fuel system. Thoroughly clean fuel line connections and surrounding areas before loosening. Avoid the use of compressed air. Avoid moving the vehicle. Only install clean components.*

WARNING —

- *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program.*

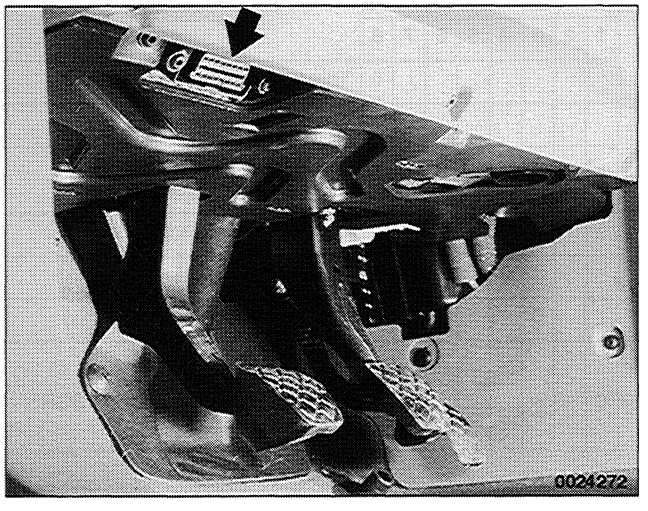
ON BOARD DIAGNOSTICS (OBD)

On Board Diagnostics, found on the Bosch Motronic M5.9 and ME7 Engine Management Systems monitor most aspects of engine operation. The current generation OBD II is integrated into all North American market Volkswagen gasoline engines. For a description of the system and an overview of operation, see **2 Fuel, Ignition, and Exhaust Systems.**Because of the large number of operating parameters monitored and the vast quantity of data available, fault diagnosis can only be properly carried out using a suitable scan tool such as the Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program. The engine control module or ECM also supports certain limited functions in a government-mandated generic scan tool mode. These functions are standardized for all OBD II compliant vehicles, but are not as comprehensive as those found by using the Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program in the proprietary mode of operation.

During repairs where the battery must be disconnected, consideration must be given to the effect that this will have on the vehicle in general and the engine management system in particular.

- Diagnostic Trouble Codes may be erased.
- Readiness codes may be erased.
- Fault counters that monitor certain functions will be reset to zero.
- Adaptive leaning values will be set to default.

Because the ignition, fuel injection, accelerator system and emission control functions are even more inter-related than on previous Motronic versions, it is difficult, if not impossible to isolate general driveability problems by examining individual components of the system. For this reason, a suitable scan tool must be used for diagnosis if driveability problems occur or if the malfunction indicator light (MIL) or E-Gas System lights (EPC) are illuminated.



Access for the scan tool is through the Data Link Connector (DLC) (**arrow**) under the lower left side of the instrument panel.

Adaptation

The Motronic ME7 engine management system is adaptive. Idle speed, ignition timing, injection timing and quantity automatically compensate and adapt to changes in the engine due to wear and operating conditions. Minor problems such as mixture changes due to small vacuum leaks can be eliminated. As a result, idle speed, fuel mixture (CO%) and ignition timing are non-adjustable.

NOTE —

Beginning in 1994 (1993 in California) automakers are required by law to apply uniform terminology, words and terms for certain components according to SAE standard J1930. These standardized terms are used throughout this section.

Readiness Codes

Federal and state legislation requires that all auto manufacturers build into their engine management systems the ability to check for proper operation of up to 8 functions. For the ME7 engine management systems, the exact number depends on equipment level of each particular vehicle. Most of the time, the readiness code will set itself after the appropriate conditions have been met. These may include a cold or a hot start, operation at a certain load or speed for a certain period of time, or operation at different temperatures. After repairs, it may be advantageous to confirm repairs rather than wait to see if they set on their own. Other than waiting, the only other method of setting the readiness codes on the Motronic ME7 system is with a scan tool. This method requires Volkswagen scan tool VAG 1551, VAG 1552, VAS 5051 or an equivalent aftermarket scan tool, and extensive knowledge of its operation and capabilities. Readiness codes are then generated according to instructions provided by the scan tool manufacturer. For the significance of the 8 digit readiness code, see **Table a**

Table a. Readiness code values

Digit position								Diagnostic Function
1	2	3	4	5	6	7	8	
							0	Three Way Catalyst
						0		Catalyst Heating (always 0)
					0			Evaporative Emissions System (Fuel tank vent system)
				0				Secondary Air Injection System
			0					Air Conditioning
		0						Oxygen Sensor
	0							Oxygen Sensor Heater
0								Exhaust Gas Recirculation - EGR (always 0)

The readiness code can be displayed in any of several areas within the ECM's diagnostic memory depending on the individual scan tool. It will always have a format consisting of 8 digits. If the 8 digit code contains characters other than the number 0, such as 10100110, than the readiness code is NOT set. When the code displays all zeros, i.e. 00000000, the readiness code IS set and no further action is required. The specifics of **Table a** apply to the 2.8L engine only. While the format is required to be the same for all engines, certain equipment may not be used on each engine. For example, the 2.8L engine does not use EGR and as such, digit number 8 will always show 0. Other engines that use EGR, such as the 1.9L diesel, will show either a 1 or a 0 as appropriate.

Engine control module coding

The Engine Control Module must "know" what equipment is installed in the vehicle in which it is operating. This process is known as coding and must be performed whenever the ECM is replaced as new ECM's are delivered in an un-coded condition. If the ECM is moved between vehicles such as might be the case for diagnostic testing, the coding will need to be changed if equipment is different. Coding memory is, however, retained when the battery is disconnected. If a new ECM is installed without being coded, the engine will usually run poorly and the automatic transmission (if equipped) will not function properly. The MIL will be illuminated.

This coding process can only be done with Volkswagen scan tool VAG 1551, VAG 1552 or equivalent. The appropriate code is electronically programmed into the ECM according to instructions provided by the scan tool manufacturer. For ECM coding information, see **ST Scan Tool Codes** at the back of the manual.

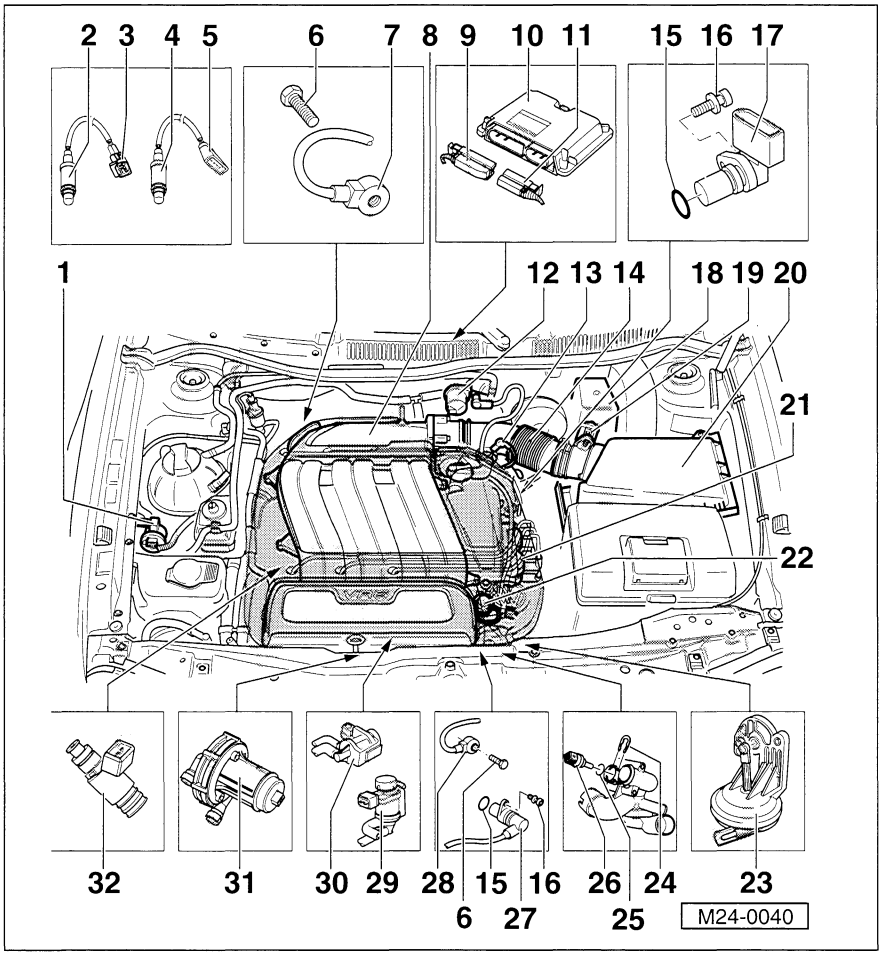
MOTRONIC ENGINE MANAGEMENT COMPONENTS (AFP ENGINE)

The following pages show the various components of the Motronic ME 7.1 engine management fuel injection system on the 2.8L (engine code: AFP).

NOTE —

Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*

Fuel injection system component locations, overview (AFP engine)



1. **Evaporative Emissions (EVAP) Canister purge regulator valve (N80)**
   - Location: Mounted to right side of engine compartment near front strut tower
2. **Heated Oxygen Sensor (HO2S), before (pre) catalytic converter (G39) (B1S1)**
   - Monitors combustion efficiency
   - Tighten to 50 Nm (37 ft-lb)
   - Location: Threaded into front exhaust pipe ahead of catalytic converter
   - Lubricate threads only with high temperature anti-seize
   - Do not allow anti-seize compound into the slots on the sensor body
3. **Harness connector, 6-pin black**
   - For pre-catalyst heated oxygen sensor (G39) and oxygen sensor heater (Z19)
   - Location: right side under vehicle in plastic shield
4. **Heated Oxygen Sensor (HO2S), after (post) catalytic converter (G130) (B1S2)**
   - Monitors catalytic converter efficiency
   - Location: threaded into rear of catalytic converter
   - Tighten to 50 Nm (37 ft-lb)
   - Lubricate threads only with high temperature anti-seize
   - Do not allow anti-seize compound into the slots on the sensor body
5. **Harness connector, 4-pin black**
   - For post-catalyst heated oxygen sensor (G130) and oxygen sensor heater (Z29)
   - Location: right side under vehicle in plastic shield
6. **Bolt**
   - Tighten to 20 Nm (15 ft-lb)
   - Correct torque is critical for proper operation of knock sensors
7. **Knock Sensor (KS) 1 (G61)**
   - Location: on rear of cylinder block (exhaust side)
8. **Intake manifold, upper section**
9. **ECM harness connector, 81-pin**
   - Terminals 1 to 81
   - Only disconnect or connect with ignition switched OFF
10. **Engine Control Module (ECM) (J220)**
    - Motronic ME7.1
    - Location: in air plenum near base of windshield in the engine compartment
11. **ECM harness connector, 40-pin**
    - Terminals 82 to 121
    - Only disconnect or connect with ignition switched OFF
12. **Throttle Valve (TV) Control module (J338)**
    - Must be matched to ECM (J220) with a scan tool if replaced
    - For Electronic Power Control, EPC, (E-Gas System)
13. **Positive Crankcase Ventilation (PCV) heating element (N79)**
    - Location: in crankcase breather hose
14. **Connecting hose**
    - Between throttle valve control module and mass air flow sensor/air cleaner assembly
15. **O-ring**
    - Always replace
16. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
17. **Camshaft Position (CMP) sensor (G40)**
    - Location: on rear of cylinder head near ignition coil pack
    - Shutter wheel (rotor) mounted on exhaust side camshaft
18. **Protective cover**
    - For secondary air injection pump relay (J229)
19. **Mass Air Flow (MAF) sensor, (G70) with Intake Air Temperature (IAT) sensor (G42)**
20. **Air filter assembly**

(continued on following page)

Fuel injection system component locations, overview continued (AFP engine)

21. Ignition coil pack (N152)
- With power output stages

22. Fuel pressure regulator
- Location: on fuel rail

23. Vacuum servo
- Connected to intake manifold rotary change-over valve
- For intake manifold change-over to performance port

24. Retaining clip
- Ensure clip is securely seated

25. O-ring
- Replace if damaged

26. Engine Coolant Temperature (ECT) sensor (G62)
- For engine control module
- Combined with sensor (G2) for instrument panel warning light
- Release cooling system pressure before removing

27. Engine speed (RPM) sensor (G28)
- Location: on front of cylinder block near oil filter
- Sensor wheel attached to crankshaft

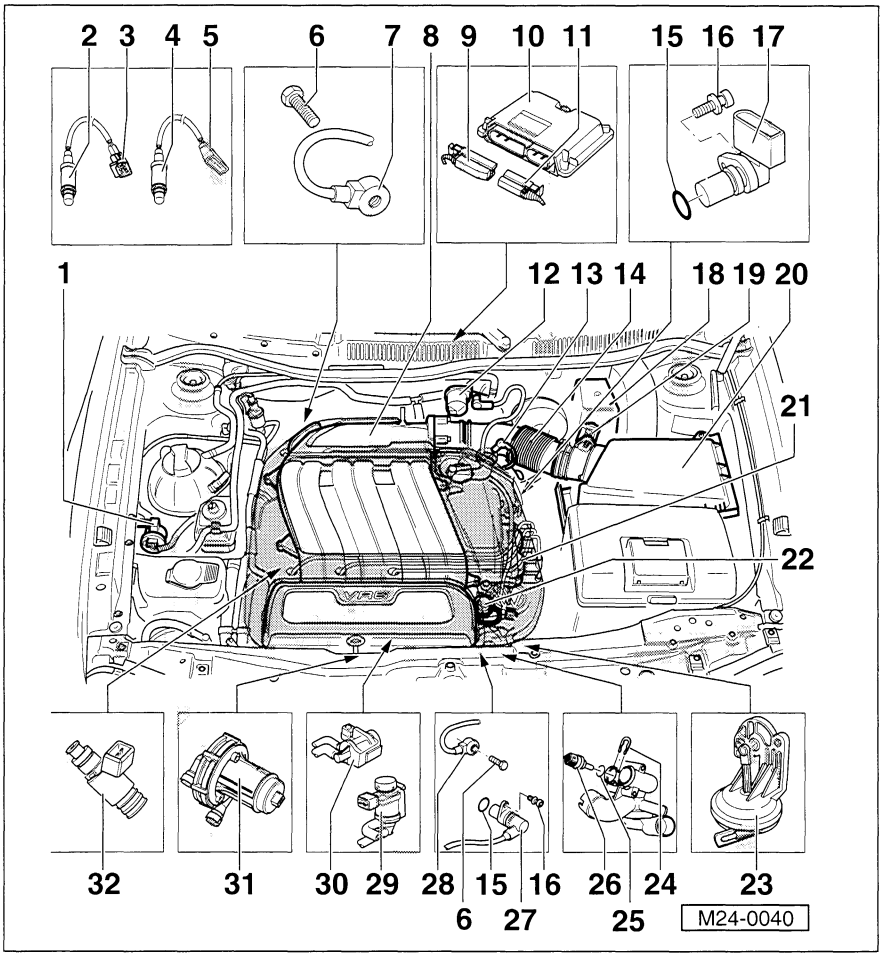
28. Knock Sensor (KS) 2 (G66)
- Location: on front of cylinder block (intake side)

29. Secondary Air Injection (AIR) solenoid valve (N112)

30. Intake Manifold Tuning (IMT) solenoid valve (N156)
- For intake manifold change-over to performance port

31. Secondary Air Injection (AIR) pump motor (V101)

32. Fuel injectors (N30, N31, N32, N33, N83, N84)

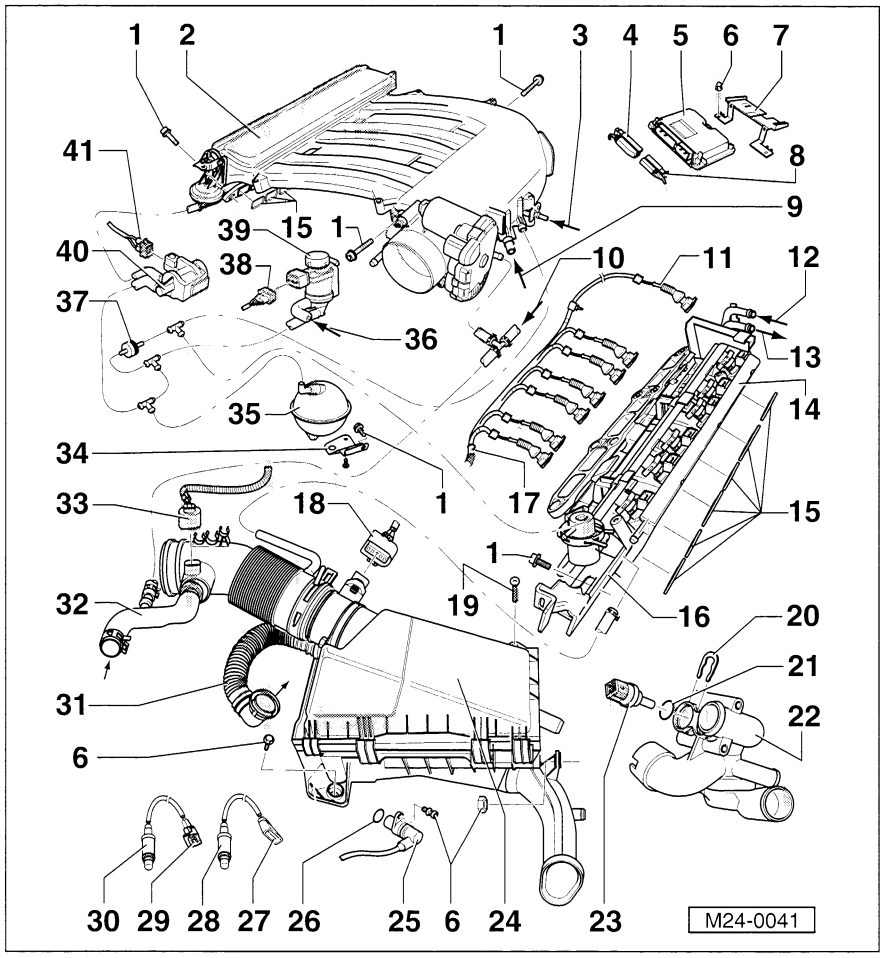


Anti-seize compound, (not shown)
- High temperature
- Volkswagen recommended anti-seize compound for all operations, G 052 112 A3

NOTE —

Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.

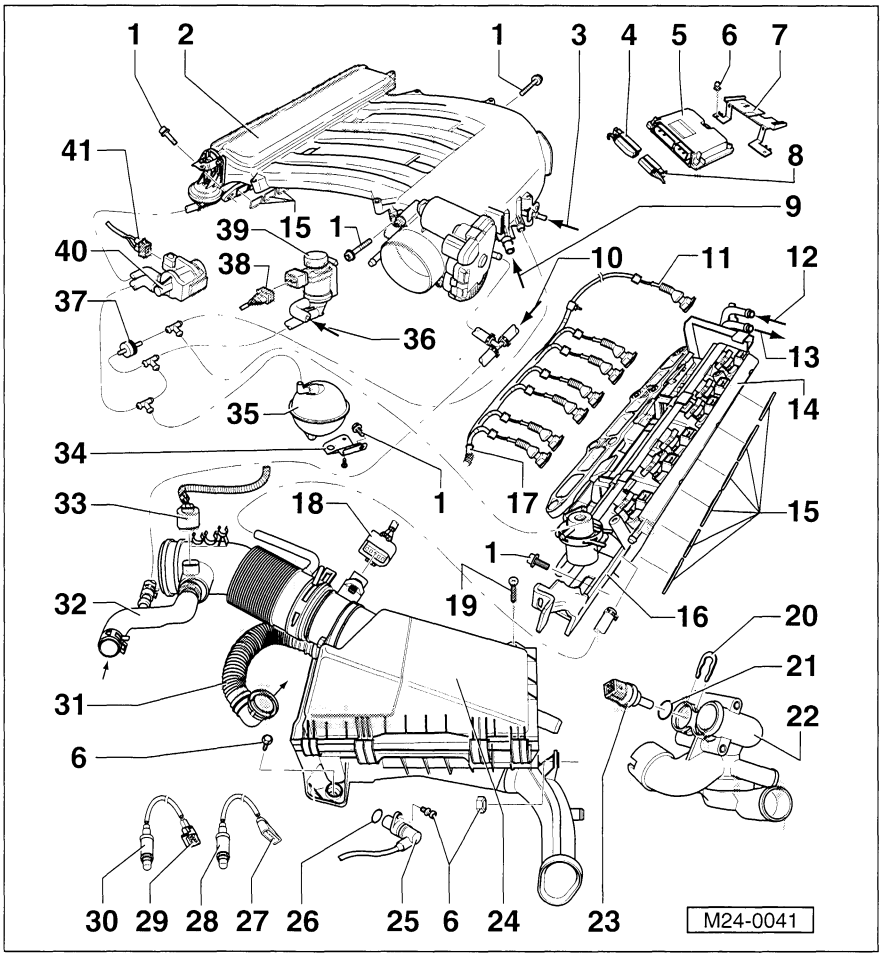
Fuel injection system components, removing and installing (AFP engine)



1. **Bolt**
   - Tighten to 25 Nm (18 ft-lb)
2. **Intake manifold, upper section**
   - Shown with throttle valve control module and intake manifold rotary change-over valve servo
3. **Vacuum connection**
   - To Leak Detection Pump (LDP)
4. **ECM harness connector, 81-pin**
   - Terminals 1 to 81
   - Only disconnect or connect with ignition switched OFF
5. **Engine Control Module (ECM) (J220)**
   - Motronic ME7.1
   - Location: in air plenum near base of windshield in the engine compartment
   - Coding required after replacement
   - Must be matched to TV control module (J338) with a scan tool if replaced
6. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
7. **Retaining bracket**
   - For engine control module
8. **ECM harness connector, 40-pin**
   - Terminals 82 to 121
   - Only disconnect or connect with ignition switched OFF
9. **Vacuum connection**
   - To power brake servo
10. **Vacuum connection**
    - To evaporative emissions (EVAP) canister purge regulator valve
11. **Harness connector, 3-pin white**
    - For knock sensor 1
    - All contacts gold plated
12. **Fuel supply connection**
    - Secure with spring clips only
    - From fuel filter
    - With white markings
13. **Fuel return connection**
    - Secure with spring clips only
    - To fuel delivery unit in fuel tank
    - With blue markings
14. **Intake manifold, lower section**
15. **Intake manifold seals**
    - 2 different sizes
    - Always replace
16. **Bracket**
    - For secondary air injection pump motor and secondary air combi valve
17. **Wiring harness**
    - With harness connectors for fuel injectors
    - With harness connector for knock sensor 1
18. **Harness connector, 5-pin black**
    - For mass air flow sensor with intake air sensor
    - All sensor and harness connectors gold plated
19. **Bolt**
    - Tighten to 6 Nm (53 in-lb)
20. **Retaining clip**
    - Ensure clip is securely seated
21. **O-ring**
    - Replace if damaged
22. **Thermostat housing**
23. **Engine Coolant Temperature (ECT) sensor (G62)**
    - 4-pin harness connector
    - For engine control module
    - Combined with sensor (G2) for instrument panel warning light
    - ECT sensor and harness connector contacts1and 3 are gold plated
    - Release cooling system pressure before removing
    - See **Engine coolant temperature (ECT) sensor, checking resistance**
24. **Air filter assembly**
25. **Engine speed (RPM) sensor (G28)**
    - Location: on cylinder block near oil filter
    - Inductive type sensor
    - Sensor wheel attached to crankshaft
26. **O-ring**
    - Always replace

(continued on following page)

Fuel injection system components, removing and installing, continued (AFP engine)



27. Harness connector, 4-pin black
- For post-catalyst heated oxygen sensor (G130) and oxygen sensor heater (Z29)
- Location: right underside of vehicle in plastic shield
- Contacts 3 and 4 are gold plated

28. Heated Oxygen Sensor (HO2S), after (post) catalytic converter (G130) (B1S2)
- Monitors catalytic converter efficiency
- Location: threaded into rear of catalytic converter
- Tighten to 50 Nm (37 ft-lb)
- Lubricate threads only with high temperature anti-seize
- Do not allow anti-seize compound into the slots on the sensor body
- Oxygen sensor heater voltage supplied by fuel pump relay

29. Harness connector, 6-pin black
- For pre-catalyst heated oxygen sensor (G39) and oxygen sensor heater (Z19)
- Right underside of vehicle in plastic shield
- Contacts 1, 2, 5 and 6 are gold plated

30. Heated Oxygen Sensor (HO2S), before (pre) catalytic converter (G39) (B1S1)
- Monitors combustion efficiency
- Tighten to 50 Nm (37 ft-lb)
- Location: Threaded into front exhaust pipe ahead of catalytic converter
- Lubricate threads only with high temperature anti-seize
- Do not allow anti-seize compound into the slots on the sensor body
- Oxygen sensor heater voltage supplied by fuel pump relay

31. Intake hose
- From air cleaner housing upper section to secondary air injection pump intake
- Ensure hose is seated tightly
- Press together at front to release

32. Connecting hose
- From crankcase breather housing on cylinder head (valve) cover

33. Harness connector, 2-pin black
- For Positive Crankcase Ventilation (PCV) heating element (N79)
- Specified supply voltage with engine running: minimum 11.5 volts

34. Bracket
- Mounted to oil pan

35. Vacuum reservoir
- For intake manifold rotary change-over valve and servo

36. Vacuum connection
- To secondary air injection (AIR) solenoid valve (N112)

37. Check valve
- Black side faces tee connection and vacuum source

38. Harness connector, 2-pin black
- For secondary air injection (AIR) solenoid valve (N112)

39. Secondary Air Injection (AIR) solenoid valve (N112)

40. Intake Manifold Tuning (IMT) solenoid valve (N156)

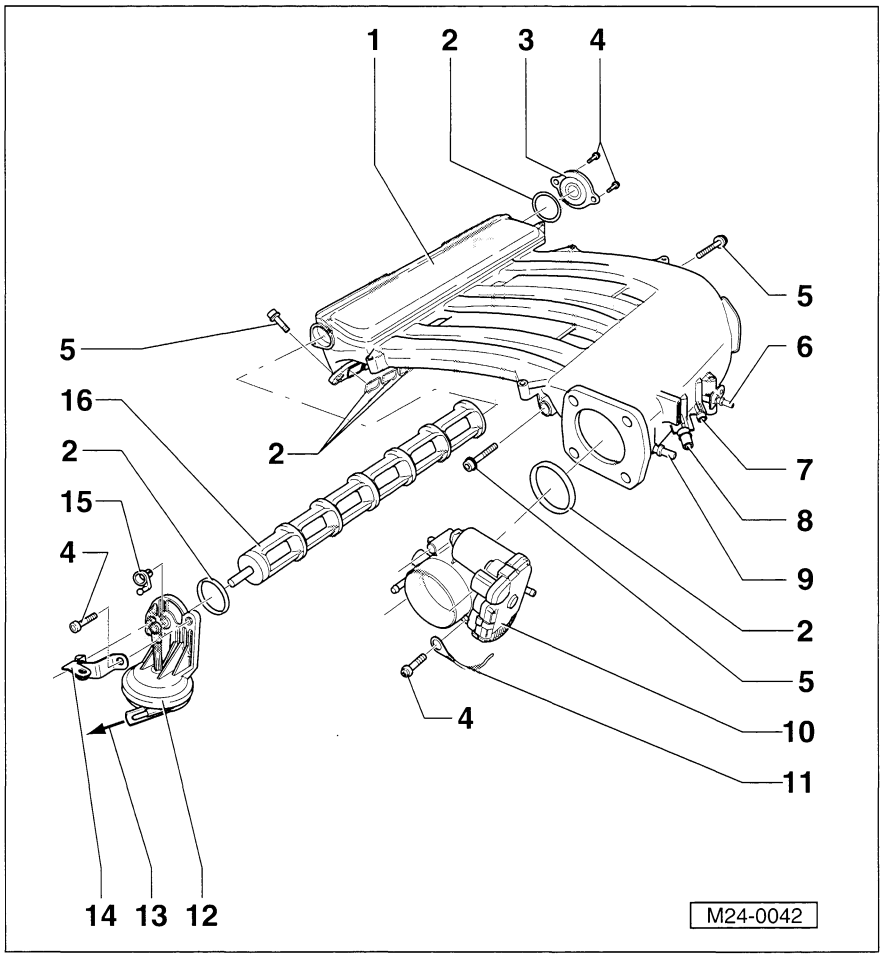
41. Harness connector, 2-pin black
- For Intake Manifold Tuning (IMT) solenoid valve (N156)

Anti-seize compound, (not shown)
- High temperature
- Volkswagen recommended anti-seize compound for all operations, G 052 112 A3

NOTE —

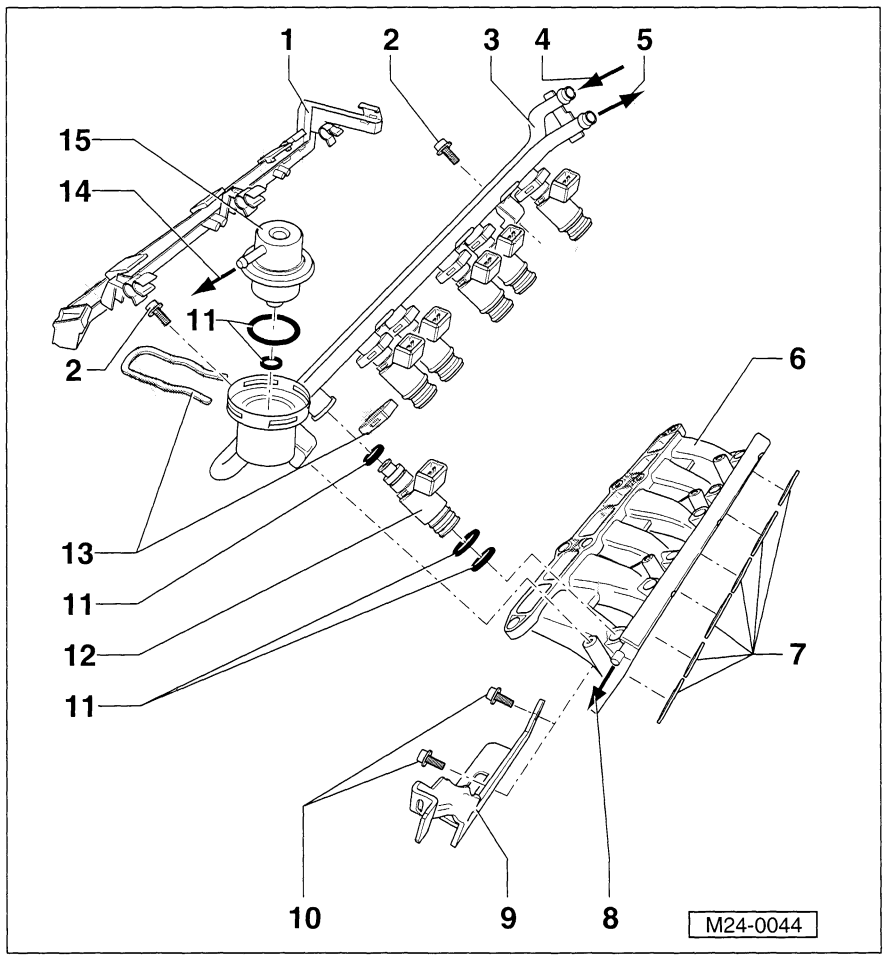
Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.

Intake manifold, upper section, assembly (AFP engine)



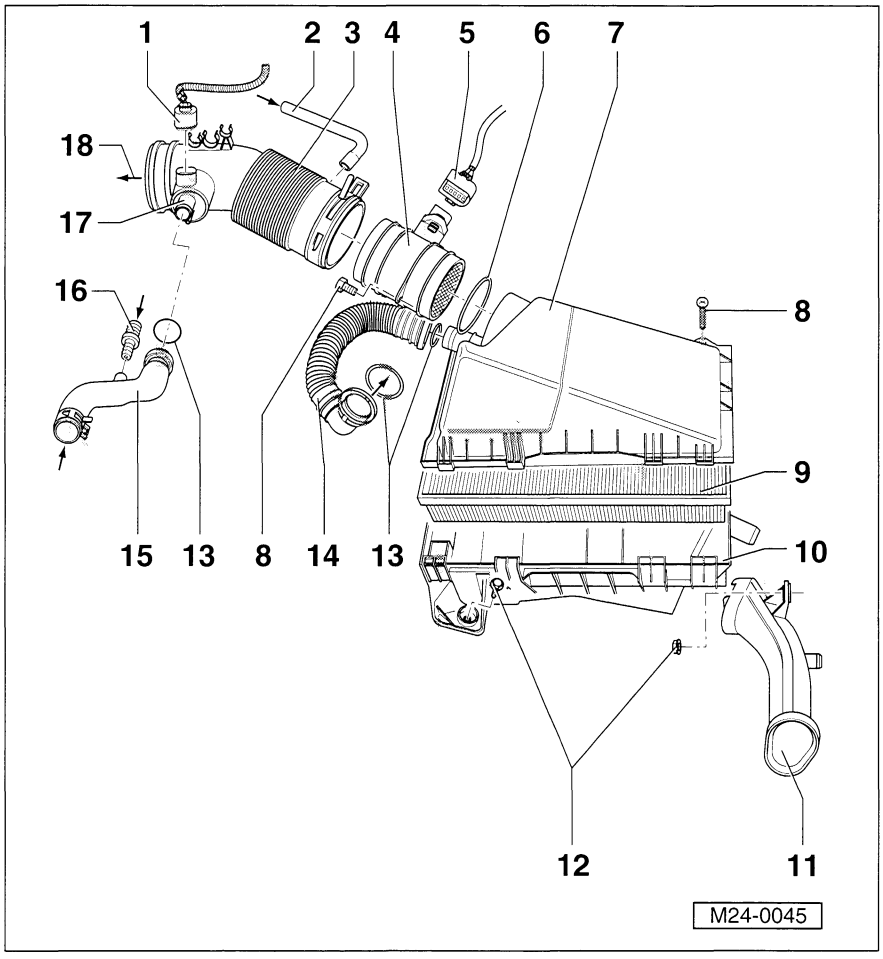
1. **Intake manifold, upper section**
2. **O-ring**
   - Always replace
3. **Bearing cap**
   - For IMT rotary valve
4. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
5. **Bolt**
   - Tighten to 25 Nm (18 ft-lb)
6. **Vacuum connection**
   - To leak Detection Pump (LDP)
7. **Vacuum connection**
   - To fuel pressure regulator, tee connectors, and check valve related components
8. **Vacuum connection**
   - To power brake servo
9. **Vacuum connection**
   - To EVAP canister purge regulator valve (N80)
10. **Throttle Valve (TV) control module (J338)**
    - For Electronic Power Control, EPC, (E-Gas System)
11. **Ground wire connection**
12. **Vacuum servo**
    - For intake manifold rotary change-over valve (intake manifold change-over to performance port)
13. **Vacuum connection**
    - To intake manifold tuning (IMT) solenoid valve (N156)
14. **Bracket**
    - For upper engine sound absorber panel
15. **Operating lever**
    - For Intake Manifold Tuning (IMT) valve
    - Ensure lever is securely seated at both ends
16. **Intake Manifold Tuning (IMT) valve (Intake manifold rotary change-over valve)**

Intake manifold, lower section and fuel rail, assembly (AFP engine)



1. **Wiring harness cable guide**
   - Ensure it is securely clipped into fuel rail
2. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
3. **Fuel rail**
4. **Fuel supply line/hose**
   - Secure with spring clips only
   - From fuel filter
   - With white markings
5. **Fuel return line/hose**
   - Secure with spring clips only
   - To fuel delivery unit in fuel tank
   - With blue markings
6. **Intake manifold, lower section**
7. **Intake manifold seals**
   - 2 different sizes
   - Always replace
8. **Vacuum connection**
   - To intake hose
   - For air shrouded injectors
9. **Bracket**
   - For secondary air injection pump motor and secondary air inlet valve
10. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
11. **O-ring**
    - Always replace
    - Moisten with clean engine oil or fuel before installing
12. **Fuel injectors (N30, N31, N32, N33, N83, N84)**
    - 2-pin harness connector
    - Air shrouded for improved fuel atomization
13. **Retaining clip**
    - Ensure proper seating on fuel rail and injector
14. **Vacuum connection**
    - To upper section of intake manifold and tee connectors
15. **Fuel pressure regulator**
    - Fuel pressure regulator with residual check valve

Air cleaner assembly (AFP engine)



1. **Harness connector, 2-pin black**
   - For positive crankcase ventilation (PCV) heating element (N79)
   - Specified supply voltage with engine running: minimum 11.5 volts
2. **Connecting hose**
   - To intake manifold, lower section
   - For air shrouded injectors
3. **Connecting hose**
   - Between throttle valve control module and mass air flow sensor/air cleaner assembly
4. **Mass Air Flow sensor (MAF), (G70) with Intake Air Temperature sensor (IAT), (G42)**
   - All sensor and harness connectors gold plated
   - See **Intake air temperature (IAT) sensor, checking resistance**
5. **Harness connector, 5-pin black**
   - For mass air flow sensor with intake air sensor
   - All sensor and harness connectors gold plated
6. **O-ring seal**
   - Replace if damaged
7. **Air cleaner housing, upper section**
8. **Bolt**
   - Tighten to 6 Nm (53 in-lb)
9. **Filter element, paper**
10. **Air cleaner housing, lower section**
11. **Duct, intake air (air snorkel)**
12. **Bolt/nut**
    - Tighten to 10 Nm (7 ft-lb)
13. **O-ring**
    - Replace if damaged
14. **Intake hose**
    - From air cleaner housing upper section to secondary air injection pump intake
    - Ensure hose is seated tightly
    - Press together at front to release
15. **Connecting hose**
    - For crankcase breather
    - From breather housing on cylinder head (valve) cover
16. **Connecting fitting**
    - Note installed position
    - From tee connection and evaporative emissions canister purge regulator valve
17. **Positive Crankcase Ventilation (PCV) heating element (N79)**
    - Location: in crankcase breather hose
18. **Air flow to throttle valve control module**

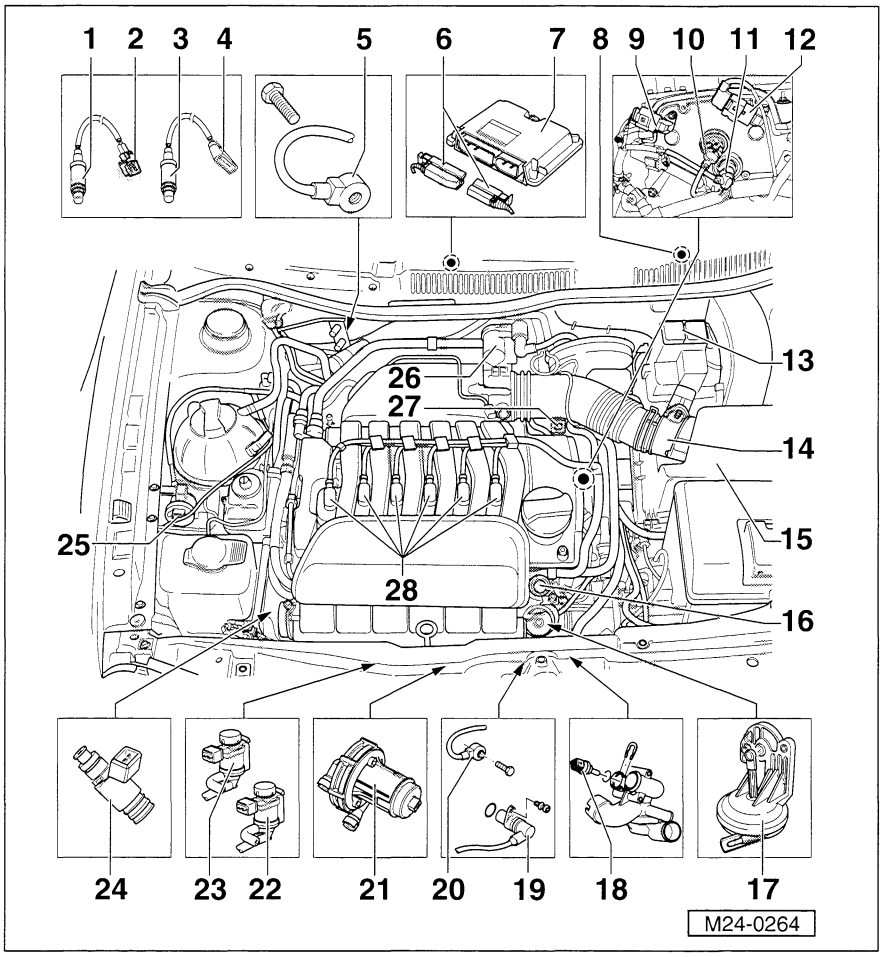
MOTRONIC ENGINE MANAGEMENT COMPONENTS (BDF ENGINE)

The following pages show the various components of the Motronic ME 7.1 engine management fuel injection system on the 2.8L (engine code: BDF).

NOTE —

Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*

Fuel injection system component locations, overview (BDF engine)



1. **Heated Oxygen sensor (HO2S), before (pre) catalytic converter (G39) (B1S1)**
   - Monitors combustion efficiency
   - Location: Threaded into front exhaust pipe ahead of catalytic converter
   - Tighten to 50 Nm (37 ft-lb)
   - Lubricate threads only with high temperature anti-seize
   - Do not allow anti-seize compound into the slots on the sensor body
2. **Harness connector, 6-pin black**
   - For pre-catalyst heated oxygen sensor (G39) and oxygen sensor heater (Z19)
   - Location: right underside of vehicle in plastic shield
3. **Heated Oxygen Sensor (HO2S), after (post) catalytic converter (G130) (B1S2)**
   - Monitors catalytic converter efficiency
   - Location: threaded into rear of catalytic converter
   - Tighten to 50 Nm (37 ft-lb)
   - Lubricate threads only with high temperature anti-seize
   - Do not allow anti-seize compound into the slots on the sensor body
4. **Harness connector, 4-pin black**
   - For post-catalyst heated oxygen sensor (G130) and oxygen sensor heater (Z29)
   - Location: right underside of vehicle in plastic shield
5. **Knock Sensor (KS) 1 (G61)**
   - Location: between cylinder 1 and cylinder 3
6. **ECM harness connectors**
   - Only disconnect or connect with ignition switched OFF
   - Connector I: terminals 1 to 81
   - Connector II: terminals 82 to 121
7. **Engine Control Module (ECM), (J220)**
   - Motronic ME7.1.1
   - Location: in air plenum near base of windshield in the engine compartment
   - Press tab on left side of ECM toward left to remove
8. **Clutch vacuum vent valve switch (F36) (Clutch Pedal Position, CPP)**
   Brake light switch (F),
   Brake vacuum vent valve switch (F47) (Brake Pedal Position, BPP)
   - In driver's footwell on pedal support brackets
9. **Camshaft Position (CMP) sensor (G40)**
   - For intake camshaft
   - Mark connector and component before removing connector
10. **Intake camshaft adjustment valve (N205)**
    - Mark connector and component before removing connector
    - See **Camshaft timing adjustment, checking** in **15d Cylinder Head and Valvetrain (2.8L Engine)**
11. **Exhaust camshaft adjustment valve (N318)**
    - Mark connector and component before removing connector
    - See **Camshaft timing adjustment, checking** in **15d Cylinder Head and Valvetrain (2.8L Engine)**
12. **Camshaft Position (CMP) sensor 2 (G163)**
    - For exhaust camshaft
    - Mark connector and component before removing connector
13. **Protective housing**
    - Secondary air injection relay (J299), marked with control number 100
    - ECM power supply relay (J271) marked with control number 428
    - Relay locations may vary, check **Electrical wiring diagrams**
14. **Mass Air Flow (MAF) sensor, (G70) with Intake Air Temperature (IAT), sensor (G42)**
15. **Air filter assembly**

(continued on following page)

Fuel injection system component locations, overview continued (BDF engine)

16. Fuel pressure regulator
- Location: on fuel rail

17. Vacuum servo
- For intake manifold rotary change-over valve (intake manifold change-over to performance port)

18. Engine Coolant Temperature (ECT) sensor, (G62)
- For engine control module
- Combined with sensor (G2) for instrument panel warning light
- Release cooling system pressure before removing

19. Engine speed (RPM) sensor (G28)

20. Knock Sensor (KS) 2 (G66)
- Location: between cylinder 4 and cylinder 6

21. Secondary Air Injection (AIR) pump motor (V101)

22. Intake Manifold Tuning (IMT) valve (N156)

23. Secondary Air Injection (AIR) solenoid valve (N112)

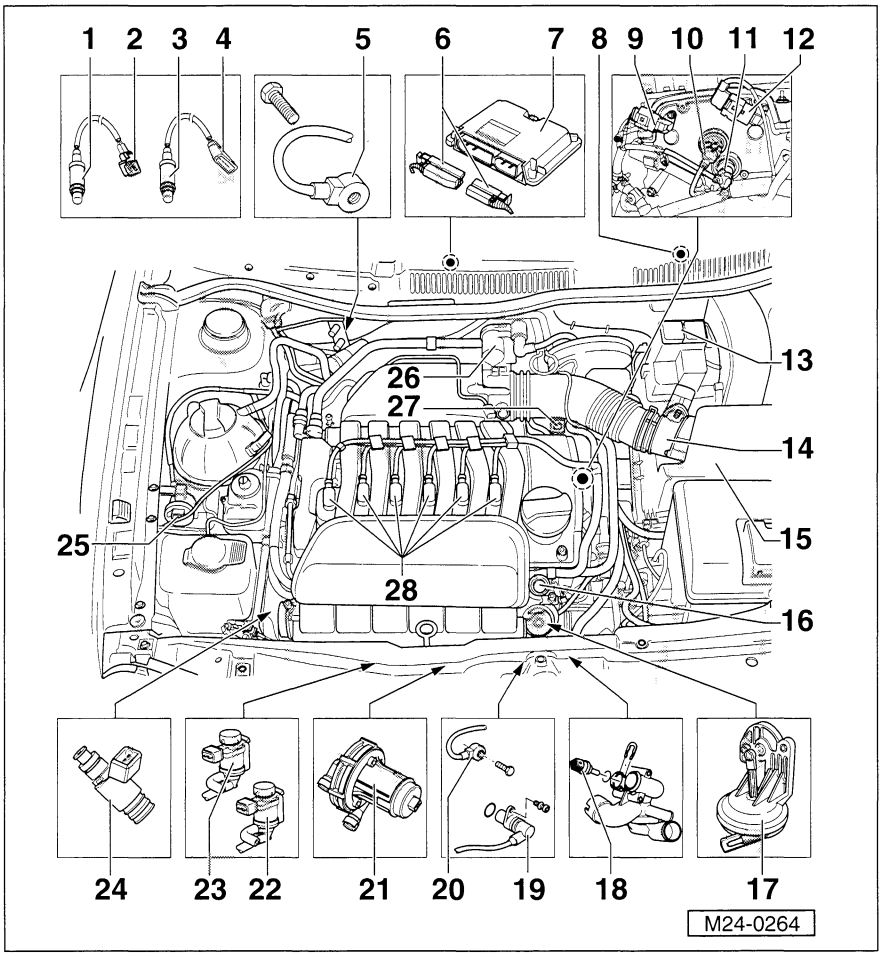
24. Fuel injectors (N30, N31, N32, N33, N83, N84)

25. Evaporative emissions (EVAP) canister purge regulator valve (N80)
- Location: Mounted to right side of engine compartment near front strut tower

26. Throttle Valve (TV) control module (J338)
- For Electronic Power Control, EPC, (E-Gas System)
- Heated by coolant

27. Combi-valve
- For secondary air injection system

28. Ignition coils with power output stage (N70, N127, N291, N292, N323 and N324)
- Individual coils with power output stages for each cylinder

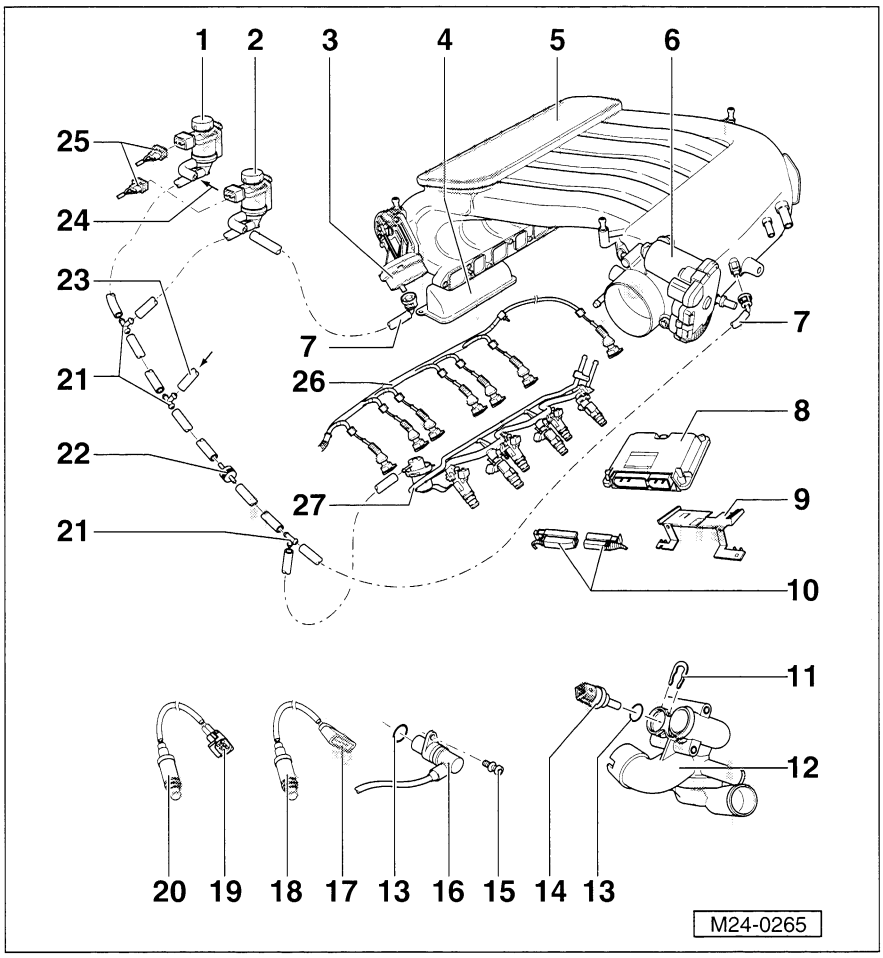


Anti-seize compound, (not shown)
- High temperature
- Volkswagen recommended anti-seize compound for all operations, G 052 112 A3

NOTE —

Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.

Fuel injection system components, removing and installing (BDF engine)



1. **Secondary Air Injection (AIR) solenoid valve (N112)**
   - Activated by ECM (pulsed, duty cycle)
2. **Intake Manifold Tuning (IMT) valve (N156)**
3. **Vacuum servo**
   - For intake manifold change-over valve
4. **Vacuum reservoir**
   - For intake manifold change-over valve
5. **Intake manifold**
6. **Throttle Valve (TV) control module (J338)**
   - Heated by coolant
7. **Vacuum line**
   - Press tabs together at front to release
8. **Engine Control Module (ECM), (J220)**
   - Motronic ME7.1.1
   - Location: in air plenum near base of windshield in the engine compartment
   - Coding required after installation
   - Must be adapted to throttle valve control module (J338) with a scan tool if replaced
9. **Retaining bracket**
   - For engine control module
10. **ECM harness connectors**
    - Only disconnect or connect with ignition switched OFF
    - Connector I: terminals 1 to 81
    - Connector II: terminals 82 to 121
11. **Retaining clip**
    - Check that it is securely seated
12. **Thermostat housing**
13. **O-ring**
    - Replace if damaged
14. **Engine Coolant Temperature (ECT) sensor (G62)**
    - For engine control module
    - Combined with sensor (G2) for instrument panel warning light
    - Release cooling system pressure before removing
    - See **Engine coolant temperature (ECT) sensor, checking resistance**
15. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
16. **Engine speed (RPM) sensor (G28)**
17. **Harness connector, 4-pin black**
    - For post-catalyst heated oxygen sensor (G130) and oxygen sensor heater (Z29)
    - Location: right underside of vehicle in plastic shield
18. **Heated Oxygen Sensor (HO2S), after (post) catalytic converter (G130) (B1S2)**
    - Monitors catalytic converter efficiency
    - Location: threaded into rear of catalytic converter
    - Tighten to 50 Nm (37 ft-lb)
    - Lubricate threads only with high temperature anti-seize G5
    - Do not allow anti-seize compound into the slots on the sensor body
    - Oxygen sensor heater voltage supplied by fuel pump relay
19. **Harness connector, 6-pin black**
    - For pre-catalyst heated oxygen sensor (G39) and oxygen sensor heater (Z19)
    - Right underside of vehicle in plastic shield
20. **Heated Oxygen sensor (HO2S), before (pre) catalytic converter (G39) (B1S1)**
    - Monitors combustion efficiency
    - With additional monitoring sensor
    - Location: Threaded into front exhaust pipe
    - Tighten to 50 Nm (37 ft-lb)
    - Lubricate threads only with high temperature anti-seize G5
    - Do not allow anti-seize compound into the slots on the sensor body
    - Oxygen sensor heater voltage supplied by fuel pump relay

(continued on following page)

Fuel injection system components, removing and installing, continued (BDF engine)

21. Tee fittings

22. Check valve
- Black side faces tee connection and vacuum source
- White connector faces toward N112 and N156

23. Vacuum line
- From vacuum reservoir

24. Flow
- Vacuum to/from Secondary Air Injection (AIR) solenoid valve (N112)

25. Harness connectors, 2-pin black
- Mark connector and component before removing connector

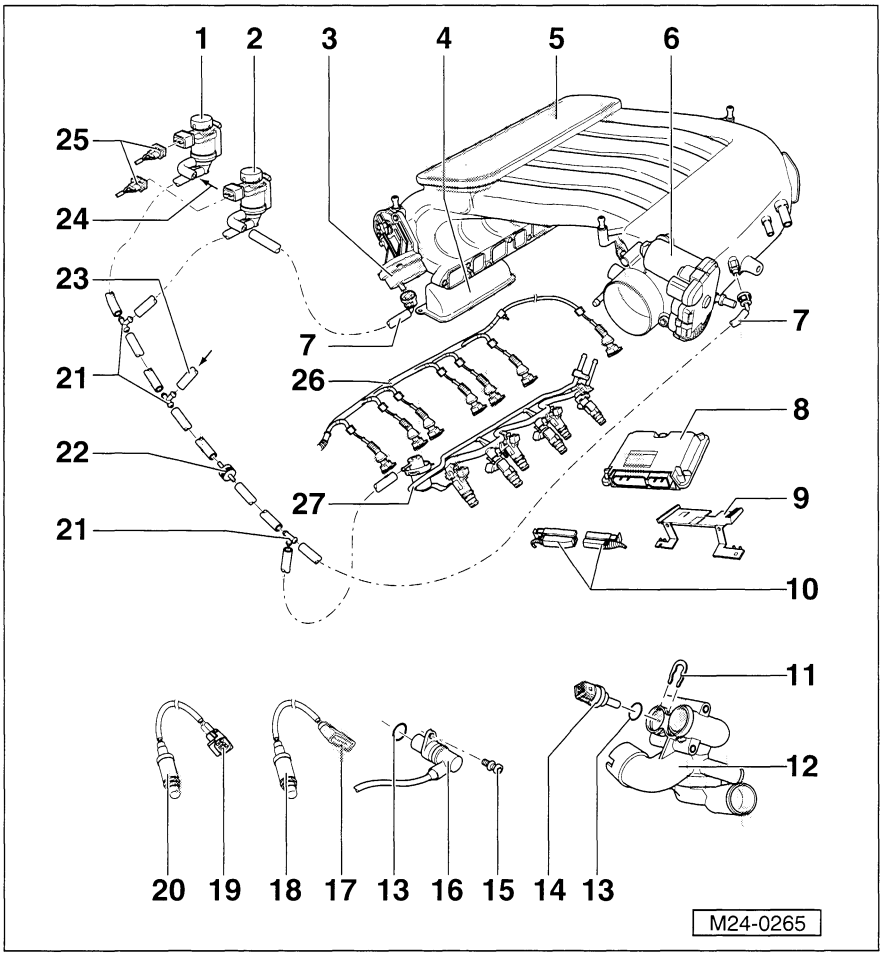
26. Wiring harness

27. Fuel rail
- With injectors and fuel pressure regulator

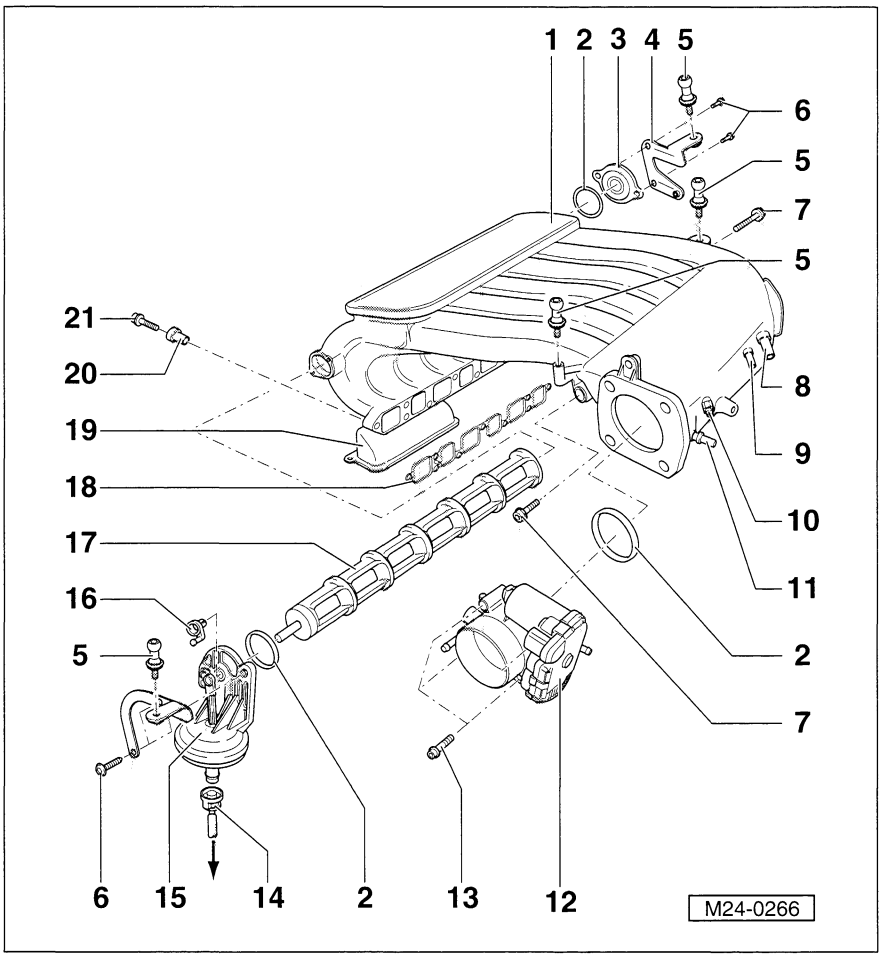
Anti-seize compound, (not shown)
- High temperature
- Volkswagen recommended anti-seize compound for all operations, G 052 112 A3

NOTE —

Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.

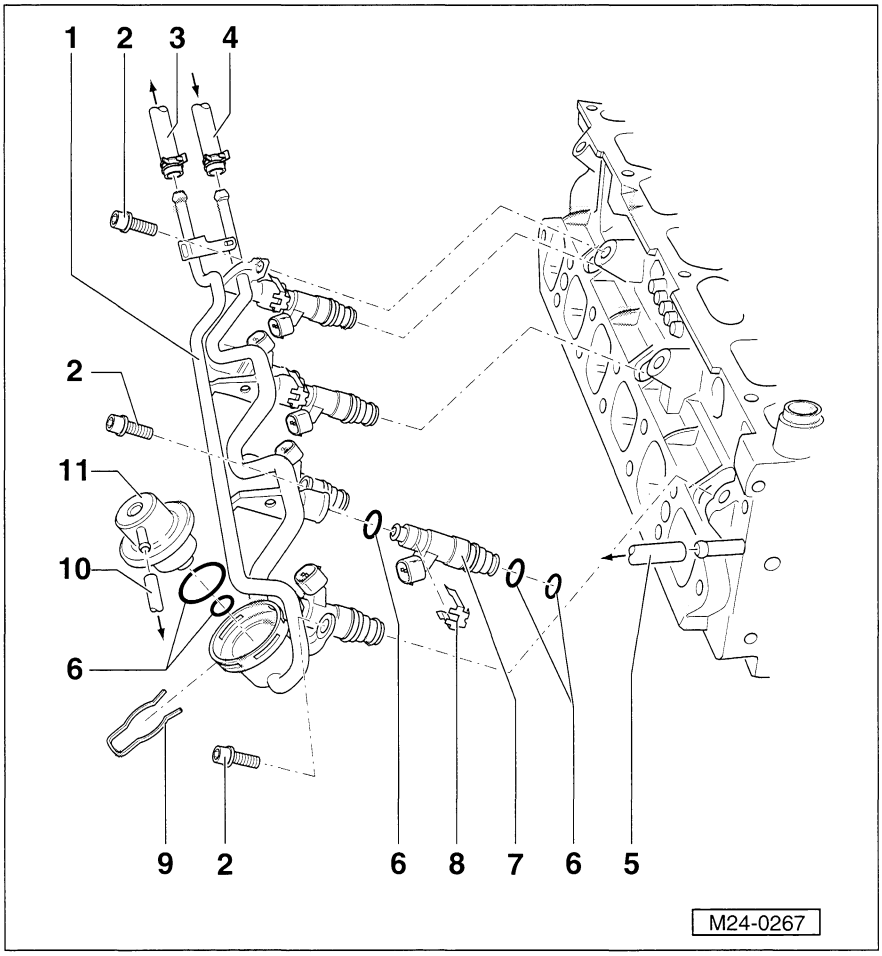


Intake manifold assembly (BDF engine)



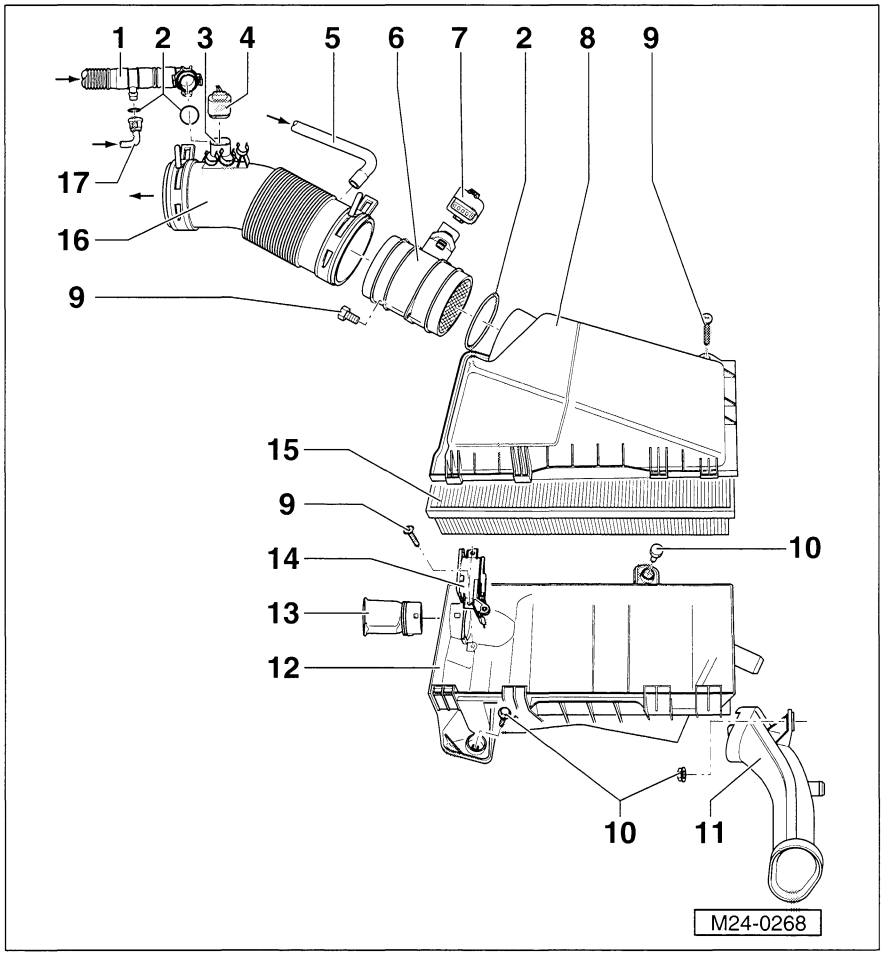
1. **Intake manifold assembly**
2. **Seal**
   - Always replace
3. **Bearing cap**
   - For Intake Manifold Tuning (IMT) valve
4. **Bracket**
   - For engine cover mounting pin
5. **Mounting pin**
   - Tighten to 5 Nm (44 in-lb)
   - For engine cover
6. **Bolt**
   - Tighten to 5 Nm (44 in-lb)
7. **Bolt**
   - Tighten to 23 Nm (17 ft-lb)
8. **Vacuum connection**
   - From brake booster
9. **Vacuum connection**
   - From Leak Detection Pump (LDP)
10. **Vacuum connection**
    - From fuel pressure regulator tee connection
11. **Vacuum connection**
    - From crankcase breather/EVAP canister purge regulator solenoid valve tee fitting
12. **Throttle Valve (TV) control module (J338)**
13. **Bolt**
    - Tighten to 8 Nm (71 in-lb)
14. **Vacuum connection**
    - To Intake Manifold Tuning (IMT) valve
15. **Vacuum servo**
    - For Intake Manifold Tuning (IMT) valve
16. **Operating lever**
    - For Intake Manifold Tuning (IMT) valve
    - Ensure lever is securely seated at both ends
17. **Intake Manifold Tuning (IMT) valve (Intake manifold rotary change-over valve)**
18. **Gasket**
    - Replace if damaged
    - Observe installed position
19. **Vacuum reservoir**
    - For Intake Manifold Tuning (IMT) valve
20. **Dowel sleeve**
    - To secure intake manifold and locate gasket
21. **Bolt**
    - Tighten to 13 Nm (10 ft-lb)

Fuel rail assembly (BDF engine)



1. **Fuel rail**
2. **Bolt**
   - Tighten to 8 Nm (71 in-lb)
3. **Fuel return line**
   - Blue or with blue markings
   - Secure with spring clips only
   - Ensure correct seating in recess
   - To fuel delivery unit in fuel tank
4. **Fuel supply line**
   - Black
   - Secure with spring clips only
   - Ensure correct seating in recess
   - From fuel filter
5. **Connecting hose**
   - Black
   - Secure with spring clips only
   - Ensure correct seating
   - For air shrouded injectors
   - To intake hose
6. **O-ring**
   - Always replace
   - Moisten with clean engine oil or fuel before installing
7. **Fuel injectors (N30, N31, N32, N33, N83, N84)**
   - Air shrouded for improved fuel atomization
   - When replacing, erase learned values and adapt ECM to throttle valve control module using diagnostic scan tool
8. **Retaining clip**
   - Ensure proper seating on fuel rail and injector
9. **Retaining clip**
   - Ensure proper seating on fuel rail
10. **Vacuum line**
    - To tee connection for check valve/intake manifold
11. **Fuel pressure regulator**
    - Fuel pressure regulator with residual check valve

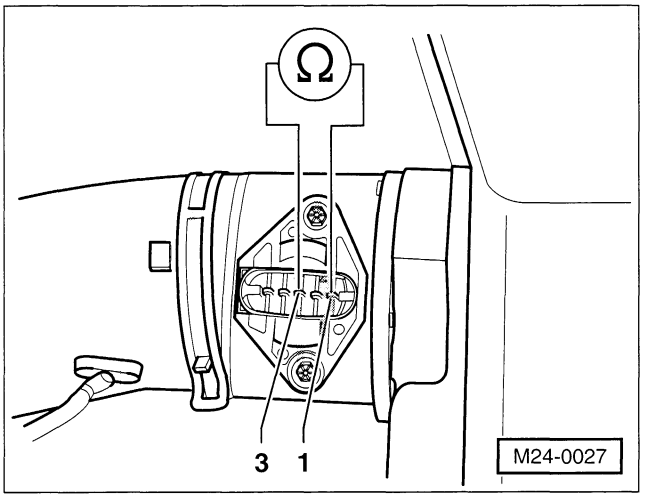
Air cleaner assembly (BDF engine)



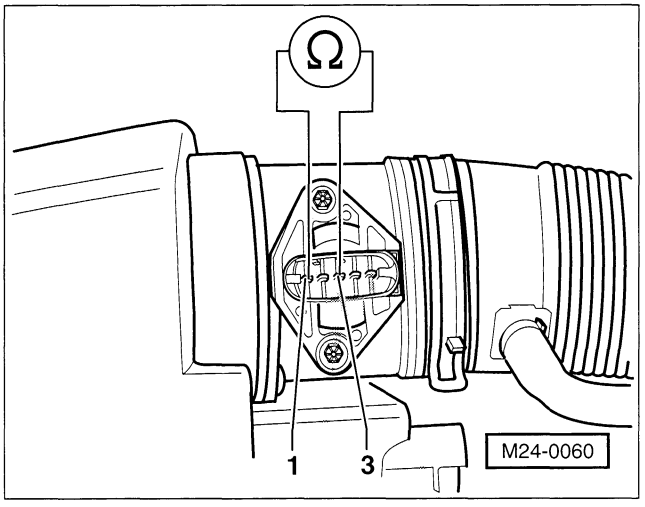
1. **Connecting hose**
   - For crankcase breather
   - Ensure proper seating
   - Press clips together at front to release
2. **O-ring seal**
   - Replace if damaged
3. **Positive Crankcase Ventilation (PCV) heating element (N79)**
   - For crankcase breather
   - Location: in intake hose
4. **Harness connector, 2-pin black**
   - For positive crankcase ventilation (PCV) heating element
   - Specified supply voltage with engine running: minimum 11.5 volts
5. **Connecting hose**
   - To connection on cylinder head
   - For air shrouded injectors
   - Ensure proper seating
6. **Mass Air Flow (MAF) sensor, (G70) with Intake Air Temperature (IAT) sensor, (G42)**
   - All sensor and harness connectors gold plated
   - See **Intake air temperature (IAT) sensor, checking resistance**
7. **Harness connector, 5-pin black**
   - For mass air flow sensor with intake air sensor
   - All sensor and harness connectors gold plated
8. **Air cleaner housing, upper section**
9. **Bolt**
   - Tighten to 6 Nm (53 in-lb)
10. **Bolt/nut**
    - Tighten to 10 Nm (7 ft-lb)
11. **Duct, intake air (air snorkel)**
    - For cold air intake
12. **Air cleaner housing, lower section**
13. **Duct, intake air**
    - For warm air intake
14. **Control flap**
15. **Filter element, paper**
16. **Connecting (intake) hose**
    - Between throttle valve control module and mass air flow sensor/air cleaner assembly
    - Ensure proper seating
    - Secure with spring clips only
17. **Vacuum line**
    - From tee connection and evaporative emissions canister purge solenoid valve
    - Press clips together at front to release

FUEL INJECTION COMPONENTS, TESTING

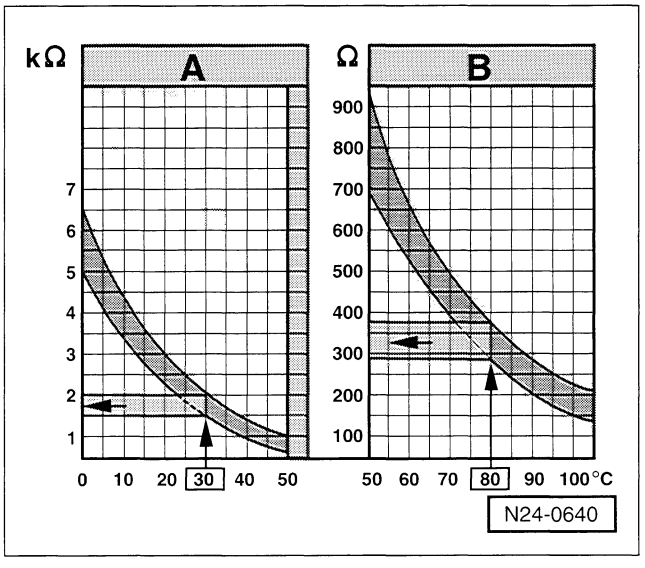
Intake Air Temperature (IAT) sensor, measuring resistance



➤ **AFP engine:**
Measure resistance at terminals **1** and **3**.



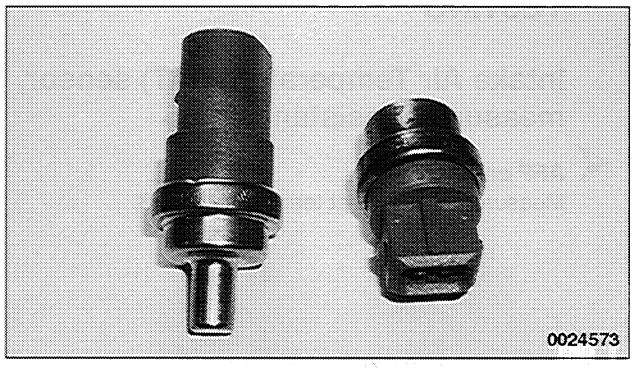
➤ **BDF engine:**
Measure resistance at terminals **1** and **3**.



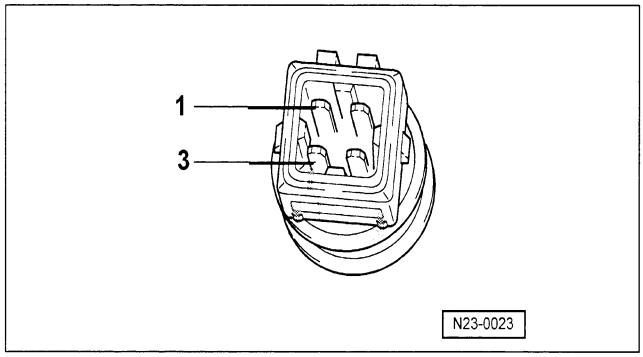
➤ Compare resistance reading to graph:

- Scale **A** shows resistance for intake air temperature range 0-50°C (32-122°F)
- Scale **B** shows resistance for intake air temperature range 50-100°C (122-212°F)
- Example:
  30°C corresponds to 1500-2000 Ω
  80°C corresponds to 275-375 Ω

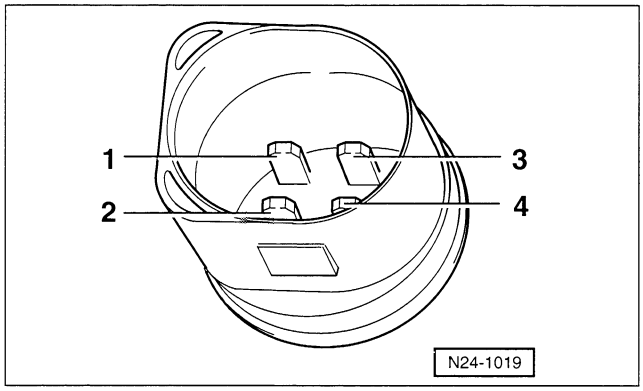
Engine coolant temperature (ECT) sensor, measuring resistance



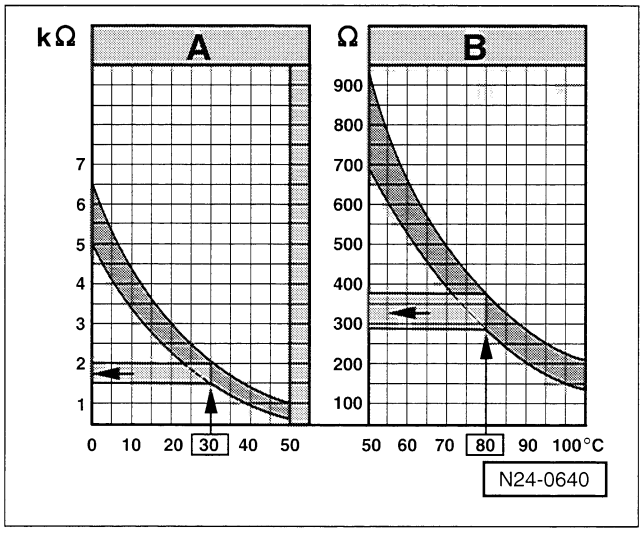
Several different version engine coolant temperature sensors were installed in 2.8L engines. The early style sensor (**right**) was blue and square shaped. The later style sensor (**left**) is longer, oval shaped, and either green or black. Use the illustrations below to determine which style sensor is installed.



Measure resistance at terminals **1** and **3** on early style ECT sensor.

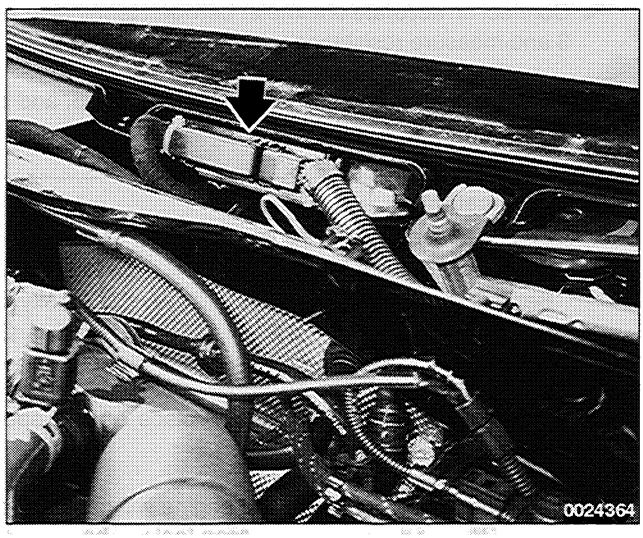


Measure resistance at terminals **3** and **4** on later style sensor.



Compare ECT resistance reading to graph at left.

- Scale **A** shows resistance for coolant temperature range 0-50°C (32-122°F)
- Scale **B** shows resistance for coolant temperature range 50-100°C (122-212°F)
- Example:
  30°C corresponds to 1500-2000 Ω
  80°C corresponds to 275-375 Ω



Engine Control Module (ECM)

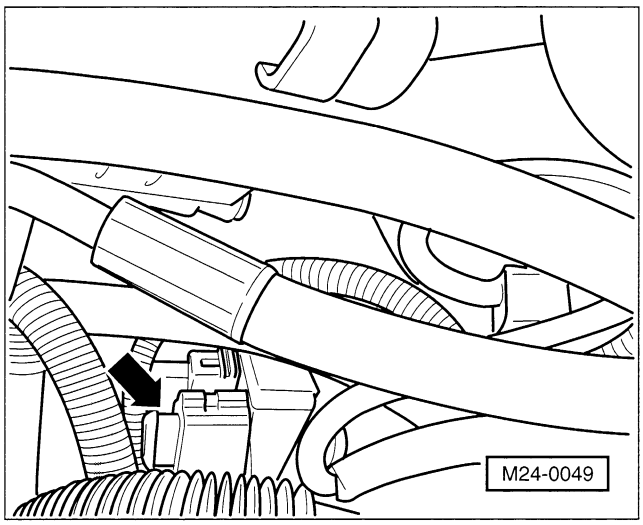
The engine control module (**arrow**) is located in the air plenum near base of windshield in the engine compartment. Access to the ECM requires removal of the windshield wiper arms and the air plenum cover.

> ***WARNING —***
> *Use care when removing wiper arms and air plenum cover.*

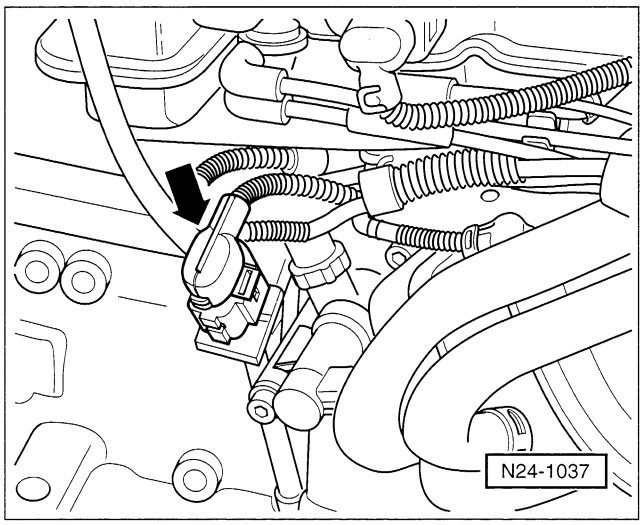
Engine speed (RPM) sensor

Operation of the engine management system depends on a wide variety of input sensors. Failure of most of these sensors will allow the engine to continue to run, albeit poorly. One major exception to this is the engine speed sensor (G28). Failure of this sensor will prevent the engine from starting and running and will set a diagnostic trouble code in the ECM.

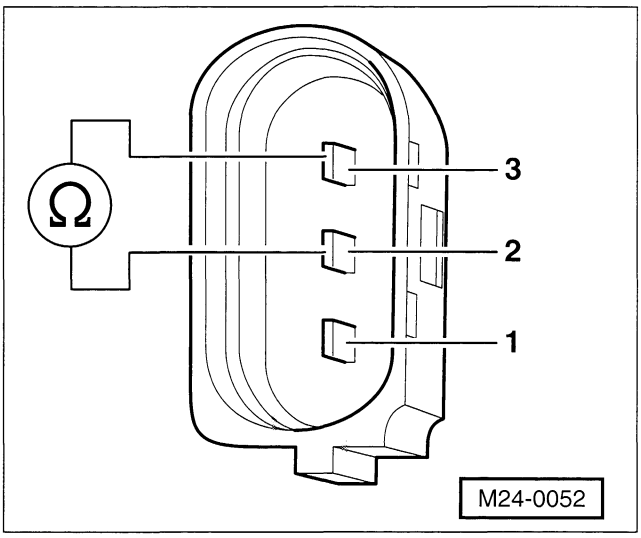
Note that most diagnostic functions require the use of a scan tool such as the Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program, however a quick check can be accomplished as follows:



AFP engine:
Disconnect the grey 3-pin harness connector (**arrow**) from the engine speed sensor plug near the secondary air injection pump.



BDP engine:
Disconnect the grey 3-pin harness connector (**arrow**) from the engine speed sensor plug near the secondary air injection pump.



➤ Connect an accurate ohmmeter between terminals 2 and 3 and measure resistance.

– Measure resistance between terminals 1 and 3, and between terminals 1 and 2.

Specification

- Engine speed sensor resistance values, (2.8L engine)

Between terminals 2 and 3 . . . . . 480 to 1000 Ω
Between terminals 1 and 2 . . . . . .infinity Ω
Between terminals 1 and 3 . . . . . .infinity Ω

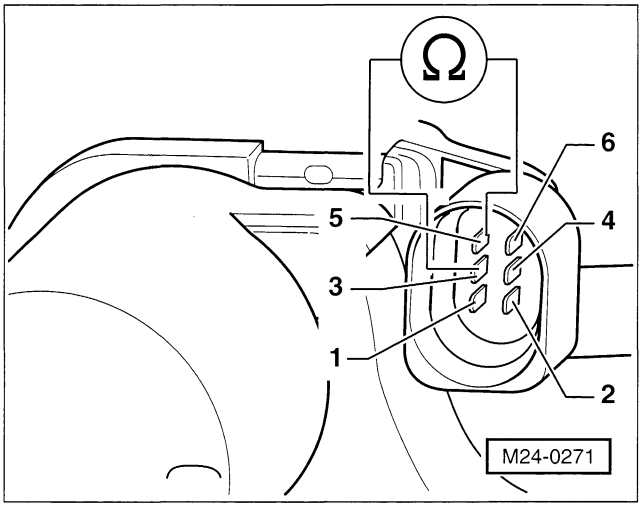
– If specification is not obtained, replace engine speed sensor.

– If specification is obtained, and engine will not start, additional testing with a suitable scan tool will be required.

Throttle Valve (TV) control module

NOTE —
The throttle valve control module should first be functionally tested using a diagnostic scan tool such as the Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program. A simple test for internal component resistance is described below.

– Pull 6-pin connector off throttle valve control module.



➤ Measure resistance from throttle valve drive between terminals 3 and 5.

- Specification: 1.0 - 5.0 Ω

– If the specification is not obtained, replace throttle valve control module.

– Check Diagnostic Trouble Code (DTC) memory, repair malfunctions as necessary and erase DTC memory using diagnostic scan tool.

– Adapt Engine Control Module (ECM) to throttle valve control module, see **Scan Tool** section in the back of this manual.

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26

GENERAL

This repair group covers repair and troubleshooting for the emission control systems and removal and installation of exhaust components.

Engine Codes

- AWD, AWW, AWP . . . 1.8L 4-cylinder turbo gasoline
- ALH . . . . . 1.9L 4-cylinder turbo diesel
- BEW . . . . . 1.9L 4-cylinder PD turbo diesel
- AEG, AVH, AZG, BBW, BEV . .2.0L 4-cylinder gasoline
- AFP, BDF . . . . . .2.8L 6-cylinder gasoline

NOTE —

- *Oxygen sensor (Lambda) system replacement is covered in* **24 Fuel Injection–Gasoline**.
- *All cars have a self-diagnostic program to detect emissions-related problems and store coded fault information in electronic memory. When diagnosing an emissions-related problem it is best to first check for stored fault codes and to troubleshoot using Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program.*
- *The cars covered by this manual have a vacuum hose routing diagram (sticker) located in the engine compartment which can be helpful when working with vacuum hoses.*

Service precautions

To help guard against personal injury or damage to car components, the following warnings and cautions apply when servicing the exhaust system.

WARNING —

- *Exhaust gases are colorless, odorless, and very toxic. Run the engine only in a well-ventilated area. Immediately repair any leaks in the exhaust system or structural damage to the car body that might allow exhaust gases to enter the passenger compartment.*
- *The exhaust system, catalytic converter and other emission control systems operate at very high temperatures. Allow these components to cool before servicing, or wear protective clothing to prevent burns. Do not use flammable chemicals near a hot catalytic converter.*
- *Old corroded exhaust system components crumble easily and often have exposed sharp edges. To avoid injury, wear eye protection and heavy gloves when working with such parts.*
- *Do not work under a lifted car unless it is solidly supported on jack stands designed for that purpose. Never work under a car that is supported solely by a jack.*
- *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased.*

EXHAUST SYSTEM (ALL ENGINES)

For safe and proper exhaust system operation, all components must be free of holes and all connections must be airtight. Check the system immediately if it becomes noisy or an exhaust odor is detected inside the car.

NOTE —

Excessive exhaust system back pressure can cause driveability problems such as a rough idle or stalling. Back pressure problems are caused by external damage such as crushed or collapsed parts, or internal damage such as a plugged catalytic converter.

Exhaust system replacement

The exhaust systems for the various engines available in the cars covered by this manual are illustrated in several exploded views later in this repair group. Use these illustrations as a guide for removal and installation. Tightening torques and other relevant installation information are given in the component lists.

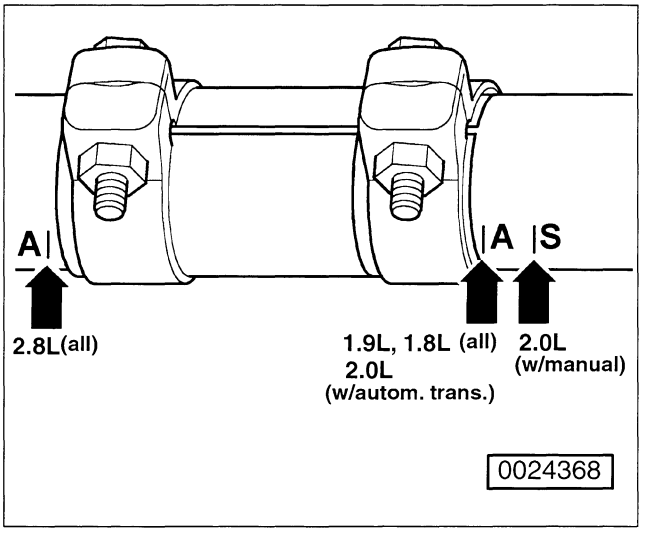
A liberal application of penetrating oil to cold exhaust system nuts, bolts and slip joints will make removal easier. New fasteners, clamps and rubber mounts are always recommended when replacing exhaust components. Gaskets should be replaced whenever flange joints are disconnected. Use high-temp anti-seize compound on threaded fasteners to extend their service life and make future replacement easier. Some slight smoking and/or odor is normal as new exhaust system parts become hot for the first few times.

WARNING —

Inspect the exhaust system heat shields on the car underbody and repair or replace any damaged parts. Heat shields protect the car occupants, undercoating, and various other components from excessive heat. Damaged or missing shields, particularly those above the catalytic converter, will increase interior temperatures and create a fire hazard.

NOTE —

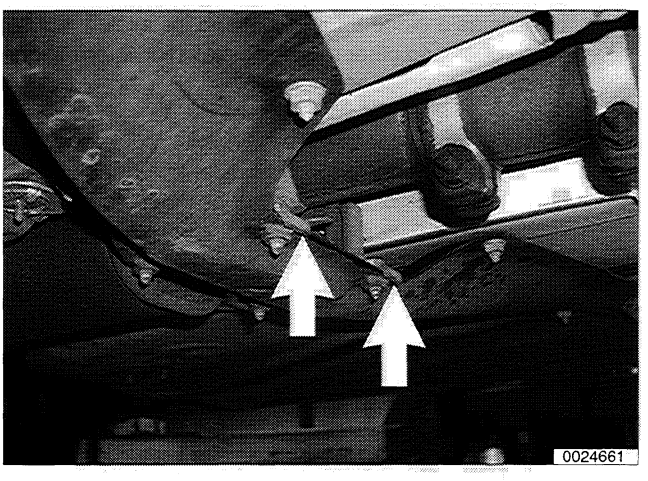
- *After performing repairs on the exhaust system, ensure that the system is not under stress and that it has sufficient clearance from the body. If necessary, loosen the double clamps and align the muffler and exhaust pipe so sufficient clearance is maintained to the body while the support rings are evenly loaded.*
- *When performing repairs, always replace self-locking nuts.*



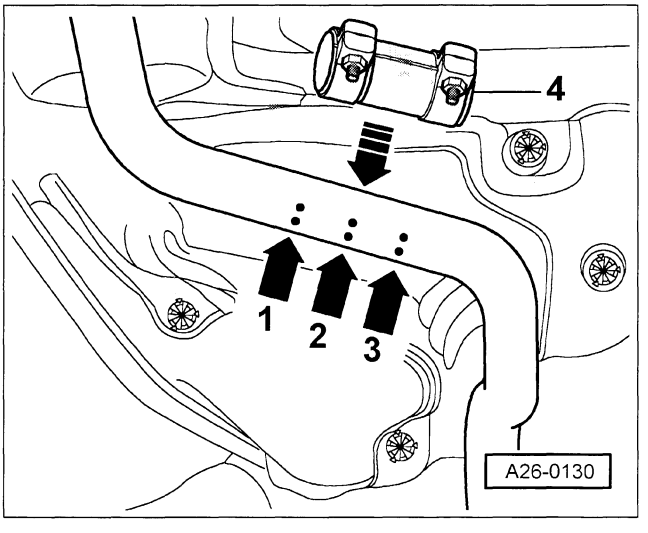
Exhaust system, installation details

The figures below show various details relevant to installing exhaust components in all cars covered by this manual.

➢ Installation position of double clamp that attaches front and rear exhaust sections. Position clamp approx. 5 mm inside of appropriate mark based on engine/transmission.



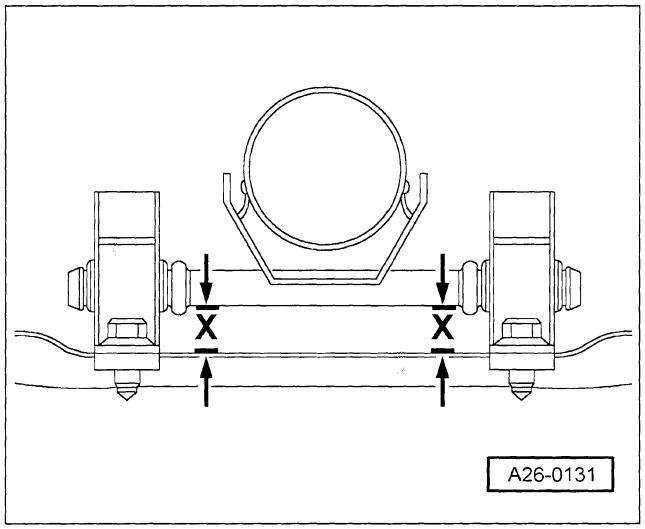
➢ Exhaust mount located behind double clamp. Ensure that tabs (**arrows**) on foot of mount points forward.



➢ Exhaust pipe separation point. Cut pipe at right angles at **arrow 2**. Repair clamp (**4**) is then positioned between **arrow 1** and arrow **3**.

Tightening torque

- Exhaust pipe repair clamp bolts . . . . 40 Nm (30 ft-lb)



➤ Ensure that rear muffler is aligned stress free. Mounting pins on exhaust pipe must run parallel with tunnel bridge (dimension **X** should be equal on left and right sides).

Catalytic converter

The three-way catalytic converter used on gasoline engines chemically reduces pollutants in the engine exhaust. A properly operating converter provides a 90-95 percent reduction of the three major exhaust gas pollutants (nitrogen (NO_x), carbon monoxide (CO), and unburned hydrocarbons (HC).

On diesel engines a two-way catalytic converter is used that reduces carbon monoxide (CO) and unburned hydrocarbons (HC). Diesel engines covered by this manual do not use an oxygen sensor to monitor the catalytic converter.

The three-way (gasoline) catalytic converter works correctly only when the air/fuel ratio is kept within a very narrow range. On gasoline powered cars the oxygen sensor provides the feedback for control of the air/fuel mixture. For more information see **24 Fuel Injection–Gasoline**, for the appropriate engine.

The catalytic converter itself does not require any routine maintenance. However, any problem that increases converter temperature beyond its normal operating range (incorrect ignition timing or air/fuel mixture, engine misfire, prolonged idling or extended high engine loads) can damage the converter. Reduced power, stalling, exhaust system rattles and excessive emissions are symptoms that may be caused by a faulty catalytic converter.

Catalytic converters on gasoline powered vehicles covered by this manual use a second heated oxygen sensor to monitor the operation of the catalyst. If the converter fails to properly oxidize the spent combustion gasses, the heated oxygen sensor will detect this malfunction and a fault code (DTC) will be stored in the ECM.

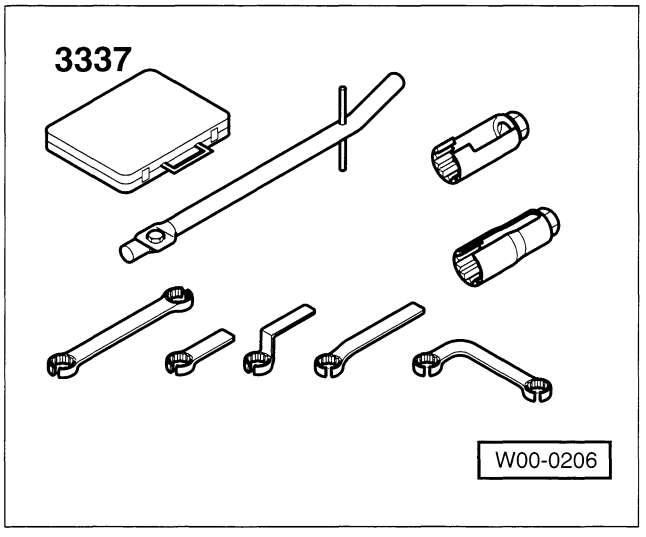
Exhaust leaks anywhere in the system, but especially between the cylinder head and the catalytic converter, can cause running problems, false DTCs or converter failure.

> ***WARNING —***
> *Do not operate the starter for long periods if the engine fails to start. Extended cranking may allow excess fuel to enter the catalytic converter, creating a fire hazard and possibly damaging the converter.*

Accurately testing the function of the catalytic converter requires an infrared exhaust gas analyzer to check the air/fuel mixture adjustment (% CO) at the exhaust system test port upstream of the catalytic converter, and then again at the tailpipe. If the converter is working properly, the tailpipe reading will be lower than the test port reading. If the reading is the same or only slightly less, the converter is probably faulty.

Oxygen sensor, removing and installing

Testing the oxygen sensor requires specialized scan tool equipment. Scan tools are available from Volkswagen and aftermarket suppliers. For a list of the various Diagnostic Trouble Codes (DTCs) applicable to these scan tools, see **ST Scan Tool Codes** at the back of the book.

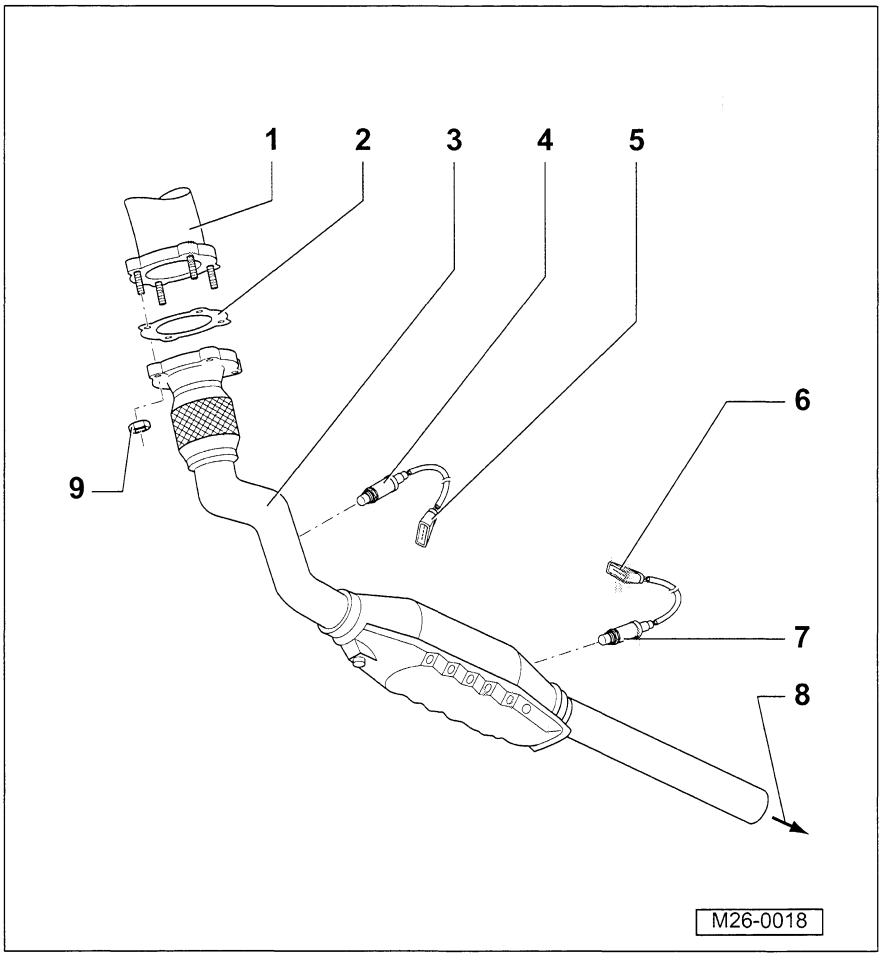


Removing and installing the oxygen sensor requires a Volkswagen special tool 3337 to avoid damaging the sensor.

> ***CAUTION —***
> - *When installing oxygen sensor be sure to use high temperature anti-seize compound that contains no silicone and is marked "safe for oxygen sensors". (VW part # G 052 112 A3)*
> - *Volkswagen part numbers are given for reference only. Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.*
> - *Do not allow anti-seize compound to enter slots on oxygen sensor body.*

EXHAUST SYSTEM (1.8L ENGINE)

Front exhaust pipe and catalytic converter (1.8L engine)



1. **Turbocharger**
2. **Gasket**
   - Always replace
3. **Front exhaust pipe with catalytic converter**
4. **Heated Oxygen Sensor (HO2S), before (pre) catalytic converter (G39) (B1S1)**
   - Tighten to 50 Nm (37 ft-lb)
   - If seal leaks, cut off and replace
   - Lubricate threads only with high temperature anti-seize
   - Do not allow anti-seize compound into the slots on the sensor body
5. **Harness connector, black**
   - AWD: 4-pin
   - AWP, AWW: 6-pin
   - Contacts gold plated
6. **Harness connector,4-pin black**
   - Contacts gold plated
7. **Heated Oxygen Sensor (HO2S), after (post) catalytic converter (G130) (B1S2)**
   - Tighten to 50 Nm (37 ft-lb)
   - If seal leaks, cut off and replace
   - Lubricate threads only with high temperature anti-seize
   - Do not allow anti-seize compound into the slots on the sensor body
8. **Exhaust flow**
   - Outlet to center muffler
9. **Nut**
   - Tighten to 40 Nm (30 ft-lb)

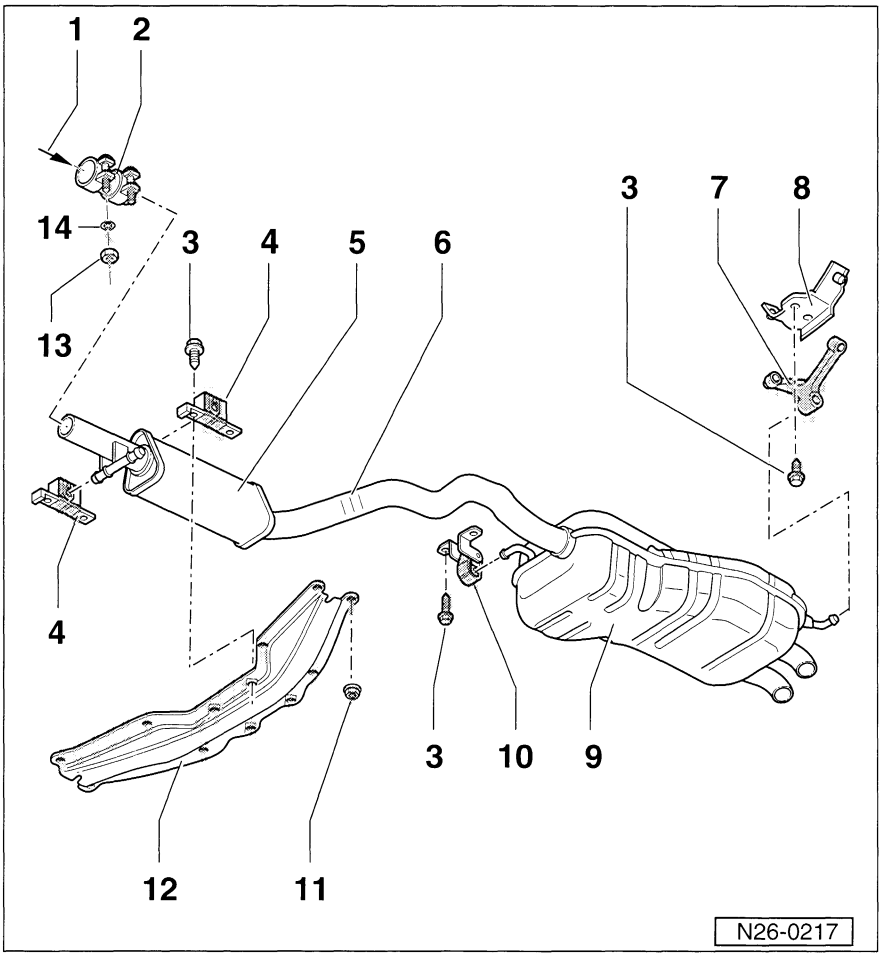
Anti-seize compound, (not shown)

- High temperature
- Volkswagen recommended anti-seize compound for all operations, G 052 112 A3

NOTE —

Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.

Muffler system (1.8L engine except, GTI 337)



1. **Exhaust flow**
   - From front exhaust pipe with catalytic converter
2. **Double clamp**
   - Note installed position A, illustration 0024368 shown earlier
3. **Bolt**
   - Tighten to 25 Nm (18 ft-lb)
4. **Mount**
   - Note installed position, illustration A26-0128 shown earlier
5. **Center muffler**
   - Center and rear mufflers are installed as one unit but can be obtained individually when replacing
   - Saw through connecting pipe at separation point to replace mufflers individually
   - Note installed position, align as illustrated in A26-0128, shown earlier
6. **Separation point (cut lines)**
   - Center and rear mufflers are installed as one unit but can be obtained individually when replacing
   - Saw through connecting pipe at separation point to replace mufflers individually
   - Use double clamp, item 2, above, to join pipes
7. **Rear exhaust hanger**
8. **Rear exhaust mount**
9. **Rear muffler**
   - Center and rear mufflers are installed as one unit but can be obtained individually when replacing
   - Saw through connecting pipe at separation point to replace mufflers individually
10. **Muffler mount with hanger**
11. **Nut**
    - Tighten to 20 Nm (15 ft-lb)
12. **Tunnel bridge**
13. **Nut**
    - Tighten to 40 Nm (30 ft-lb)
14. **Washer**

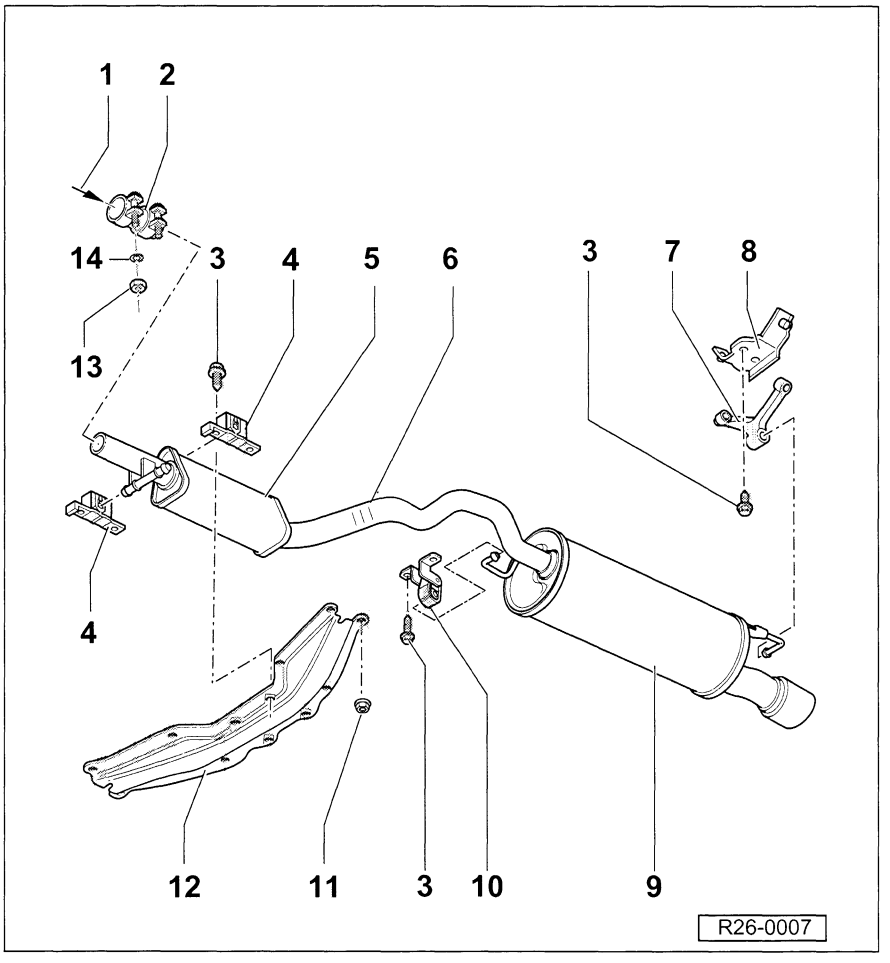
Anti-seize compound, (not shown)

- High temperature
- Volkswagen recommended anti-seize compound for all operations, G 052 112 A3

NOTE —

Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.

Muffler system (1.8L engine, GTI 337)



1. **Exhaust flow**
   - From front exhaust pipe with catalytic converter
2. **Double clamp**
   - Note installed position A, illustration 0024368 shown earlier
3. **Bolt**
   - Tighten to 25 Nm (18 ft-lb)
4. **Mount**
   - Note installed position, illustration A26-0128 shown earlier
5. **Center muffler**
   - Center and rear mufflers are installed as one unit but can be obtained individually when replacing
   - Saw through connecting pipe at separation point to replace mufflers individually
   - Note installed position, align as illustrated in A26-0128, shown earlier
6. **Separation point (cut lines)**
   - Center and rear mufflers are installed as one unit but can be obtained individually when replacing
   - Saw through connecting pipe at separation point to replace mufflers individually
   - Use double clamp, item 2, above, to join pipes
7. **Rear exhaust hanger**
8. **Rear exhaust mount**
9. **Rear muffler**
   - Center and rear mufflers are installed as one unit but can be obtained individually when replacing
   - Saw through connecting pipe at separation point to replace mufflers individually
10. **Muffler mount with hanger**
11. **Nut**
    - Tighten to 20 Nm (15 ft-lb)
12. **Tunnel bridge**
13. **Nut**
    - Tighten to 40 Nm (30 ft-lb)
14. **Washer**

Anti-seize compound, (not shown)

- High temperature
- Volkswagen recommended anti-seize compound for all operations, G 052 112 A3

NOTE —

Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.

EXHAUST SYSTEM (1.9L ENGINE)

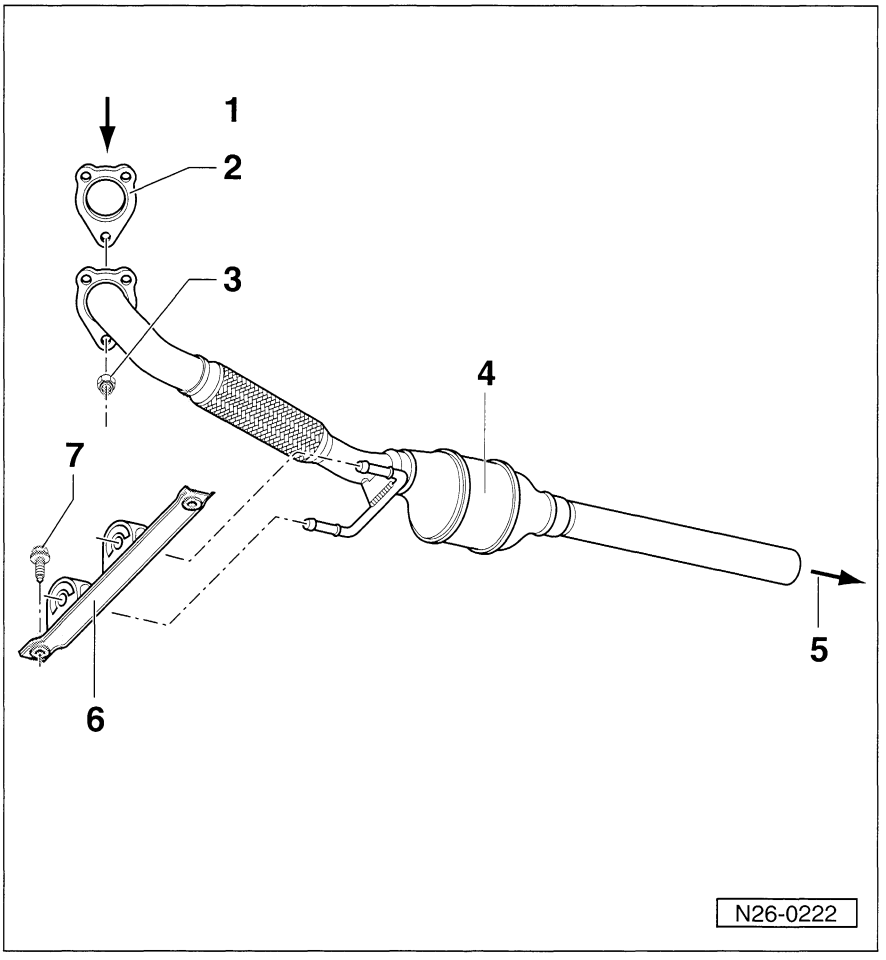
Front exhaust pipe and catalytic converter (1.9L TDI engine)

1. **Exhaust flow**
   - From turbocharger
2. **Gasket**
   - Always replace
3. **Nut**
   - Tighten to 25 Nm (18 ft-lb)
4. **Front exhaust pipe with catalytic converter**
5. **Exhaust flow**
   - Outlet to center muffler
6. **Front support**
7. **Bolt**
   - Tighten to 25 Nm (18 ft-lb)

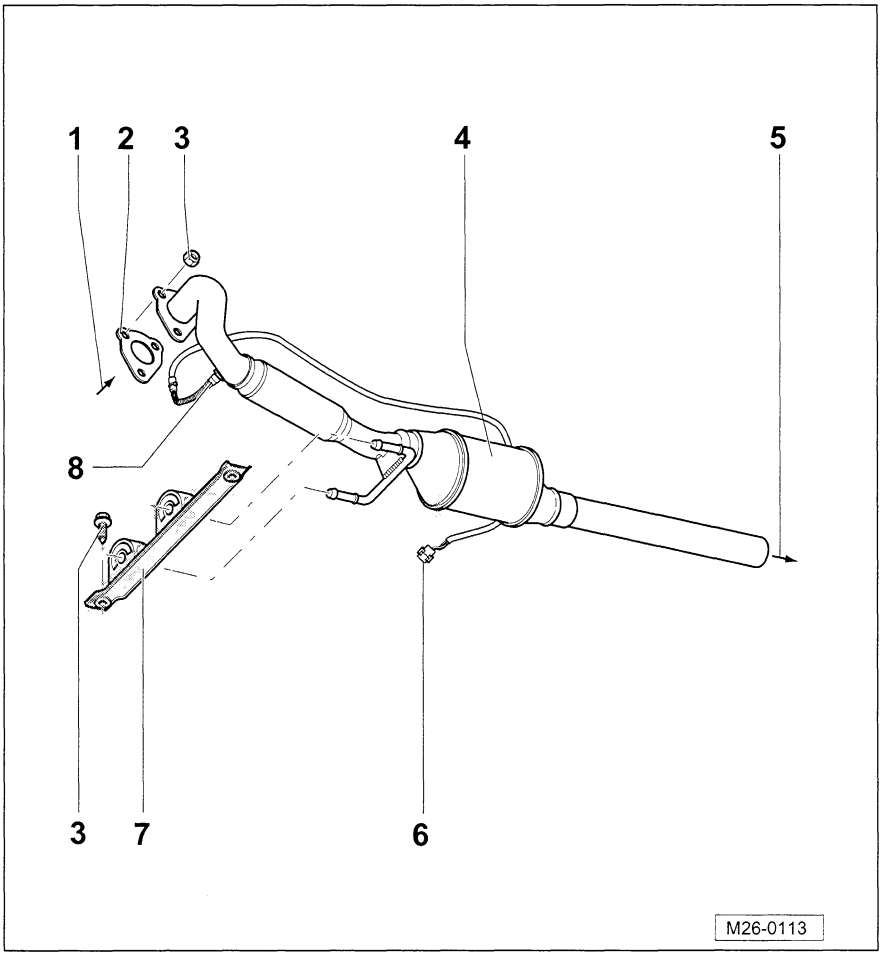
Anti-seize compound, (not shown)
- High temperature
- Volkswagen recommended anti-seize compound for all operations, G 052 112 A3

NOTE —

Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.



Front exhaust pipe and catalytic converter (1.9L PD TDI engine)



1. **Exhaust flow**
   - From turbocharger
2. **Gasket**
   - Always replace
3. **Nut**
   - Tighten to 25 Nm (18 ft-lb)
   - Always replace
4. **Front exhaust pipe with catalytic converter**
5. **Exhaust flow**
   - Outlet to center muffler
6. **Harness connector,4-pin black**
   - Contacts gold plated
7. **Front support**
8. **Heated Oxygen Sensor (HO2S), before (pre) catalytic converter (G39) (B1S1)**
   - Tighten to 50 Nm (37 ft-lb)
   - If seal leaks, cut off and replace
   - Lubricate threads only with high temperature anti-seize
   - Do not allow anti-seize compound into the slots on the sensor body

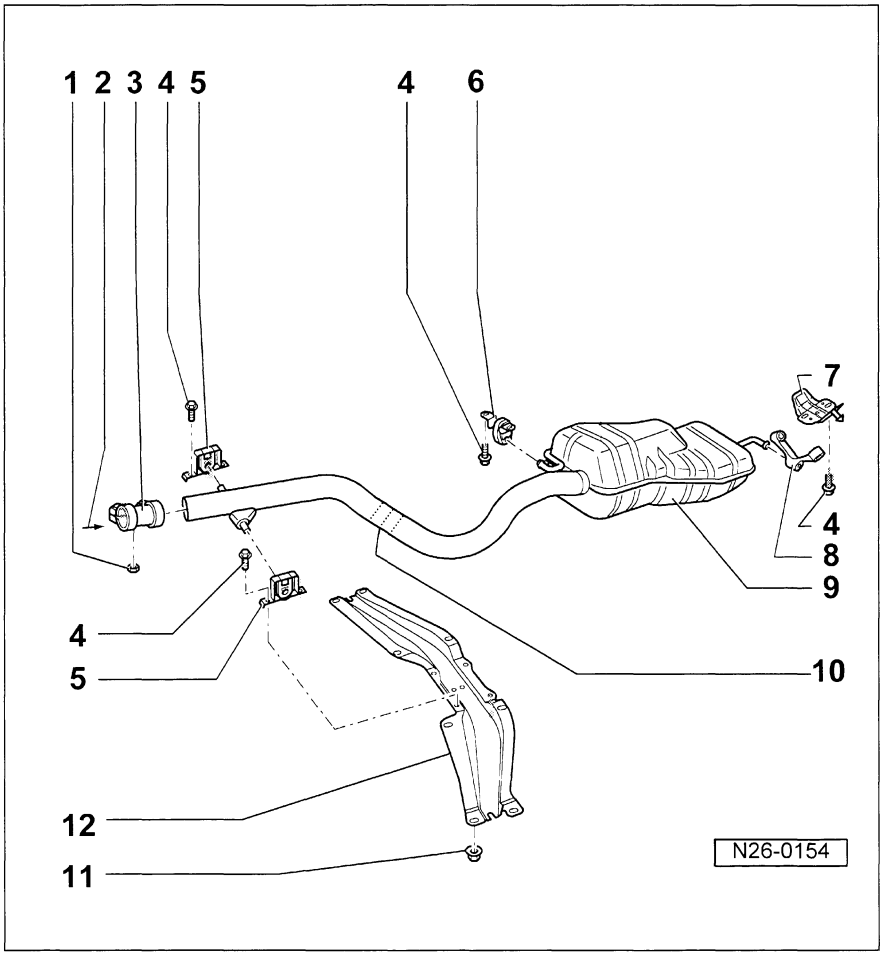
Anti-seize compound, (not shown)

- High temperature
- Volkswagen recommended anti-seize compound for all operations, G 052 112 A3

NOTE —

Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.

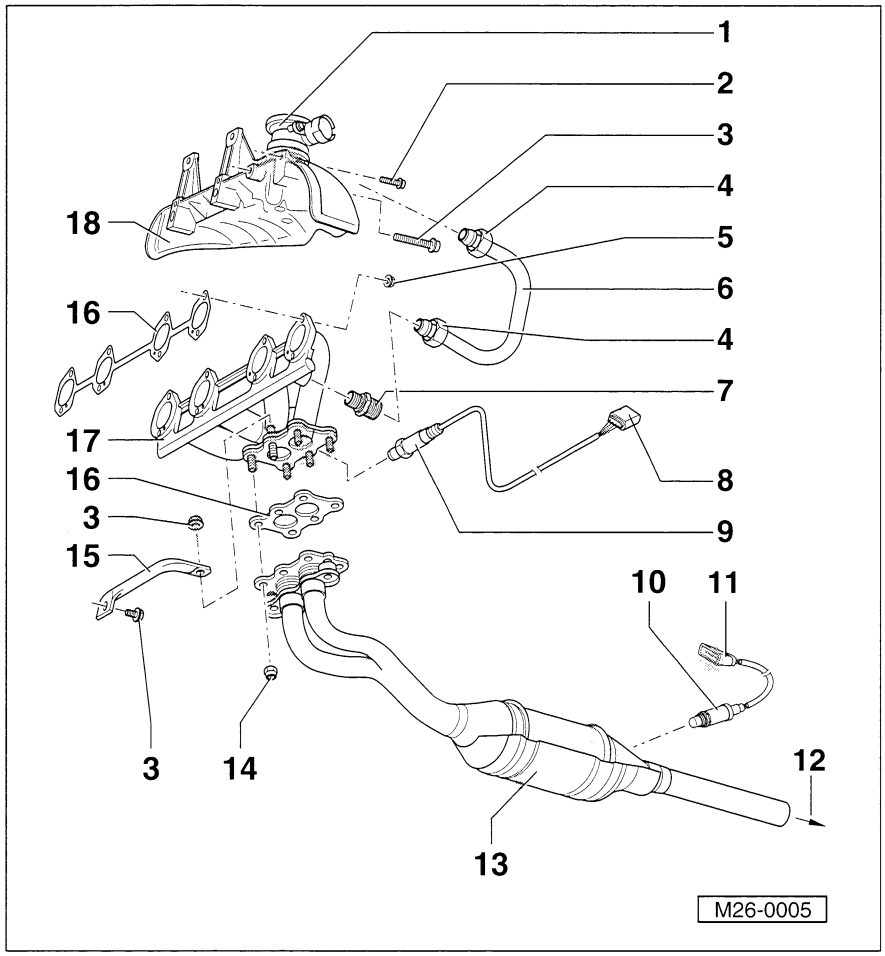
Muffler system (1.9L engine)



1. **Nut**
   - Tighten to 40 Nm (30 ft-lb)
2. **Exhaust flow**
   - From front exhaust pipe with catalytic converter
3. **Double clamp**
   - Note installed position A, illustration 0024368 shown earlier
4. **Bolt**
   - Tighten to 25 Nm (18 ft-lb)
5. **Mount**
6. **Muffler mount with hanger**
7. **Rear exhaust hanger**
8. **Rear exhaust mount**
9. **Rear muffler**
   - Center and rear mufflers are installed as one unit but can be obtained individually when replacing
   - Saw through connecting pipe at separation point to replace mufflers individually
10. **Separation point (cut lines)**
    - Center and rear mufflers are installed as one unit but can be obtained individually when replacing
    - Saw through connecting pipe at separation point to replace mufflers individually
    - Use double clamp, item 3, above, to join pipes
11. **Nut**
    - Tighten to 25 Nm (18 ft-lb)
12. **Tunnel bridge**

EXHAUST SYSTEM (2.0L ENGINE)

Exhaust manifold and catalytic converter (2.0L AEG engine)



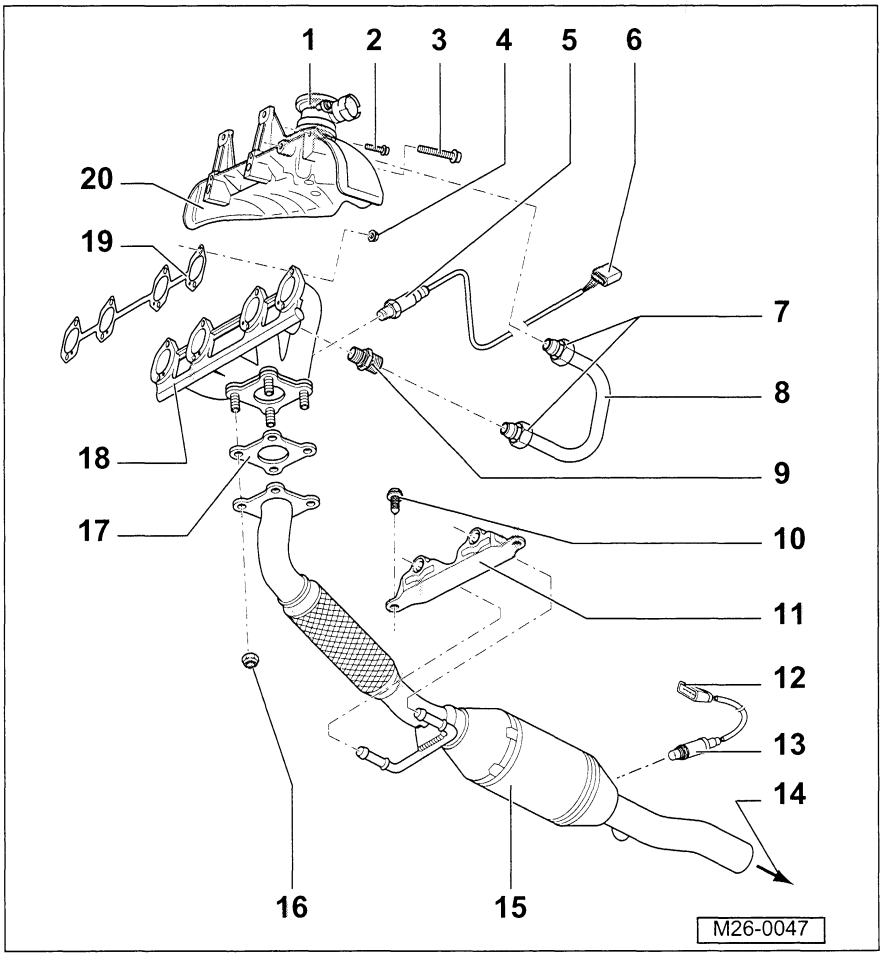
1. **Combi-valve**
2. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
3. **Bolt**
   - Tighten to 25 Nm (18 ft-lb)
4. **Flare nut**
   - Tighten to 30 Nm (22 ft-lb)
5. **Nut**
   - Tighten to 25 Nm (18 ft-lb)
   - Always replace
6. **Connecting pipe**
   - For secondary air injection
7. **Union**
   - Tighten to 35 Nm (26 ft-lb)
8. **Harness connector, 6-pin black**
   - For HO2S (B1S1)
9. **Heated Oxygen Sensor (HO2S), before (pre) catalytic converter (G39) (B1S1)**
   - Tighten to 50 Nm (37 ft-lb)
   - If seal leaks, cut off and replace
   - Lubricate threads only with high temperature anti-seize
   - Do not allow anti-seize compound into the slots on the sensor body
   - See **Oxygen sensor, removing and installing**
10. **Heated Oxygen Sensor (HO2S), after (post) catalytic converter (G130) (B1S2)**
    - Tighten to 50 Nm (37 ft-lb)
    - If seal leaks, cut off and replace
    - Lubricate threads only with high temperature anti-seize
    - Do not allow anti-seize compound into the slots on the sensor body
    - See **Oxygen sensor, removing and installing**
11. **Harness connector, 4-pin brown**
    - For HO2S (B1S2)
12. **Exhaust flow**
    - Outlet to center muffler
13. **Front exhaust pipe with catalytic converter**
14. **Nut**
    - Tighten to 40 Nm (30 ft-lb)
    - Always replace
15. **Exhaust manifold support brace**
16. **Gasket**
    - Always replace
17. **Exhaust manifold**
18. **Warm air collector plate (stove)**

Anti-seize compound, (not shown)
- High temperature
- Volkswagen recommended anti-seize compound for all operations, G 052 112 A3

NOTE —

Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.

Exhaust manifold and catalytic converter (2.0L AVH, AZG engine)



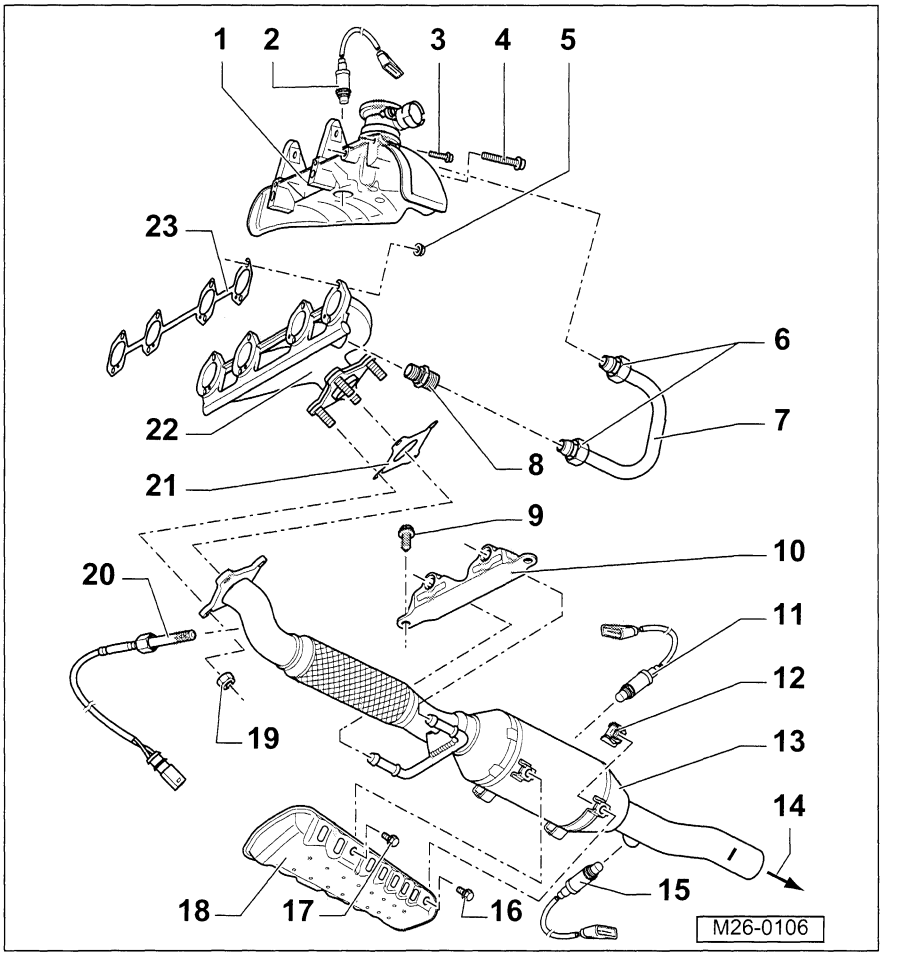
1. **Combi-valve**
2. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
3. **Bolt**
   - Tighten to 25 Nm (18 ft-lb)
4. **Nut**
   - Tighten to 30 Nm (22 ft-lb)
   - Always replace
5. **Heated Oxygen Sensor (HO2S), before (pre) catalytic converter (G39) (B1S1)**
   - Tighten to 50 Nm (37 ft-lb)
   - If seal leaks, cut off and replace
   - Lubricate threads only with high temperature anti-seize
   - Do not allow anti-seize compound into the slots on the sensor body
   - See **Oxygen sensor, removing and installing**
6. **Harness connector, 6-pin black**
   - For HO2S (B1S1)
7. **Flare nut**
   - Tighten to 30 Nm (22 ft-lb)
8. **Connecting pipe**
   - For secondary air injection
9. **Union**
   - Tighten to 35 Nm (26 ft-lb)
10. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
11. **Front support**
12. **Harness connector, 4-pin brown**
    - For HO2S (B1S2)
13. **Heated Oxygen Sensor (HO2S), after (post) catalytic converter (G130) (B1S2)**
    - Tighten to 50 Nm (37 ft-lb)
    - If seal leaks, cut off and replace
    - Lubricate threads only with high temperature anti-seize
    - Do not allow anti-seize compound into the slots on the sensor body
    - See **Oxygen sensor, removing and installing**
14. **Exhaust flow**
    - Outlet to center muffler
15. **Front exhaust pipe with catalytic converter**
16. **Nut**
    - Tighten to 40 Nm (30 ft-lb)
    - Always replace
17. **Gasket**
    - Always replace
18. **Exhaust manifold**
19. **Gasket**
    - Always replace
20. **Warm air collector plate (stove)**

Anti-seize compound, (not shown)
- High temperature
- Volkswagen recommended anti-seize compound for all operations, G 052 112 A3

NOTE —

Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.

Exhaust manifold and catalytic converter (2.0L BBW engine)



1. **Warm air collector plate (stove)**

2. **Heated Oxygen Sensor (HO2S), before (pre) catalytic converter (G39) (B1S1)**
   - Tighten to 50 Nm (37 ft-lb)
   - If seal leaks, cut off and replace
   - Lubricate threads only with high temperature anti-seize
   - Do not allow anti-seize compound into the slots on the sensor body
   - See **Oxygen sensor, removing and installing**
   - See **Harness connectors, installed position and identification (2.0L BBW engine)**

3. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)

4. **Bolt**
   - Tighten to 25 Nm (18 ft-lb)

5. **Nut**
   - Tighten to 25 Nm (18 ft-lb
   - Always replace

6. **Flare nut**
   - Tighten to 40 Nm (30 ft-lb)

7. **Connecting pipe**
   - For secondary air injection

8. **Union**
   - Tighten to 60 Nm (44 ft-lb)

9. **Bolt**
   - Tighten to 25 Nm (18 ft-lb)

10. **Front support**

11. **Oxygen Sensor (O2S), center catalytic converter (G465) (B1S3)**
    - Tighten to 50 Nm (37 ft-lb)
    - If seal leaks, cut off and replace
    - Lubricate threads only with high temperature anti-seize
    - Do not allow anti-seize compound into the slots on the sensor body
    - See **Oxygen sensor, removing and installing**
    - See **Harness connectors, installed position and identification (2.0L BBW engine)**

12. **Speed nut**
    - Slide on from front

13. **Front exhaust pipe with catalytic converter**
    - With anti-vibration element

14. **Exhaust flow**
    - Outlet to center muffler

15. **Heated Oxygen Sensor (HO2S), after (post) catalytic converter (G130) (B1S2)**
    - Tighten to 50 Nm (37 ft-lb)
    - If seal leaks, cut off and replace
    - Lubricate threads only with high temperature anti-seize
    - Do not allow anti-seize compound into the slots on the sensor body
    - See **Oxygen sensor, removing and installing**
    - See **Harness connectors, installed position and identification (2.0L BBW engine)**

16. **Bolt**
    - Tighten to 5 Nm (44 in-lb)

17. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)

18. **Heat shield**
    - Ensure all fasteners are tight

19. **Nut**
    - Tighten to 25 Nm (18 ft-lb)
    - Always replace

20. **Exhaust Gas Temperature (EGT) sensor 1 (G235)**
    - Tighten to 45 Nm (33 ft-lb)

21. **Gasket**
    - Always replace

22. **Exhaust manifold**

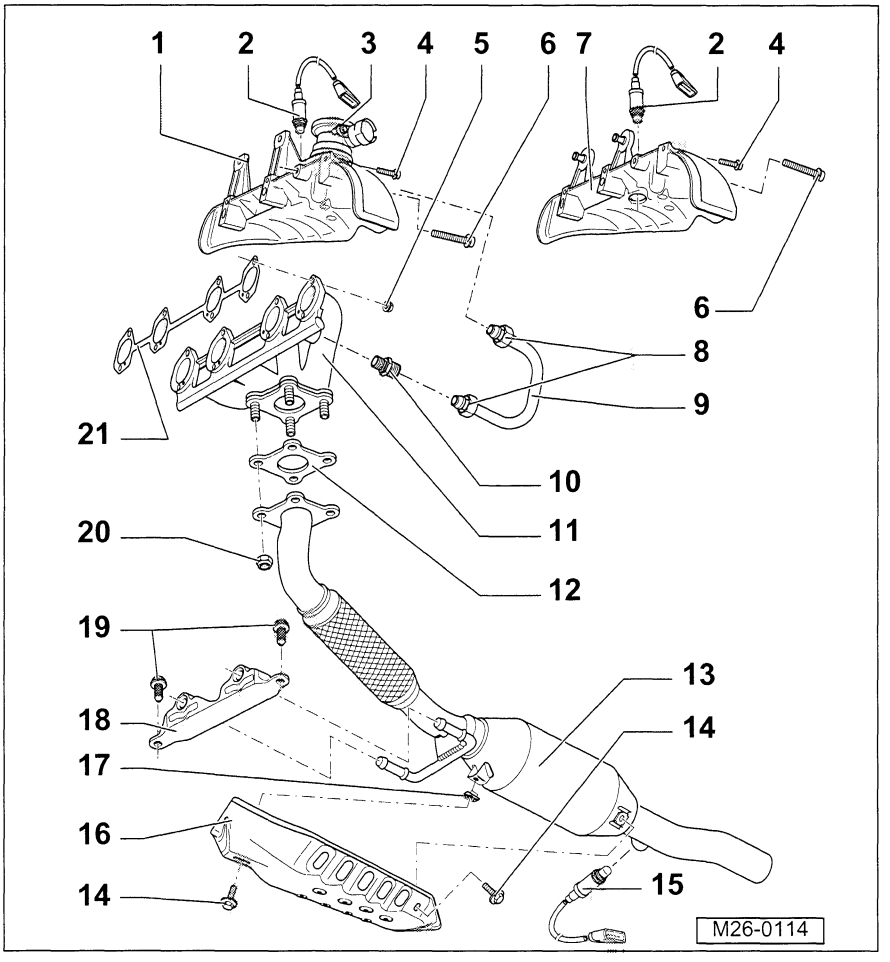
23. **Gasket**
    - Always replace

Anti-seize compound, (not shown)
- High temperature
- Volkswagen recommended anti-seize compound for all operations, G 052 112 A3

NOTE —

Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.

Exhaust manifold and catalytic converter (2.0L BEV engine)



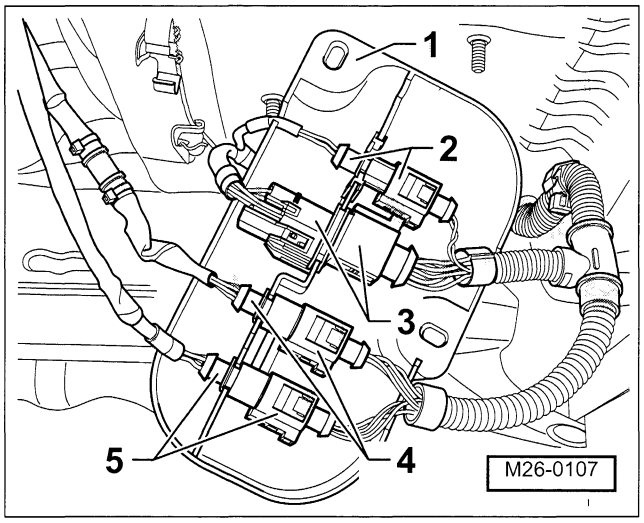
1. **Warm air collector plate (stove)**
2. **Heated Oxygen Sensor (HO2S), before (pre) catalytic converter (G39) (B1S1)**
   - Tighten to 50 Nm (37 ft-lb)
   - If seal leaks, cut off and replace
   - Lubricate threads only with high temperature anti-seize
   - Do not allow anti-seize compound into the slots on the sensor body
   - See **Oxygen sensor, removing and installing**
   - See **Harness connectors, installed position and identification (2.0L BEV engine)**
3. **Combi-valve**
4. **Bolt**
   - Tighten to 25 Nm (18 ft-lb)
5. **Nut**
   - Tighten to 25 Nm (18 ft-lb
   - Always replace
6. **Bolt**
   - Tighten to 30 Nm (22 ft-lb)
7. **Warm air collector plate (stove)**
   - Not for USA/Canada versions
8. **Flare nut**
   - Tighten to 30 Nm (22 ft-lb)
9. **Connecting pipe**
   - For secondary air injection
10. **Union**
    - Tighten to 35 Nm (26 ft-lb)
11. **Exhaust manifold**
12. **Gasket**
    - Always replace
13. **Front exhaust pipe with catalytic converter**
14. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
15. **Heated Oxygen Sensor (HO2S), after (post) catalytic converter (G130) (B1S2)**
    - Tighten to 50 Nm (37 ft-lb)
    - If seal leaks, cut off and replace
    - Lubricate threads only with high temperature anti-seize
    - Do not allow anti-seize compound into the slots on the sensor body
    - See **Oxygen sensor, removing and installing**
    - See **Harness connectors, installed position and identification (2.0L BEV engine)**
16. **Heat shield**
    - Ensure all fasteners are tight
17. **Speed nut**
18. **Front support**
19. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
20. **Nut**
    - Tighten to 40 Nm (30 ft-lb)
    - Always replace
21. **Gasket**
    - Always replace

Anti-seize compound, (not shown)

- High temperature
- Volkswagen recommended anti-seize compound for all operations, G 052 112 A3

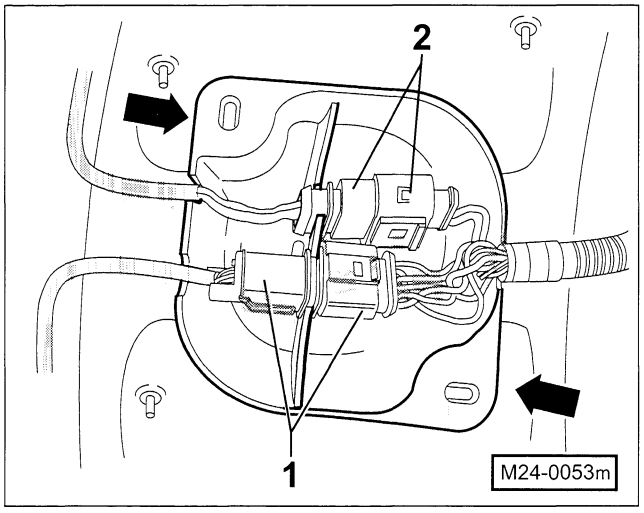
NOTE —

Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.



Harness connectors, installed position and identification (2.0L BBW engine)

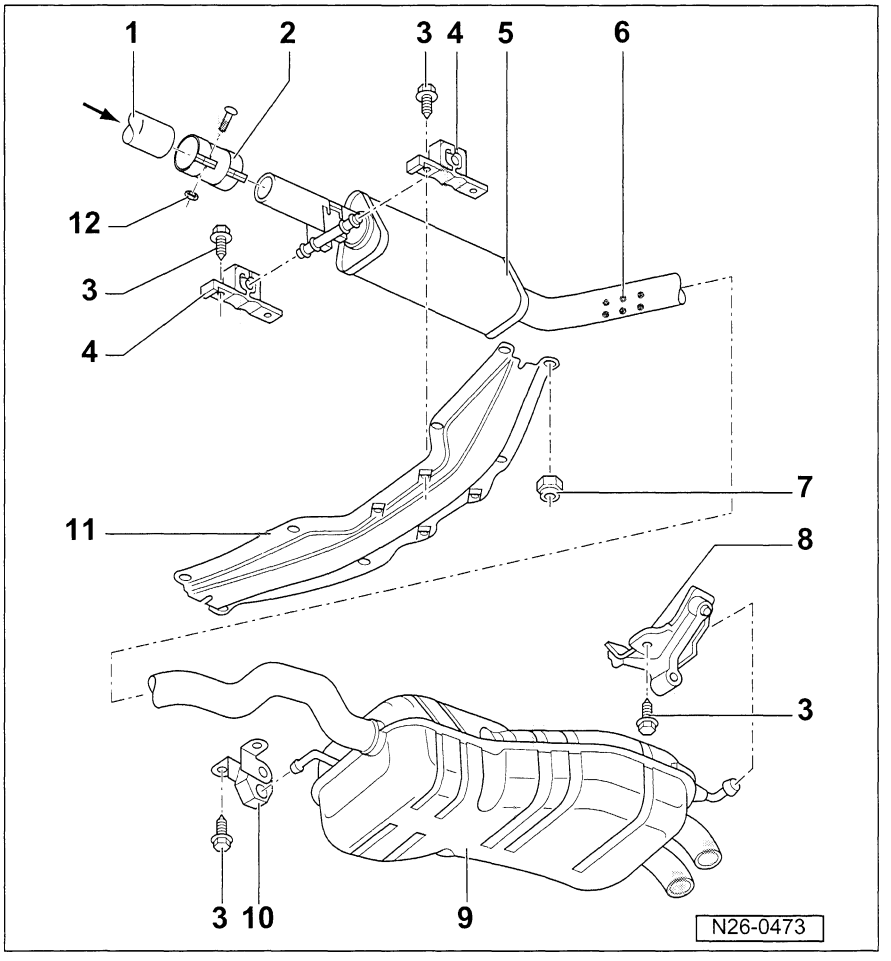
1. Protective housing, right side under vehicle
2. EGT sensor 1 (G235)
3. HO2S (B1S1) (G39)
4. O2S (B1S3) (G465)
5. HO2S (B1S2) (G130)



Harness connectors, installed position and identification (2.0L BEV engine)

Protective housing, right side under vehicle (arrows)
1. HO2S (B1S1) (G39)
2. HO2S (B1S2) (G130)

Muffler system (2.0L engine)



1. **Exhaust flow**
   - From front exhaust pipe with catalytic converter
2. **Double clamp**
   - Note installed position A, illustration 0024368 shown earlier
3. **Bolt**
   - Tighten to 25 Nm (18 ft-lb)
4. **Mount**
   - Note installed position, illustration A26-0128 shown earlier
5. **Center muffler**
   - Center and rear mufflers are installed as one unit but can be obtained individually when replacing
   - Saw through connecting pipe at separation point to replace mufflers individually
   - Note installed position, align as illustrated in A26-0128, shown earlier
6. **Separation point (cut lines)**
   - Center and rear mufflers are installed as one unit but can be obtained individually when replacing
   - Saw through connecting pipe at separation point to replace mufflers individually
   - Use double clamp, item 2, above, to join pipes
7. **Nut**
   - Tighten to 20 Nm (15 ft-lb)
8. **Rear exhaust mount and hanger**
9. **Rear muffler**
   - Center and rear mufflers are installed as one unit but can be obtained individually when replacing
   - Saw through connecting pipe at separation point to replace mufflers individually
10. **Muffler mount with hanger**
11. **Tunnel bridge**
12. **Nut**
    - Tighten to 40 Nm (30 ft-lb)
13.
14. **Nut**
    - Tighten to 20 Nm (15 ft-lb)

Anti-seize compound, (not shown)

- High temperature
- Volkswagen recommended anti-seize compound for all operations, G 052 112 A3

NOTE —

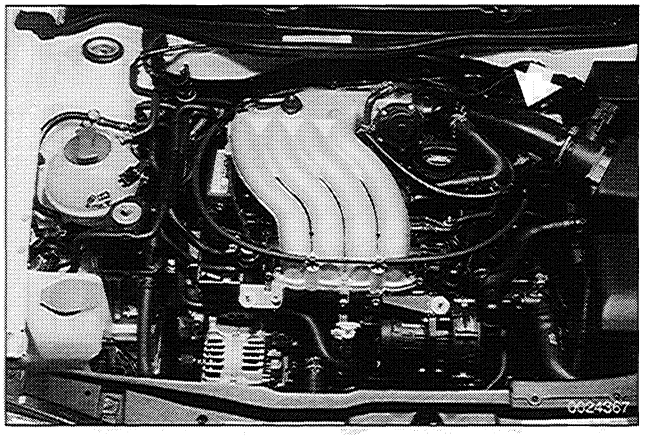
Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.

Exhaust manifold, removing (2.0L engine)

NOTE —
For removal of the exhaust manifold on the turbocharged 1.9L and 1.8L engines, see **21 Turbocharger and Intercooler**.

– Remove engine cover.

– Remove intake manifold upper section.



◀ Remove intake air hose (**arrow**).

– Remove pressure and vacuum hoses from secondary air injection valve (combi-valve) where equipped. See **Secondary air injection system, components**, given later.

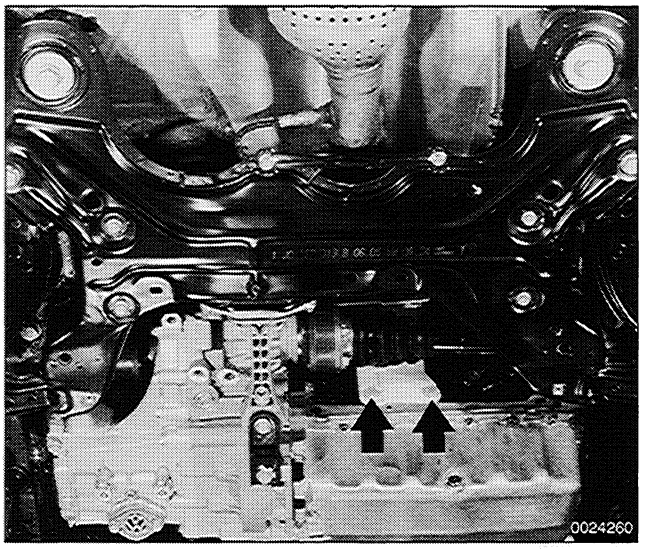
NOTE —
The combi-valve is located behind the upper intake manifold.

– Remove connecting pipe between combi-valve and exhaust manifold. See **Exhaust manifold and catalyst** given earlier.

– Remove warm air collector plate. See **Exhaust manifold and catalyst** given earlier.

– Remove lower center sound absorber panels under vehicle.

– Disconnect pre-cat oxygen sensor harness connector if HO2S is installed in exhaust manifold.



◀ Remove right side inner CV joint heat shield (**arrow**) as applicable.

– Remove nuts securing front exhaust pipe to exhaust manifold. **Exhaust manifold and catalyst** given earlier.

– Unbolt exhaust manifold support brace from engine block.

– Remove exhaust manifold bolts and manifold with support brace still attached.

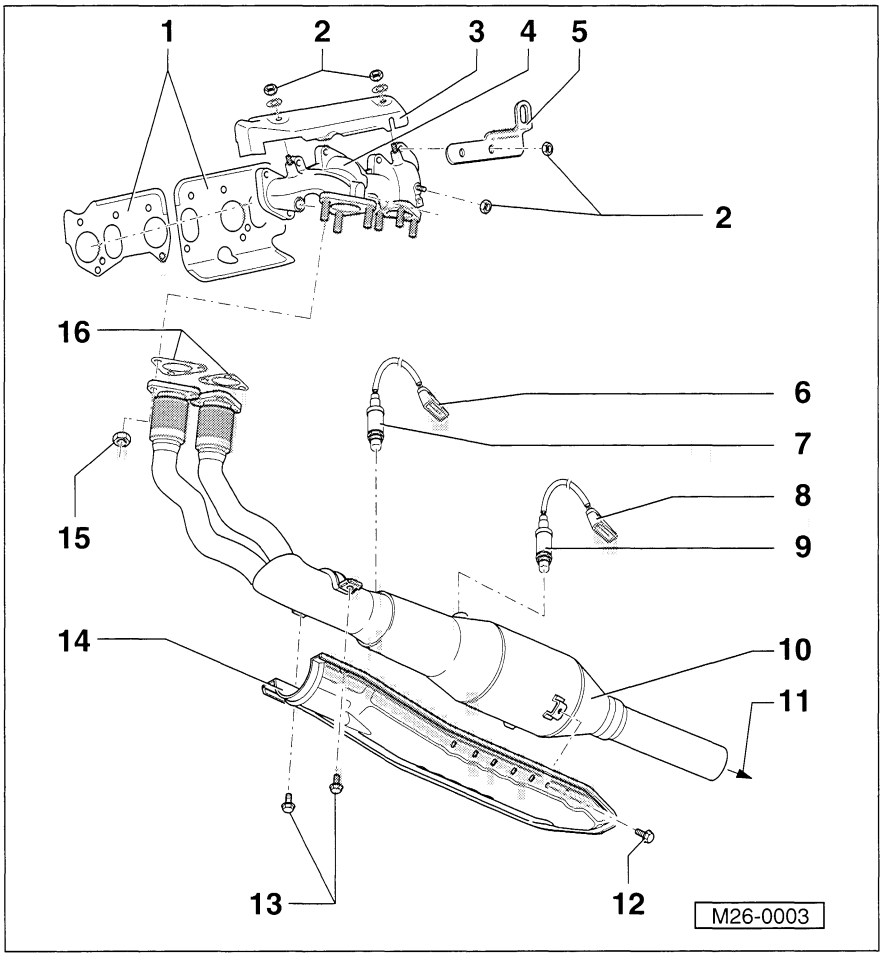
– Installation is the reverse of the removal noting the following:

- Replace all gaskets and self-locking nuts/bolts.
- **Exhaust manifold and catalyst** given earlier for tightening torques.
- Use high-temp anti-seize compound on threaded fasteners to extend their service life and make future replacement easier.

– Be sure to quality check your work, see **Quality Review** at the end of this repair group.

EXHAUST SYSTEM (2.8L ENGINE)

Exhaust manifold and catalyst (2.8L AFP engine)



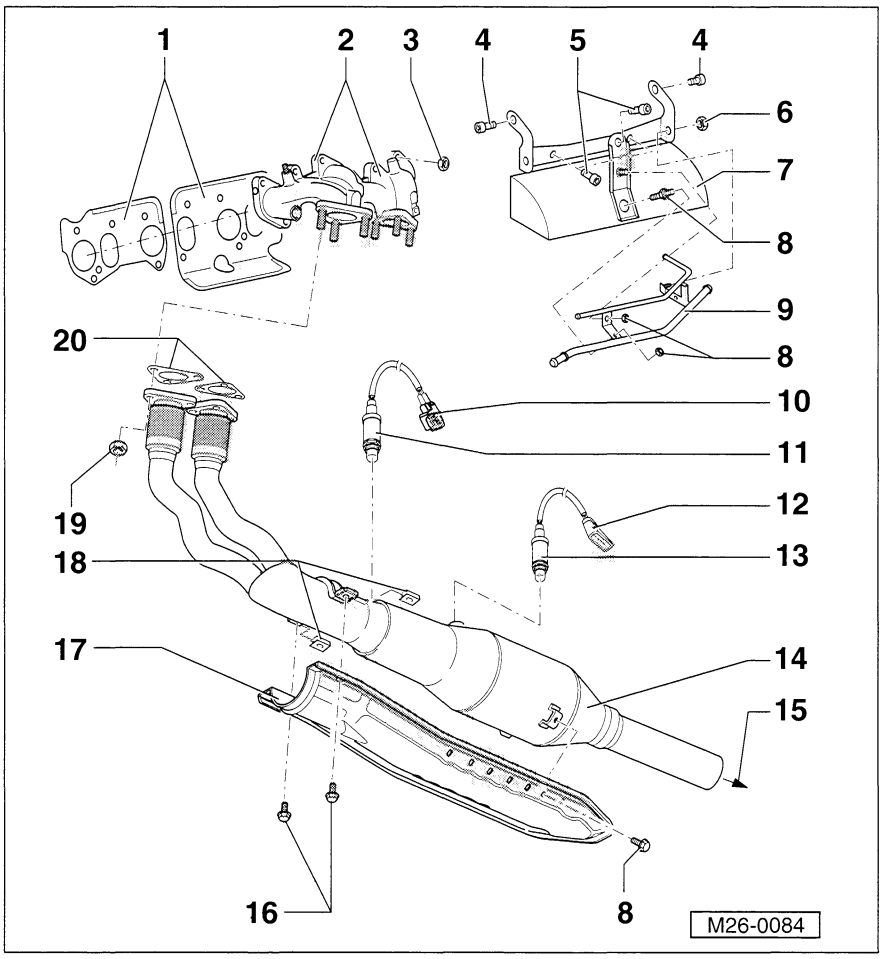
1. **Gasket**
   - Always replace
   - Two-piece
2. **Nut**
   - Tighten to 25 Nm (18 ft-lb)
   - Always replace manifold securing nuts
3. **Heat shield**
4. **Exhaust manifolds**
   - Two-piece
5. **Bracket**
   - For lifting engine and/or cylinder during repairs
6. **Harness connector, 6-pin black**
   - For HO2S (B1S1)
7. **Heated Oxygen Sensor (HO2S), before (pre) catalytic converter (G39) (B1S1)**
   - Tighten to 50 Nm (37 ft-lb)
   - If seal leaks, cut off and replace
   - Lubricate threads only with high temperature anti-seize
   - Do not allow anti-seize compound into the slots on the sensor body
   - See **Oxygen sensor, removing and installing**
8. **Harness connector, 4-pin black**
   - For HO2S (B1S2)
9. **Heated Oxygen Sensor (HO2S), after (post) catalytic converter (G130) (B1S2)**
   - Tighten to 50 Nm (37 ft-lb)
   - If seal leaks, cut off and replace
   - Lubricate threads only with high temperature anti-seize
   - Do not allow anti-seize compound into the slots on the sensor body
   - See **Oxygen sensor, removing and installing**
10. **Front exhaust pipe with catalytic converter**
11. **Exhaust flow**
    - Outlet to center muffler
12. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
13. **Bolt**
    - Tighten to 15 Nm (10 ft-lb)
14. **Heat shield**
15. **Nut**
    - Tighten to 40 Nm (30 ft-lb)
16. **Gasket for front exhaust pipe**
    - Always replace

Anti-seize compound, (not shown)
- High temperature
- Volkswagen recommended anti-seize compound for all operations, G 052 112 A3

NOTE —

Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.

Exhaust manifold and catalyst (2.8L BDF engine)



1. **Gasket**
   - Always replace
   - Two-piece
2. **Exhaust manifolds**
   - Two-piece
3. **Nut**
   - Tighten to 25 Nm (18 ft-lb)
   - Always replace
4. **Bolt**
   - Tighten to 23 Nm (17 ft-lb)
5. **Bolt**
   - Tighten to 13 Nm (10 ft-lb)
6. **Nut**
   - Tighten to 25 Nm (18 ft-lb)
7. **Heat shield**
8. **Stud**
   - Tighten to 10 Nm (7 ft-lb)
9. **Coolant pipe**
   - Secured to exhaust manifold and heat shield
10. **Harness connector, 6-pin black**
    - For HO2S (B1S1)
11. **Heated Oxygen Sensor (HO2S), before (pre) catalytic converter (G39) (B1S1)**
    - Tighten to 50 Nm (37 ft-lb)
    - If seal leaks, cut off and replace
    - Lubricate threads only with high temperature anti-seize
    - Do not allow anti-seize compound into the slots on the sensor body
    - See **Oxygen sensor, removing and installing**
12. **Harness connector, 4-pin black**
    - For HO2S (B1S2)
13. **Heated Oxygen Sensor (HO2S), after (post) catalytic converter (G130) (B1S2)**
    - Tighten to 50 Nm (37 ft-lb)
    - If seal leaks, cut off and replace
    - Lubricate threads only with high temperature anti-seize
    - Do not allow anti-seize compound into the slots on the sensor body
    - See **Oxygen sensor, removing and installing**
14. **Front exhaust pipe with catalytic converter**
15. **Exhaust flow**
    - Outlet to center muffler
16. **Bolt**
    - Tighten to 5 Nm
17. **Heat shield**
18. **Speed nut**
    - Slide on from rear
    - Always replace
19. **Nut**
    - Tighten to 40 Nm (30 ft-lb)
    - Always replace
20. **Gaskets**
    - Always replace
    - Two-piece

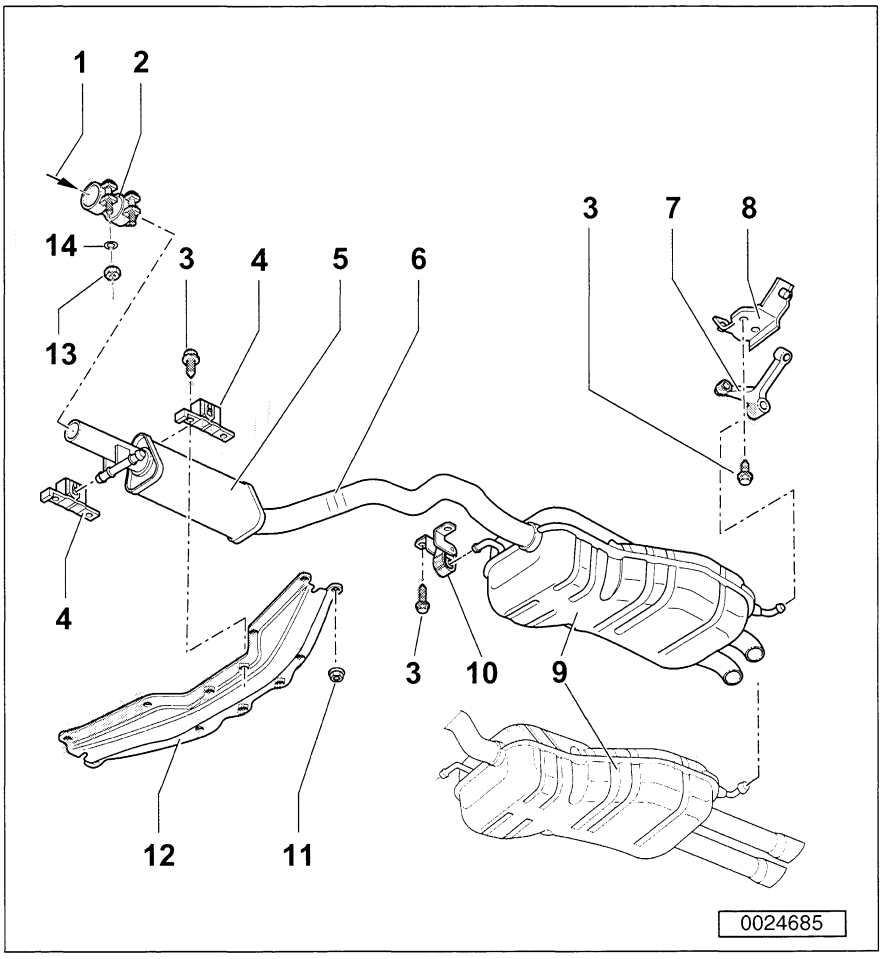
Anti-seize compound, (not shown)
- High temperature
- Volkswagen recommended anti-seize compound for all operations, G 052 112 A3

NOTE —

Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.

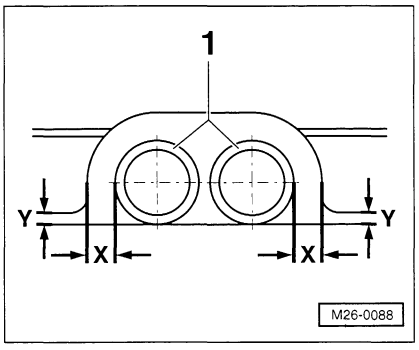
Muffler system (2.8L engine)

1. **Exhaust flow**
   - From front exhaust pipe with catalytic converter
2. **Double clamp**
   - Note installed position A, illustration 0024368 shown earlier
3. **Bolt**
   - M8, tighten to 25 Nm (18 ft-lb)
   - M10, tighten to 40 Nm (30 ft-lb)
4. **Mount**
   - Note installed position, illustration A26-0128 shown earlier
5. **Center muffler**
   - Center and rear mufflers are installed as one unit but can be obtained individually when replacing
   - Saw through connecting pipe at separation point to replace mufflers individually
   - Note installed position, align as illustrated in A26-0128, shown earlier
6. **Separation point (cut lines)**
   - Center and rear mufflers are installed as one unit but can be obtained individually when replacing
   - Saw through connecting pipe at separation point to replace mufflers individually
   - Use double clamp, item 2, above, to join pipes
7. **Rear exhaust hanger**
8. **Rear exhaust mount**
9. **Rear muffler**
   - Center and rear mufflers are installed as one unit but can be obtained individually when replacing
   - Saw through connecting pipe at separation point to replace mufflers individually
   - AFP tailpipes curve downwards behind rear valence
   - BDP tailpipes exit straight out through rear valence. See **Installation position of rear muffler end pipes (2.8L BDF engine)**
10. **Muffler mount with hanger**
11. **Nut**
    - Tighten to 20 Nm (15 ft-lb)



12. **Tunnel bridge**
13. **Nut**
    - Tighten to 40 Nm (30 ft-lb)
14. **Washer**

Anti-seize compound, (not shown)
- High temperature
- Volkswagen recommended anti-seize compound for all operations, G 052 112 A3



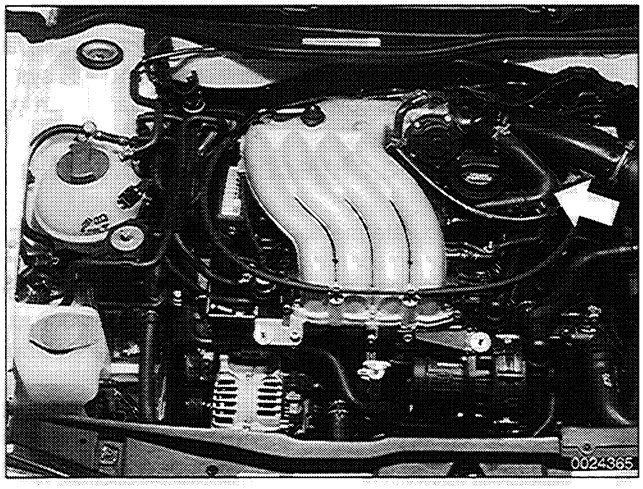
NOTE —
Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.

Installation position of rear muffler end pipes (2.8L BDF engine)
- Align rear muffler so that dimension to body (**X**) and (**Y**) for end pipes (**1**) is equal on left and right-hand sides.

EMISSION CONTROLS (GASOLINE ENGINES)

Positive Crankcase Ventilation (PCV)

The PCV system traps crankcase vapors and routes them back into the intake air stream to be burned.



The PCV system consists simply of a breather hose (**arrow**) between the valve cover and the intake air boot. On the 2.0L and 2.8L engines the valve cover contains a flame trap to prevent ignition of the crankcase vapors in the event of a backfire. To prevent icing during cold weather, a heating element is integrated into the breather hose.

On the 1.8L turbocharged engine the PCV breather hose has a pressure regulating valve at the intake air boot that prevents turbocharger boost from pressurizing the crankcase.

> ***WARNING —***
> *Replace PCV hoses only with parts designed for PCV or fuel system service. Conventional vacuum and heater hoses deteriorate rapidly when exposed to oil vapors and combustion gasses.*

Most crankcase ventilation problems result when the hoses or valves become clogged with oily residues. Restrictions create excessive crankcase pressure that can eventually cause driveability problems. PCV system service is limited to inspecting and cleaning the breather valves, hoses, and replacing faulty parts.

Secondary Air Injection System

The Secondary Air Injection (AIR) system on the 1.8L, 2.0L and 2.8L gasoline engines uses an electrically driven air pump to inject fresh air behind the exhaust valves.

Specification

- Secondary Air Injection operation
  approximate temperature and time on initial start-up
  1.8L . . . . . 5–33°C (41–91°F), 100 seconds
  2.0L . . . . . 15–35°C (59–95°F), 100 seconds
  2.8L . . . . . 15–35°C (59–95°F), 65 seconds

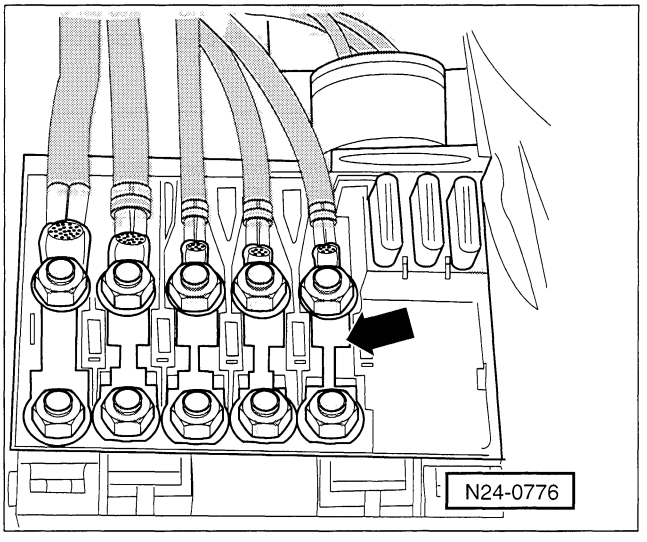
Also, after each subsequent engine start, depending on the system, and up to a coolant temperature of 85° or 96°C (185° or 205°F), the secondary air injection system will, switch in for 5 seconds during idle as a test after a 10 or 20 second delay.

The purpose of the AIR system is to reduce exhaust emissions during engine warm-up when the Motronic engine management system is in open loop. The AIR system produces an oxygen rich exhaust gas, causes afterburning and reduces the duration of the catalyst heat-up phase. Activation initiates from the Motronic ECM via the secondary air injection pump relay to the secondary air injection solenoid valve and combi-valve.

The system consists of the air pump, the vacuum-operated shut-off valve (combi-valve), the inlet (solenoid) valve, and the related duct work. Exploded views of the AIR system for various engines covered by this manual are given later.

Secondary air injection pump, testing

The most accurate method for testing the AIR system is with Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program using the output diagnostic test mode function. However, a quick test can be performed as follows.



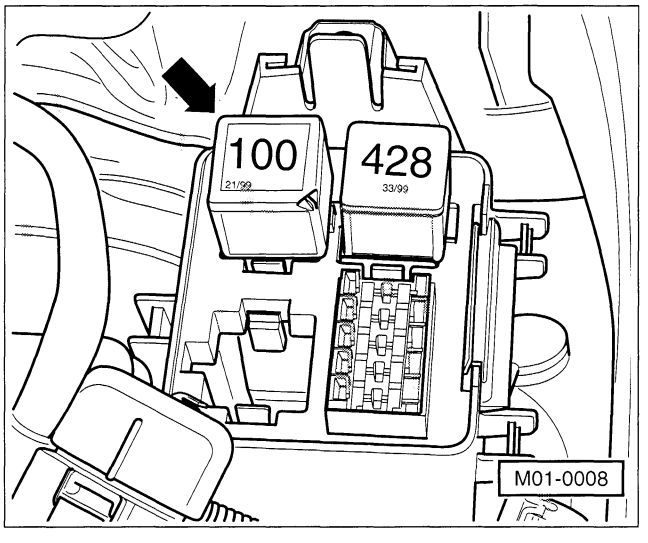
– Disconnect the pressure hose from the outlet on the rear of the secondary air injection (AIR) pump. See the appropriate component view of the secondary air system for pressure hose identification.

➤ With the engine fully warm, start and allow the engine to idle. Approximately 20 seconds after starting, the air pump should run for about five seconds and secondary air should be felt coming from the pump outlet.

- If the air pump does not run, check the fuse (**arrow**) on top of the battery.
- If fuse is OK check the secondary air injection pump relay (J299) using the wiring diagrams in **97 Wiring Diagrams, Fuses and Relays.**

– If the pump does not run and no wiring faults can be found, check the signal from the ECM to the pump. Disconnect the harness connector from the pump and connect a voltmeter to the connector. Start the engine while checking for voltage 20 seconds after starting.

- If voltage is present, the pump is most likely faulty and should be replaced.
- If voltage is not present, check the wiring at the AIR relay and between the ECM and the AIR relay. If no faults are found, the relay or ECM may be faulty.



Secondary air injection pump, relay

➤ Secondary air injection pump relay (**arrow**) is located in the housing for relays located at left rear of engine compartment.

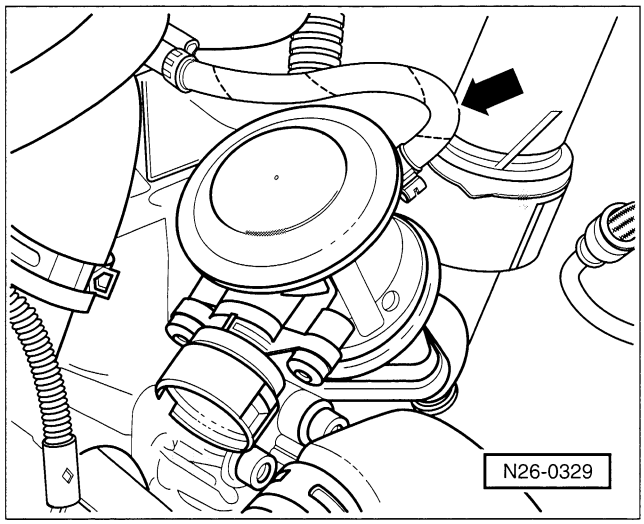
- If tools are necessary to pull relays or control modules, first disconnect battery (-) ground.
- Secondary air injection pump relay is marked with control number "100".
- Engine control module power supply relay is marked with control number "428".
- Location of relays may vary depending on model and equipment installed.

Secondary air injection solenoid valve, checking

NOTE —

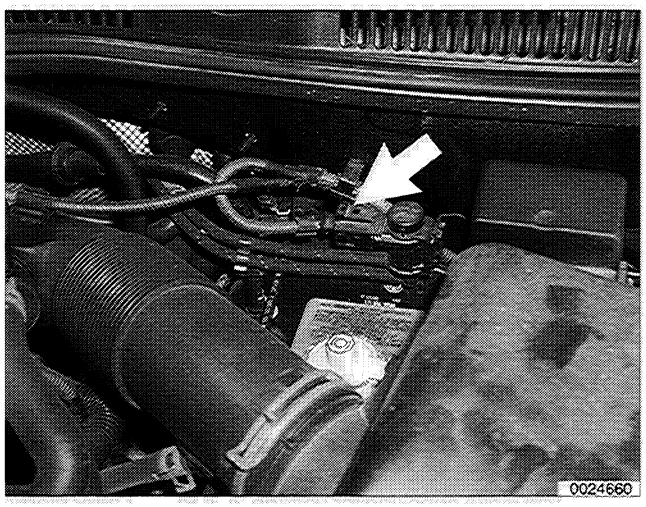
- *Engine oil temperature should be between 5–33°C (41–91°F).*
- *Ensure that secondary air injection pump motor is OK.*

– Disconnect the secondary air injection solenoid valve vacuum hose as shown below:



1.8L engine

- Disconnect vacuum line (**arrow**) at combination valve.

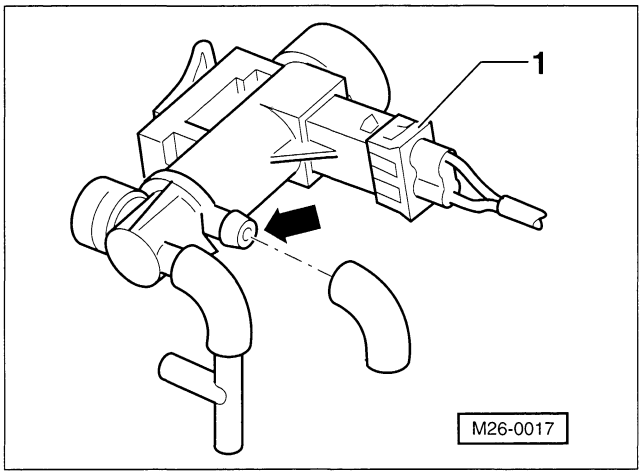


2.0L AEG engine

- Disconnect vacuum line (**arrow**) at secondary air injection solenoid valve.

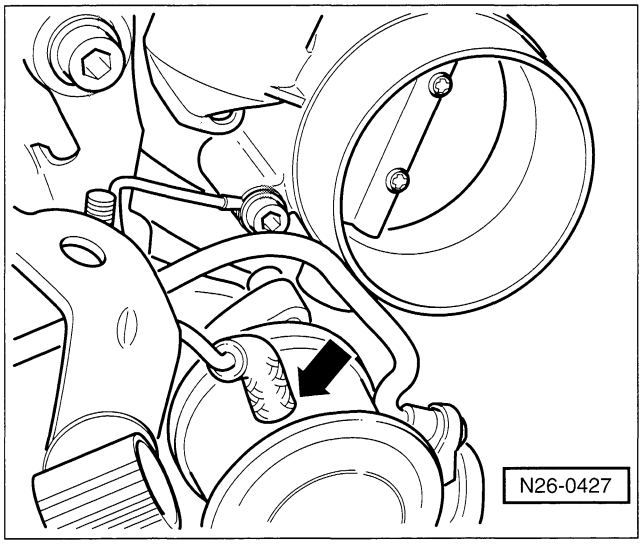
NOTE —

2.0L engines with engine code AVH, AZG do not have a secondary air injection valve.



2.8L AFP engine

– Disconnect vacuum line (**arrow**) at secondary air injection solenoid valve.



2.8L BDF engine

– Disconnect vacuum line (**arrow**) at combination valve.

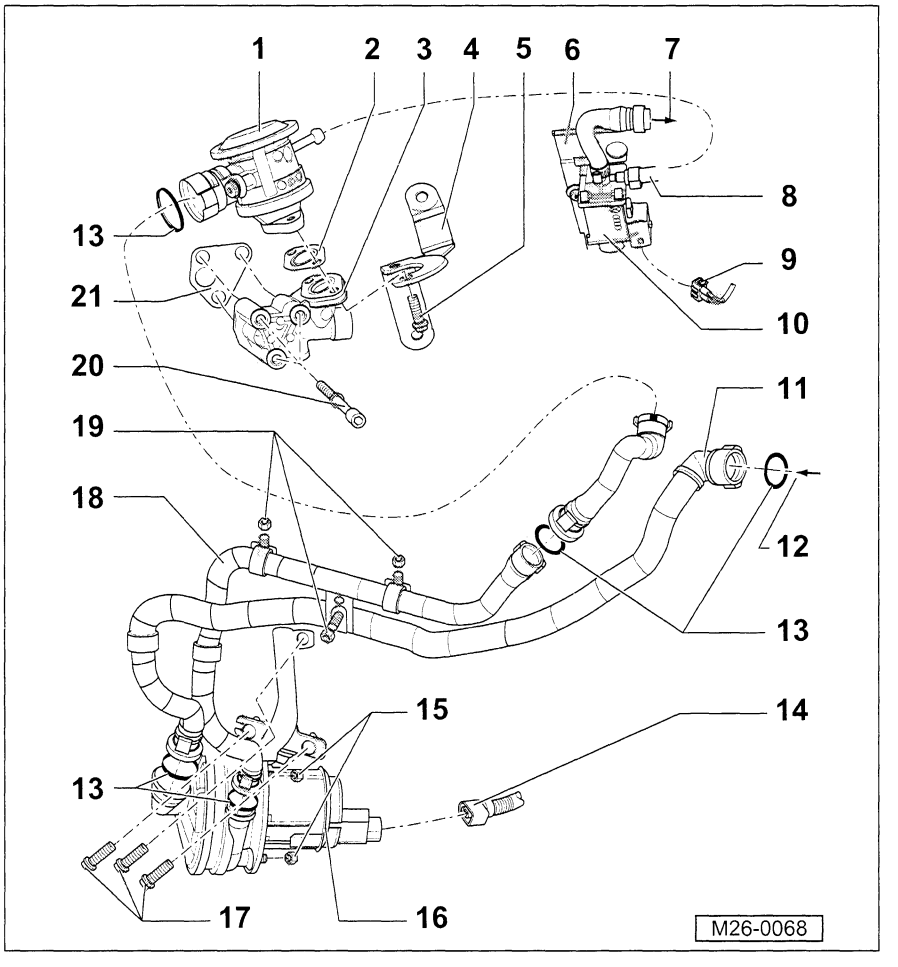
Continued for all engines

– Start the engine while checking for vacuum at the hose 20 seconds after starting. If vacuum is present, the valve is functioning correctly.

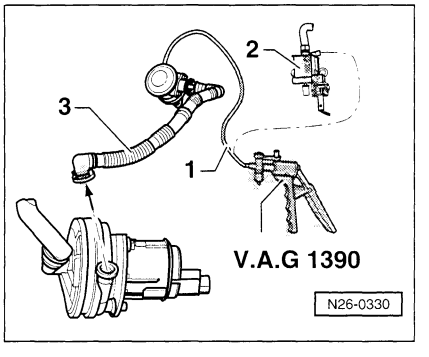
– If vacuum is not present, shut off engine and disconnect the harness connector from the solenoid valve and connect a voltmeter to the harness connector. Start the engine while checking for voltage 20 seconds after starting.

- If voltage is present, the solenoid valve is most likely faulty and should be replaced.
- If voltage is not present, check the wire between solenoid valve and the ECM. If no faults are found, the ECM may be faulty.

Secondary air injection system, components (1.8L engine)



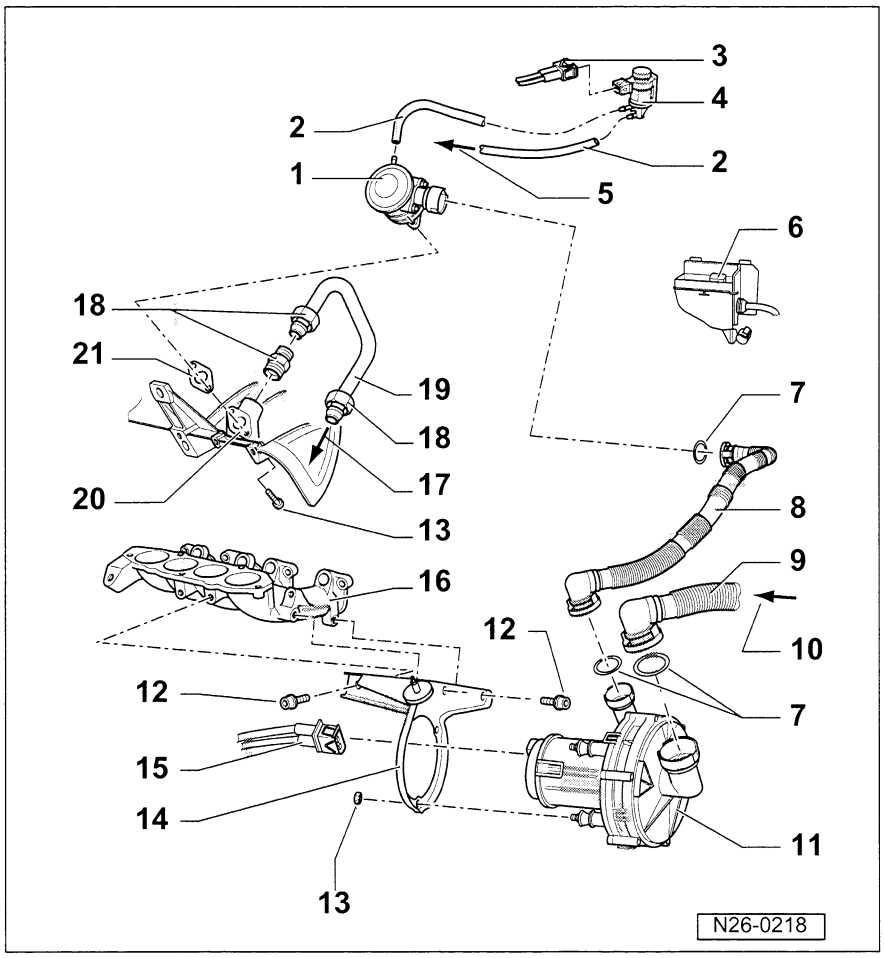
1. **Combi-valve**
   - Checking, see **Combi-valve, checking**
2. **Gasket**
   - Always replace
3. **Fitting flange**
   - Secured at cylinder head
4. **Mounting bracket**
5. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
6. **Mounting bracket**
   - Secured at intake manifold
7. **Flow**
   - To vacuum reservoir
8. **Vacuum hose**
9. **Harness connector, 2-pin**
10. **Secondary Air Injection (AIR) solenoid valve (N112)**
    - Secured to mounting bracket, item **6**
    - Tighten to 6 Nm (53 in-lb)
    - Resistance: 21-24 Ω
11. **Intake hose**
    - For secondary air pump
    - Ensure hose is tightly sealed
    - Press together at front to release
12. **Air flow**
    - AIR Pump intake from air cleaner assembly
13. **O-rings**
    - Always replace
14. **Harness connector, 2-pin**
15. **Nut**
    - Tighten to 10 Nm (7 ft-lb)
16. **Secondary Air Injection (AIR) pump motor (V101)**
17. **Bolts**
    - Tighten to 10 Nm (7 ft-lb)
18. **Pressure hose**
    - 2 sections
    - Ensure hose is tightly sealed
    - Press together at front to release
19. **Nut**
    - Tighten to 10 Nm (7 ft-lb)
    - Secured to mounting bracket, item **6**
20. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
21. **Gasket**
    - Always replace



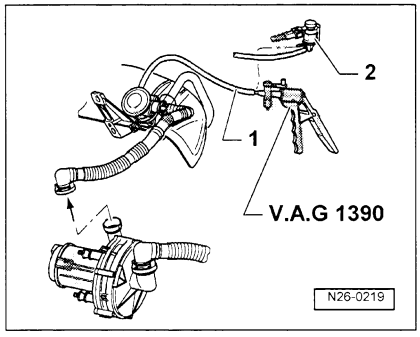
Combi-valve, checking

- Disconnect vacuum hose (**1**) from AIR solenoid valve (**2**)
- Connect hand vacuum pump (i.e. VAG 1390) to vacuum hose (**1**)
- Remove pressure hose (**arrow**) from pump motor
- Blow into pressure hose with slight pressure
  Do not use compressed air!
- Both valves must be closed
- Operate hand vacuum pump
- Combi valve should open, replace valve if it doesn't open

Secondary air injection system, components (2.0L AEG engine, early)



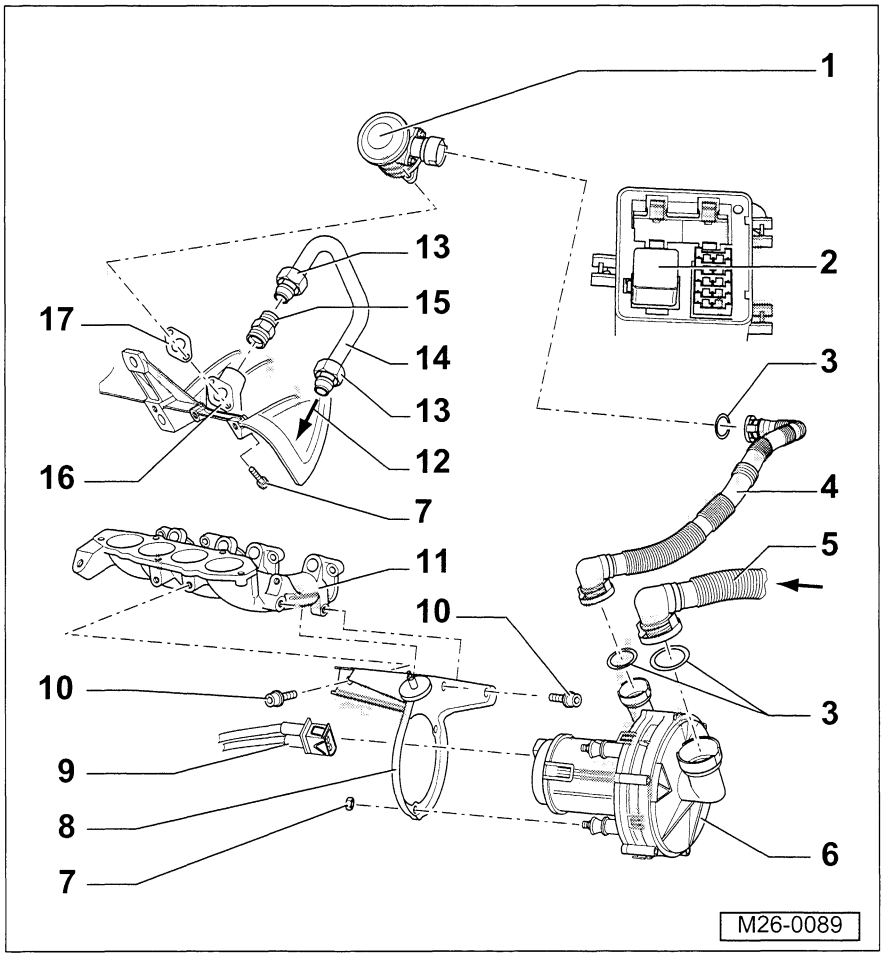
1. **Combi-valve**
   - Checking, see **Combi-valve, checking (AEG engine, early)**
2. **Vacuum hoses**
3. **Harness connector, 2-pin**
4. **Secondary Air Injection (AIR) solenoid valve (N112)**
   - Fastened to cowl panel (bulkhead)
5. **Flow**
   - To vacuum tee connection on line to power brake booster
6. **Secondary Air Injection (AIR) pump motor relay (J299)**
   - In engine compartment left, on fuse/relay panel next to brake master cylinder
   - Relay designation "100"
7. **O-rings**
   - Always replace
8. **Pressure hose**
   - Ensure hose is tightly sealed
   - Press together at front to release
9. **Intake hose**
   - From air filter upper section
10. **Air flow**
    - AIR Pump intake from air cleaner assembly
11. **Secondary Air Injection (AIR) pump motor (V101)**
12. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
13. **Nut**
    - Tighten to 10 Nm (7 ft-lb)
14. **Bracket**
    - For AIR pump motor (V101)
    - Attached to lower intake manifold
15. **Harness connector, 2-pin**
16. **Intake manifold, lower section**
17. **Air flow**
    - From fitting flange to exhaust manifold
18. **Flare nut fitting and union**
    - Tighten to 30 Nm (22 ft-lb)
19. **Connecting pipe for combi-valve**
    - Between fitting flange and exhaust manifold
20. **Warm air collector plate**
    - With mount for combi-valve
21. **Gasket**
    - Always replace



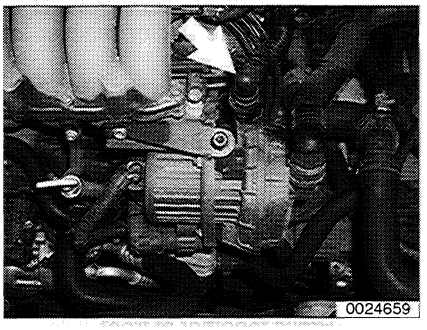
Combi-valve, checking (AEG engine, early)

- Disconnect vacuum hose (**1**) from AIR solenoid valve (**2**)
- Connect hand vacuum pump (i.e. VAG 1390) to vacuum hose (**1**)
- Remove pressure hose (**arrow**) from pump motor
- Blow into pressure hose with slight pressure
  Do not use compressed air!
- Both valves must be closed
- Operate hand vacuum pump
- Combi valve should open, replace valve if it doesn't open

Secondary air injection system, components (2.0L AEG engine, late, AVH, AZG)



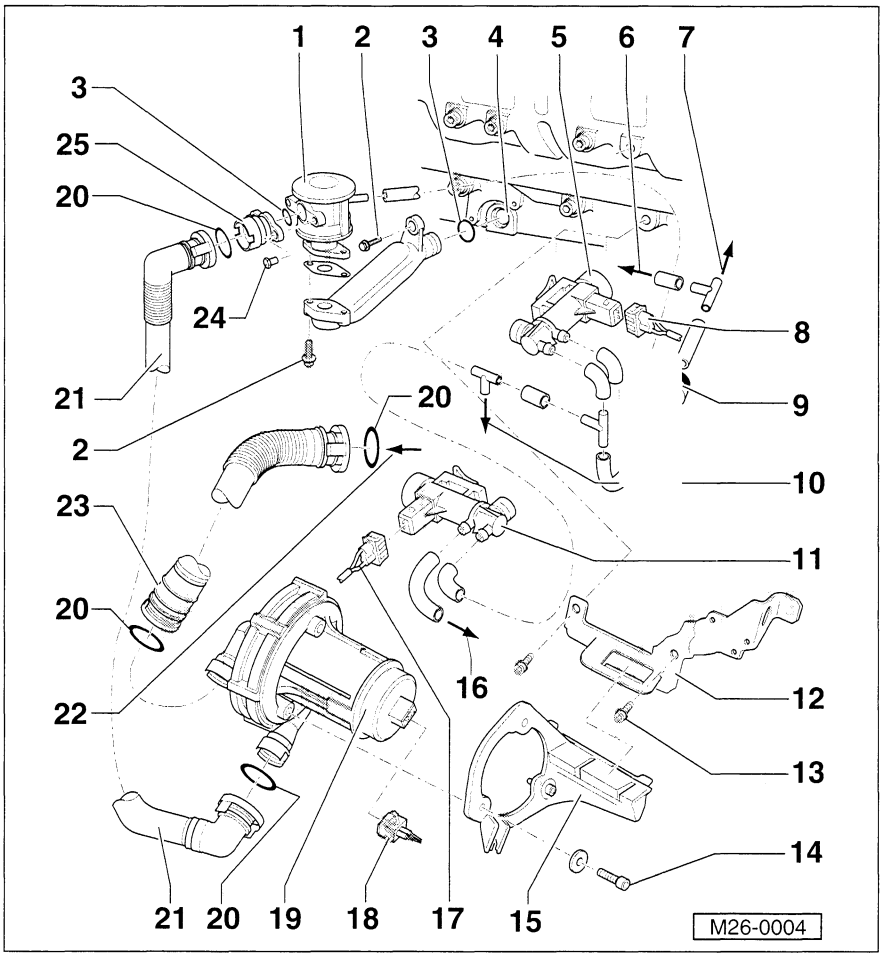
1. **Combi-valve**
   - Checking, see **Combi-valve, checking (AEG engine, late, AVH, AZG)**
2. **Secondary Air Injection (AIR) pump motor relay (J299)**
   - In engine compartment left, on fuse/relay panel next to brake master cylinder
   - Relay designation "100"
3. **O-rings**
   - Always replace
4. **Pressure hose**
   - Ensure hose is tightly sealed
   - Press together at front to release
5. **Intake hose**
   - From air filter upper section
   - Intake air flow from air cleaner assembly
6. **Secondary Air Injection (AIR) pump motor (V101)**
7. **Nut**
   - Tighten to 10 Nm (7 ft-lb)
8. **Bracket**
   - For AIR pump motor (V101)
   - Attached to lower intake manifold, BEV engine
   - Attached to upper intake manifold, AEG, AVH, AZG engines
9. **Harness connector, 2-pin**
10. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
11. **Intake manifold, lower section**
12. **Air flow**
    - From fitting flange to exhaust manifold
13. **Flare nut**
    - Tighten to 30 Nm (22 ft-lb)
14. **Connecting pipe for combi-valve**
    - Between fitting flange and exhaust manifold
15. **Union**
    - Tighten to 35 Nm (26 ft-lb)
16. **Warm air collector plate**
    - With mount for combi-valve
17. **Gasket**
    - Always replace



Combi-valve, checking (AEG engine, late, AVH, AZG)

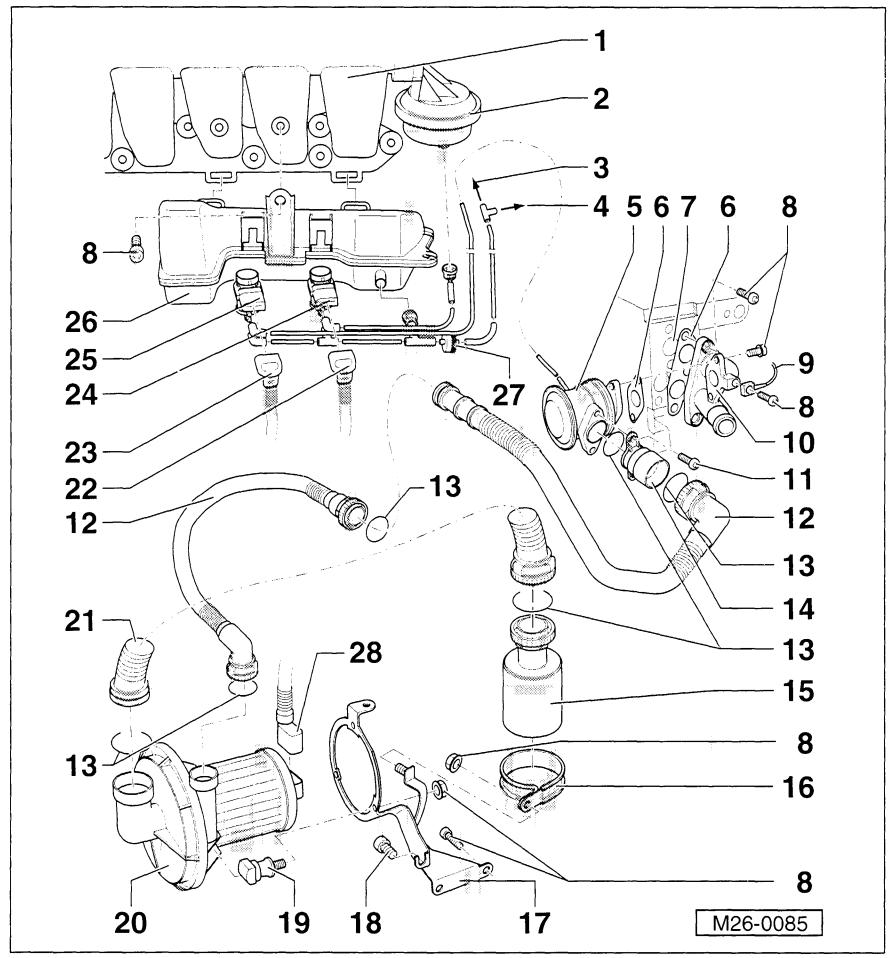
- Remove pressure hose (**arrow**) from pump motor
- Blow lightly into pressure hose to combi-valve with slight pressure Do not use compressed air!
- Combi-valve must be closed
- Blow into pressure hose to combi-valve with much greater pressure
- Combi valve must open; replace valve if it does not open

Secondary air injection system, components (2.8L AFP engine)



1. **Combi-valve**
   - Checking, see **Combi-valve, checking (2.8L engine)**
2. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
3. **O-ring**
   - Always replace
4. **Air port**
   - In cylinder head
5. **Secondary Air Injection (AIR) solenoid valve (N112)**
6. **Vacuum connection**
   - To fuel pressure regulator
7. **Vacuum connection**
   - To intake manifold
8. **Harness connector, 2-pin black**
9. **Check valve**
   - Black end faces vacuum source
   - White end faces the secondary air injection valve
10. **Vacuum connection**
    - To vacuum reservoir
    - Fastened to the front oil pan
11. **Intake Manifold Tuning (IMT) valve (N156)**
    - Clipped onto the bracket attached to the oil filter flange
12. **Mounting bracket**
13. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
14. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
15. **Bracket**
    - For AIR pump motor (V101)
    - For AIR solenoid valve (N112)
16. **Flow**
    - To vacuum servo for IMT valve
17. **Harness connector, 2-pin black**
    - For IMT valve (N156)
18. **Harness connector, 2-pin black**
    - For AIR pump motor (V101)
19. **Secondary Air Injection (AIR) pump motor (V101)**
    - On the front of engine block
    - May require loosening of A/C compressor and/or bracket for access
    - For removing and installing, put lock carrier into service position, see **50 Body–Front**
20. **O-ring**
    - Replace if damaged
21. **Pressure hose**
    - Ensure hose is tightly sealed
    - Press together at front to release
22. **Air flow**
    - AIR Pump intake from air cleaner assembly
23. **Intake hose**
    - From air filter upper section
24. **Bolt**
    - Tighten to 5 Nm (44 in-lb)
25. **Fitting flange**
    - For pressure hose to combi-valve

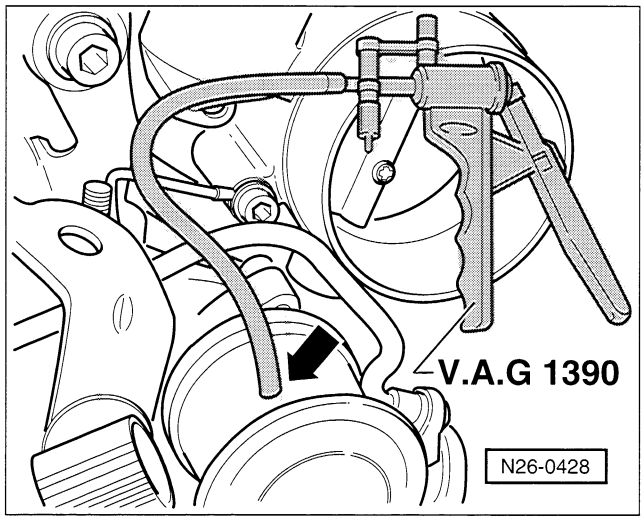
Secondary air injection system, components (2.8L BDF engine)



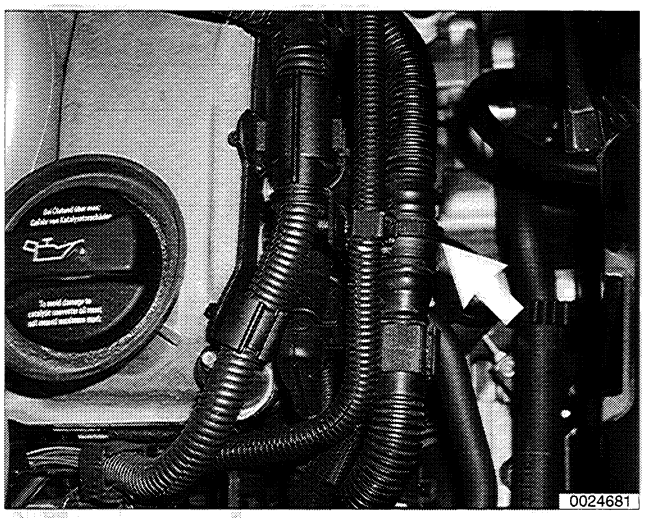
1. **Intake manifold**
2. **Vacuum servo**
   - Intake Manifold Tuning (IMT) valve (N156)
3. **Flow**
   - To intake manifold
4. **Flow**
   - To fuel pressure regulator
5. **Combi-valve**
   - Checking, see **Combi-valve, checking (2.8L engine)**
6. **Gasket**
   - Always replace
7. **Air port**
   - In cylinder head
8. **Bolt**
   - Tighten to 8 Nm (71 in-lb)
9. **Ground wire connection**
   - Check for secure connection
10. **Fitting flanges**
    - For combi-valve and coolant hose
11. **Bolt**
    - Tighten to 5 Nm (44 in-lb)
12. **Pressure hose**
    - Ensure hose is tightly sealed
    - Press together at front to release
13. **O-ring**
    - Replace if damaged
14. **Fitting flange**
    - For pressure hose to combi-valve
15. **Air cleaner,**
    - Clean/replace if dirty
    - For AIR pump motor (V101)
16. **Mounting clamp**
17. **Bracket**
    - For AIR pump motor (V101)
    - secured to oil pan and cylinder block
18. **Bolt**
    - Tighten to 20 Nm (15 ft-lb)
19. **Rubber insulator bushing**
20. **Secondary Air Injection (AIR) pump motor (V101)**
    - On the front of engine block
    - For removing and installing, put lock carrier into service position, see **50 Body–Front**
21. **Intake hose**
    - Ensure hose is tightly sealed
    - Press together at front to release
22. **Harness connector, 2-pin black**
    - For IMT valve
    - Mark connector and component before removing
23. **Harness connector, 2-pin black**
    - For AIR solenoid valve
    - Mark connector and component before removing
24. **Intake Manifold Tuning (IMT) valve (N156)**
    - Valve is activated (pulsed) by ECM (duty cycle)
25. **Secondary Air Injection (AIR) solenoid valve (N112)**
    - Valve is activated (pulsed) by ECM (duty cycle)
26. **Vacuum reservoir**
27. **Check valve**
    - Black end faces vacuum source
    - White end faces the AIR valve and IMT valve
28. **Harness connector, 2-pin black**
    - For AIR pump motor
    - Mark connector and component before removing

Combi-valve, checking (2.8L engine)

– Remove vacuum hose from combi-valve.



➢ Connect hand vacuum pump (i.e. VAG 1390) to combi-valve.



➢ Disconnect pressure hose to combi-valve at coupling (**arrow**). (BDF engine shown)

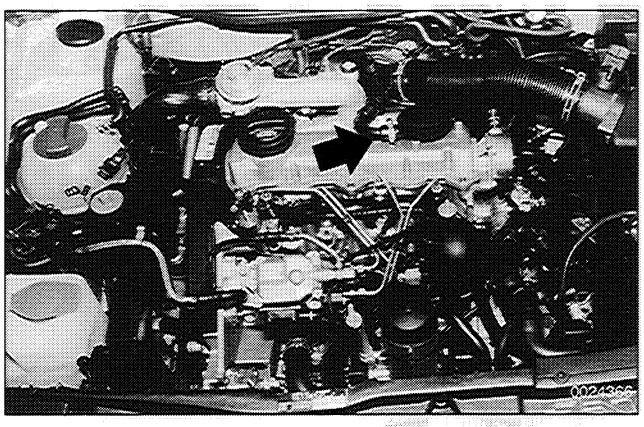
– Blow into pressure hose with slight pressure
Do not use compressed air!
  • Combi-valve must remain closed.

– Operate hand vacuum pump.
  • Combi-valve should open

– Replace combi-valve if it doesn't open or is continuously open.

EMISSION CONTROLS (DIESEL ENGINE)

Positive Crankcase Ventilation (PCV)



The PCV system traps crankcase vapors and routes them back into the intake air stream to be burned. The system consists simply of a breather hose (**arrow**) between the valve cover and the intake air boot. This breather hose has a pressure regulating valve at the intake air boot that prevents turbocharger boost from pressurizing the crankcase.

> ***WARNING —***
> *Replace PCV hoses only with parts designed for PCV or fuel system service. Conventional vacuum and heater hoses deteriorate rapidly when exposed to oil vapors and combustion gasses.*

Most crankcase ventilation problems result when the hoses or valves become clogged with oily residues. Restrictions create excessive crankcase pressure that can cause driveability problems. PCV system service is limited to inspecting and cleaning of the breather valves, hoses, and replacing faulty parts.

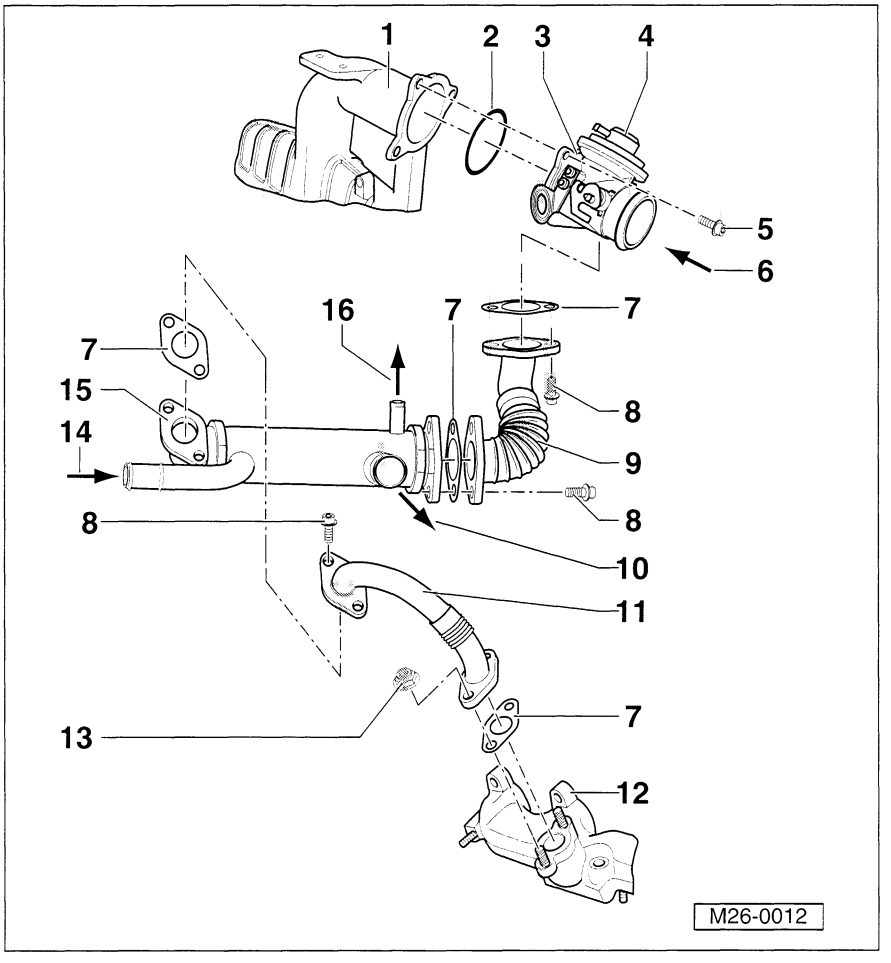
Exhaust Gas Recirculation (EGR)

The EGR system installed on the 1.9L diesel engine reduces emissions by directing a small quantity of exhaust gases back into the intake manifold to dilute the air/fuel mixture effectively. An EGR cooler reduces the exhaust gas temperature by as much as 122°F. This reduces the amount of oxides of nitrogen (NO_x) pollutants in the exhaust.

The function of the EGR system is managed by the diesel direct injection system Engine Control Module (ECM) via the EGR vacuum regulator solenoid valve. The cone shaped plunger in the mechanical EGR valve ensures that various cross sectional openings are possible at different plunger heights. Every possible valve position is provided via pulsed control from the EGR vacuum regulator solenoid valve.

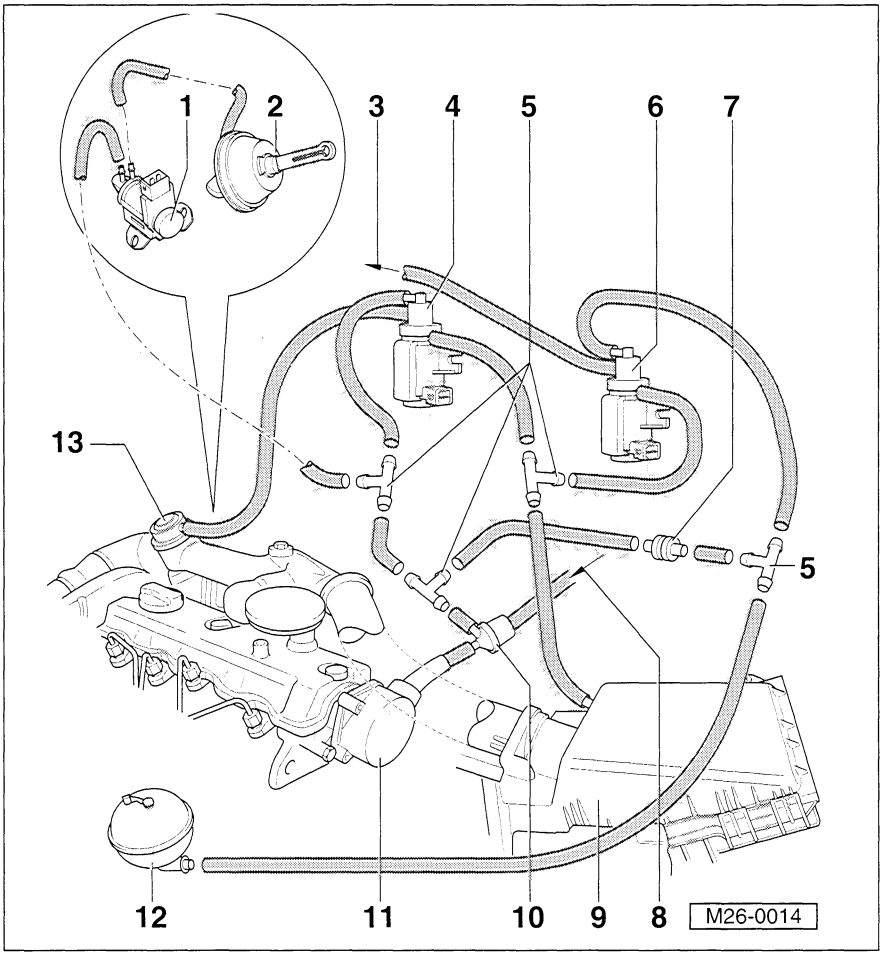
The EGR system and its various components is shown on the following page.

EGR system, assembly (1.9L TDI engine)



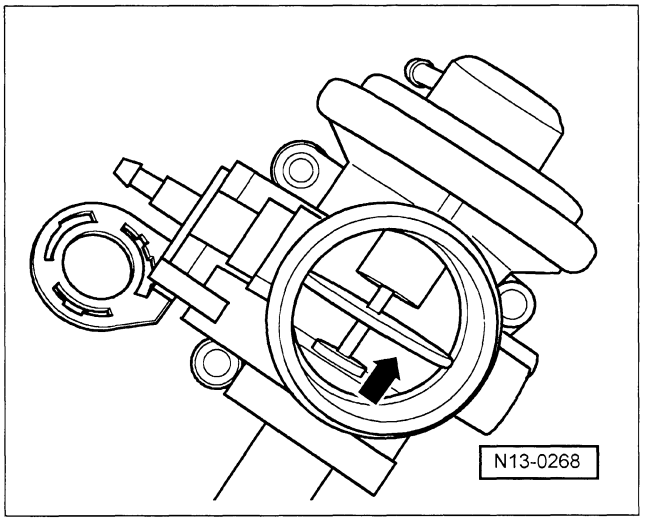
1. **Intake manifold**
2. **O-ring**
   - Always replace
3. **Intake air connector**
   - With EGR valve and control flap
4. **Exhaust Gas Recirculation (EGR) valve**
   - Integral with intake air connector, item **3**
   - See **EGR valve, checking**
5. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
6. **Flow**
   - Intake air from charge air cooler (intercooler)
7. **Gasket**
   - Always replace
8. **Bolt**
   - Tighten to 25 Nm (18 ft-lb)
9. **Connecting pipe**
   - Between EGR cooler and EGR valve
10. **Coolant flow**
    - To heater core
11. **Connecting pipe**
    - Between exhaust manifold and EGR cooler
12. **Exhaust manifold**
13. **Nut**
    - Tighten to 25 Nm (18 ft-lb)
14. **Coolant flow**
    - From outlet flange on end of cylinder head
15. **EGR cooler**
16. **Coolant flow**
    - Connection to coolant expansion tank

Vacuum hose connections (1.9L TDI engine)



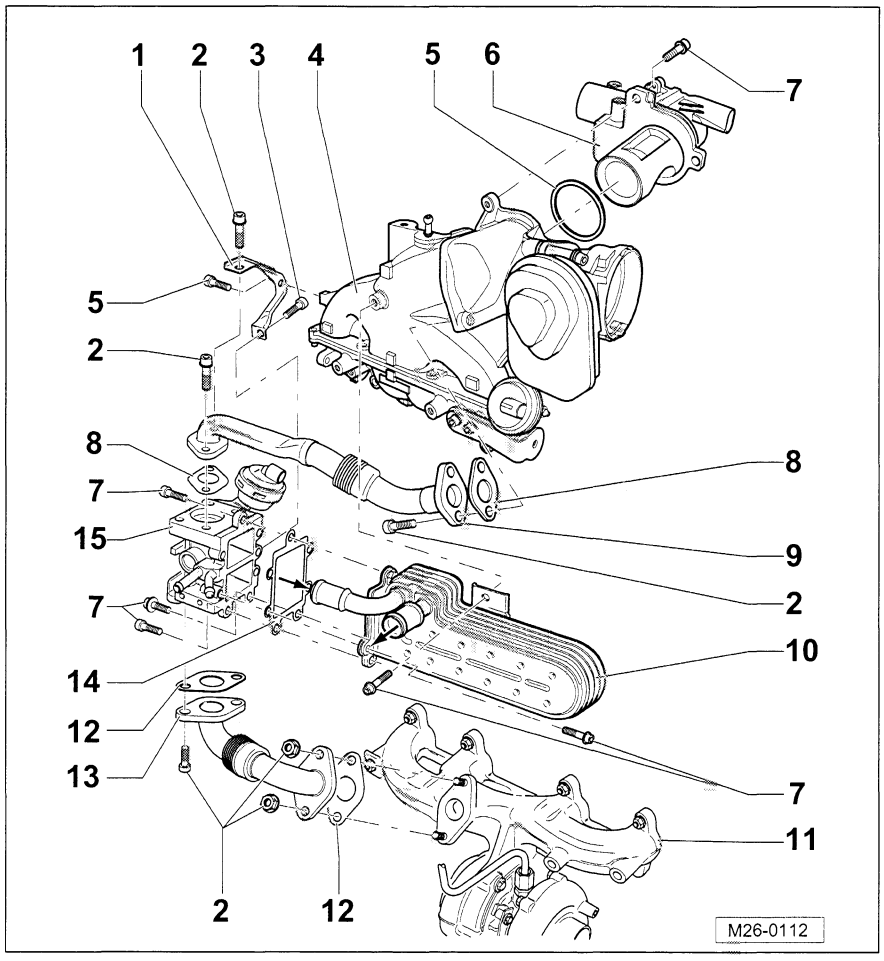
1. **Change-over valve for intake manifold flap (N239)**
2. **Vacuum servo**
   - Do not bend control rod
3. **Vacuum flow**
   - Hose to pressure unit (servo) for turbocharger wastegate
4. **EGR vacuum regulator solenoid valve (N18)**
5. **Tee connectors**
6. **Wastegate bypass regulator solenoid valve (N75)**
7. **Check valve**
   - Black end faces vacuum source
   - White end faces the line going to vacuum reservoir
8. **Vacuum flow**
   - From power brake servo
9. **Air cleaner assembly**
10. **Check valve**
    - Observe installed position
11. **Vacuum pump**
    - For brake booster
    - For systems requiring vacuum to operate
12. **Vacuum reservoir**
    - Mounted with bracket to oil pan
13. **EGR valve**

EGR valve, checking



- Remove engine cover and disconnect pipe between charge air cooler and intake manifold at manifold.
- Disconnect vacuum hose from EGR valve.
- Connect hand vacuum pump, such as VAG 1390 or equivalent, to EGR valve.
- Operate pump and observe if valve and pushrod move in direction of **arrow**.
- Disconnect hand vacuum pump hose from EGR valve.
- Pushrod and valve must move back to original position.
- If the pushrod did not move, then the EGR valve is faulty and should be replaced. If the pushrod does move correctly then the problem may be with the EGR vacuum regulator solenoid valve. Check the wiring to solenoid valve and check for a duty cycle (on-off) signal at the valve. If no faults can be found, the signal from the ECM may be missing or the valve or ECM may be faulty.
- EGR vacuum system may function properly, however, the EGR system may be inoperative due to clogging of lines and passages carrying exhaust gasses. If symptoms indicate that this is a possibility, remove EGR valve and connecting pipes, and check to insure unrestricted free flow.
- If EGR valve and connecting pipes are clear, check and clean EGR cooler and passages and ports in exhaust manifold as required to ensure free flow of exhaust gasses to the EGR valve.

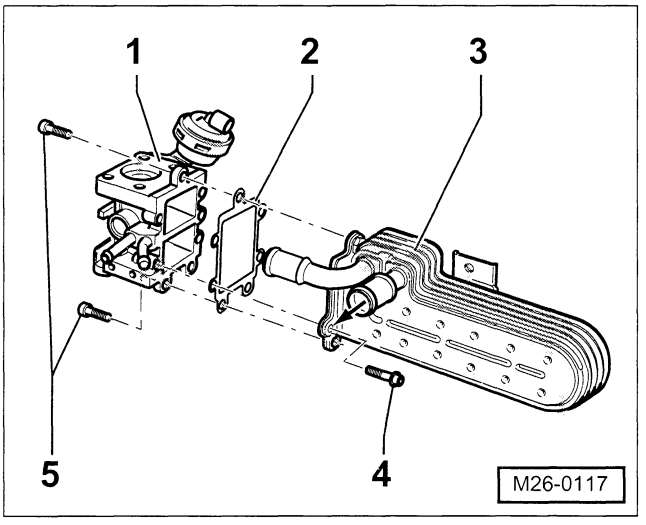
EGR system, assembly (1.9L PD TDI engine)



1. **Mounting**
   - For bypass flap, item **15**
2. **Bolt**
   - Tighten to 22 Nm (16 ft-lb)
3. **Bolt**
   - Tighten to 5 Nm (44 in-lb)
4. **Intake manifold**
   - With EGR vacuum regulator valve (N121) and Motor for intake flap (V157)
5. **O-ring**
   - Always replace
6. **EGR vacuum regulator valve (N121)**
7. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
8. **Gasket**
   - Always replace
9. **Connecting pipe**
   - Between EGR cooler and EGR valve
10. **EGR cooler**
    - See **EGR cooler, installing and assembling**
11. **Exhaust manifold**
12. **Gasket**
    - Always replace
13. **Connecting pipe**
    - Between exhaust manifold and EGR cooler
14. **Gasket**
    - Always replace
15. **Bypass flap**

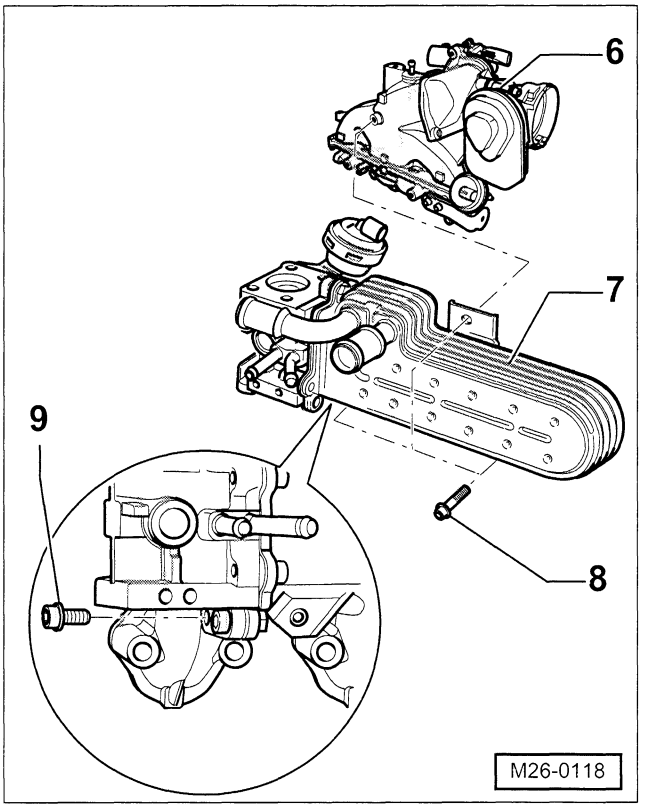
EGR cooler, installing and assembling

NOTE —
Adhere to the following procedure to prevent component damage due to stress during repairs.



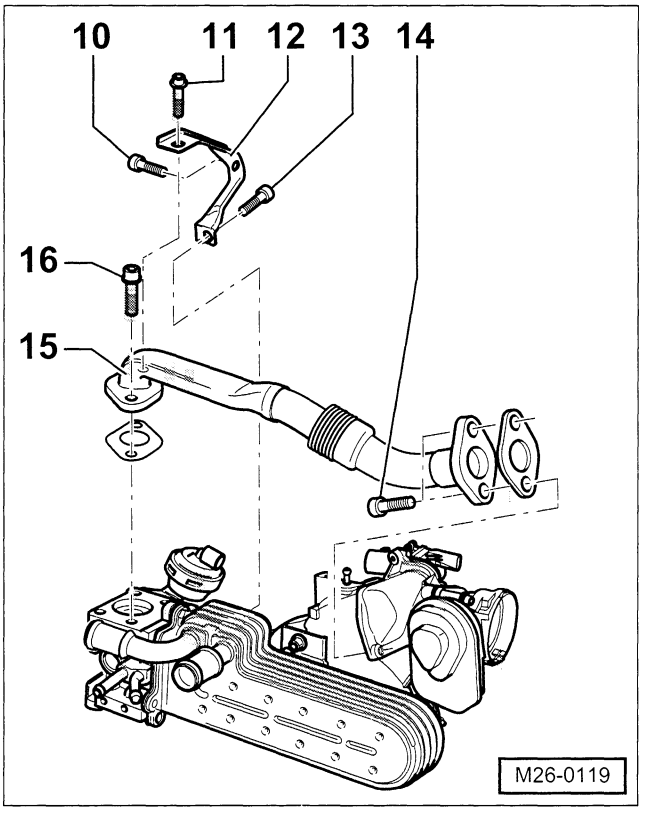
➢ Assemble bypass flap (**1**) with gasket (**2**) and two bolts (**5**) to EGR cooler (**3**) and tighten bolts by hand.

– Insert four bolts (**4**) and tighten all bolts (**5** and **4**).
  • Tighten to 10 Nm (7 ft-lb)



➢ Mount EGR cooler assembly (**7**) to intake manifold (**6**) with 3 bolts (**8**). Only tighten bolts by finger-tight so that the EGR cooler just makes contact and is able to be moved slightly within the bolt holes. This will facilitate installation of last bolt.

– Insert bolt (**9**) and tighten all bolts (**8** and **9**)
  • Tighten to 10 Nm (7 ft-lb)



➤ Install connecting pipe (**15**) with new gaskets at each end. Install bolts (**14** and **16**) and tighten bolts by hand.

– Install bracket (**12**) with bolts (**11** and **13**) onto bypass flap.

– Attach bracket (**12**) with bolt (**10**) to intake manifold and tighten.

  • Tighten to 10 Nm (7 ft-lb)

– Tighten bolt (**11**).

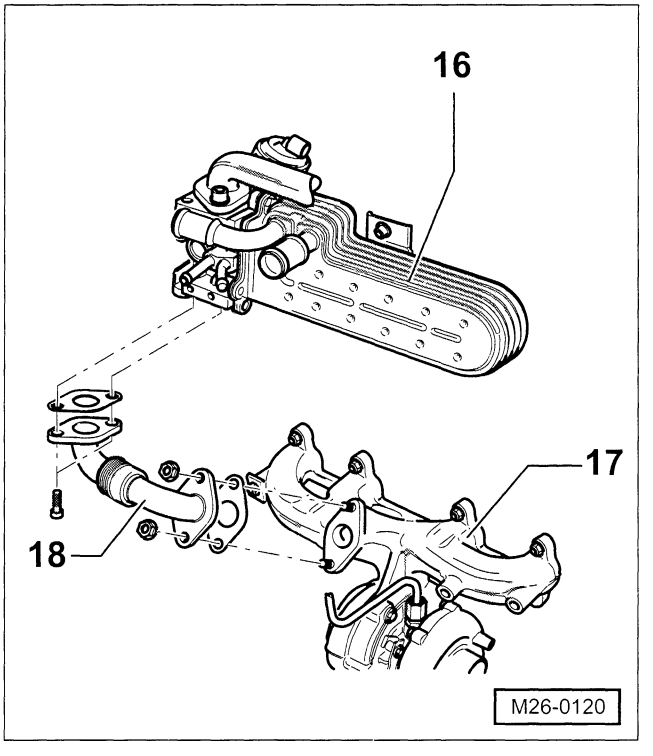
  • Tighten to 22 Nm (16 ft-lb)

– Tighten bolt (**13**).

  • Tighten to 5 Nm (44 in-lb)

– Tighten bolts (**14** and **16**).

  • Tighten to 22 Nm (16 ft-lb)



➤ Install connecting pipe (**18**) from EGR cooler (**16**) to exhaust manifold (**17**) and tighten bolts and nuts.

  • Tighten to 22 Nm (16 ft-lb)

QUALITY REVIEW

When you have finished working under the hood and around other areas of the vehicle, it is advisable to take a moment to quality check or review your work. This helps to insure that the operation or repair has been completed properly with all affected systems functioning within normal parameters. These may include the following:

- Ensure that the exhaust system is not under stress, and that it has sufficient clearance from the body. If necessary, loosen the double clamps and align the muffler and exhaust pipe so sufficient clearance is maintained to the body while the support rings are evenly loaded.
- Confirm that all heat shields are in place.
- Make sure that there are no air, vacuum or exhaust leaks.

27 Engine Electrical

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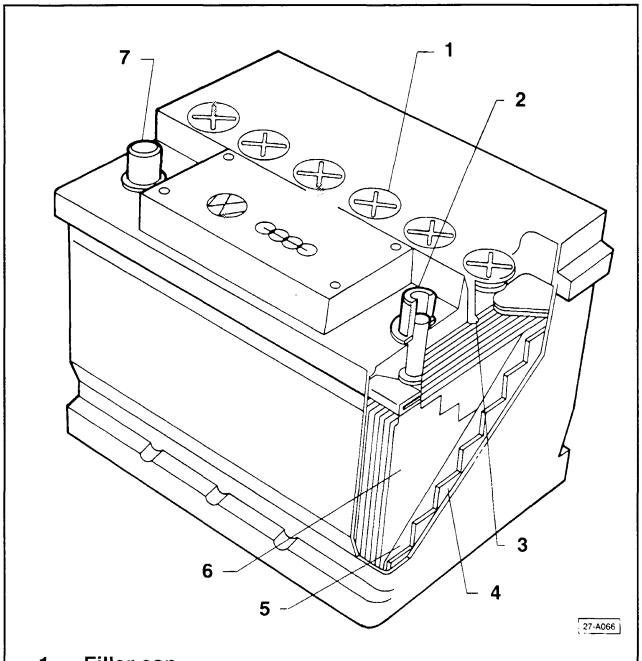
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1. **Filler cap**
2. **Positive (B+) terminal**
3. **Electrolyte level indicator**
4. **Negative plate (grey)**
5. **Separator (insulator)**
6. **Positive plate (dark brown)**
7. **Negative (–) terminal**

GENERAL

This repair group covers battery, starter, and generator troubleshooting and repair. For additional battery information, see **0 Maintenance**.

NOTE —

- *The alternator is identified as generator by the vehicle manufacturer. Car makers must, by law, use uniform words and terms (nomenclature) to describe certain components and or systems. The uniform word for alternator is generator. Therefore, the component labeled "Generator (GEN)" in the wiring diagrams is the alternator.*
- *Wiring diagrams for the battery, charging system and starter motor are given in* **97 Wiring Diagrams, Fuses and Relays**.

The six-cell, 12-volt lead-acid battery capacity is rated in Ampere/hours (Ah) and cold cranking amps (CCA). The Ah rating is determined by the average amount of current the battery can deliver over time without dropping below a specified voltage. The CCA rating is determined by the battery's ability to deliver starting current at 0°F (–18°C). The battery is installed in the engine compartment, behind the left headlight assembly.

The charging system consists of a belt-driven 14-volt generator and a voltage regulator. The voltage regulator, which is mounted in the generator, also serves as the generator brush holder. The charging system provides the current necessary to keep the battery charged and to operate the vehicle's electrical accessories.

Please read the following warnings and cautions before doing any work on any parts of the engine electrical system.

WARNING —

- *Wear goggles, rubber gloves, and a rubber apron when working around batteries and battery acid (electrolyte). Battery acid contains sulfuric acid and can cause skin irritation and burning. If acid is spilled on your skin or clothing, flush the area at once with large quantities of water. If electrolyte gets into your eyes, bathe them with large quantities of clean water for several minutes and call a physician.*
- *Batteries that are being charged or are fully charged give off explosive hydrogen gas. Keep sparks and open flames away. Do not smoke.*
- *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using a VAG 1551/1552 or equivalent scan tool.*
- *Do not disconnect the battery cables while the engine is running. The generator will be damaged.*
- *Never operate the generator with its output terminal (B+ or 30) disconnected and the other terminals connected. Never short, bridge, or ground any terminals of the charging system.*
- *Always disconnect the negative (–) battery cable when working at or near the generator. Battery voltage is always present at the rear of the generator, even with the ignition key off.*
- *Always allow a frozen battery to thaw before attempting to recharge it.*
- *Always disconnect the battery cables during battery charging. This will prevent damage to the generator and any solid-state components. Do not exceed 16.5 volts at the battery.*
- *Never reverse the battery terminals. Even a momentary wrong connection can damage the generator or electrical components.*
- *Replace the battery if the case is cracked or leaking. Electrolyte can damage the car. If electrolyte is spilled, clean the area with a solution of baking soda and water.*

BATTERY SERVICE

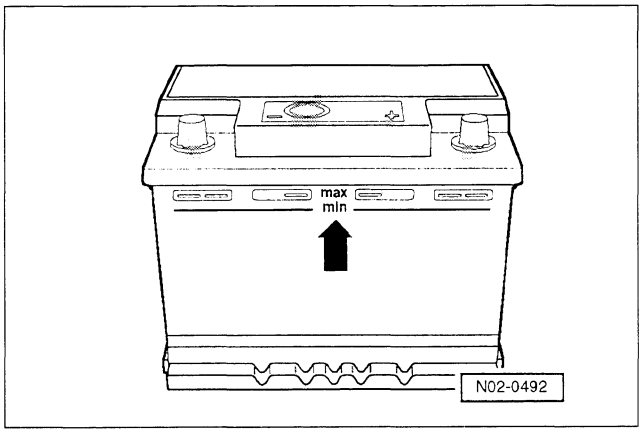
If the battery discharges when the vehicle is not driven, there may be a constant drain or current draw causing it to discharge when the ignition is off. Depending on the draw and the condition of the battery, a full discharge can happen overnight or it may take a few weeks. Although a small static drain on the battery is normal (for example to operate the clock or radio memory), a large drain such as a relay sticking on or a faulty switch will cause the battery to quickly discharge. Make a static current draw test as the first step when experiencing battery discharge.

If the current draw on the battery is not excessive and the battery still discharges, the condition of the battery should be tested. Battery testing determines the state of battery charge. The most common methods are open-circuit and load voltage testing. Batteries with filler caps can also be tested by checking the specific gravity of the electrolyte. Inexpensive specific gravity testers are available at most auto supply stores.

Some vehicles are equipped with batteries with a central gas venting system with anti-flash protection. The anti-flash protection consists of a small round fiberglass mat with a diameter of approximately 15 mm and a thickness of 2 mm. Its purpose is to vent gasses that form in the battery. The gasses that form while charging can vent centrally through an opening on the upper side of the battery cover. The anti-flash protection is also installed to prevent ignition of the flammable gasses in the battery.

> ***WARNING —***
> - *Always use genuine VW battery cell caps. Caps must be fitted with an O-ring seal.*
> - *Before diagnosing electrical problems visually inspect the battery for clean and tight connections at all terminals.*

Electrolyte level, checking



➤ A visual check of the battery electrolyte level is all that is required on batteries with a recognizable minimum and maximum marking (**arrow**).

– If there are no min. or max. markings on battery housing, or if electrolyte level cannot be read, the top plugs must be removed to view electrolyte level. The level should be the same height as visible plastic peg.

> ***WARNING —***
> *Always wear protective goggles and clothing when working with battery cells open.*

– Top off each battery cell as necessary with distilled water using a battery filling bottle. Use a hydrometer to remove any excess electrolyte. Be sure to install original sealing plug with O-ring.

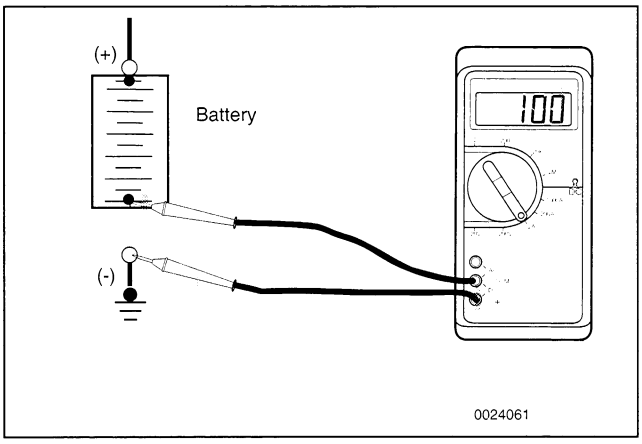
NOTE —
Use of distilled water to fill battery cells will prevent contamination of battery electrolyte and decrease the likelihood of self discharge.

Static current draw, checking

– Make sure the ignition and all electrical accessories are switched off.

– Disconnect the negative (–) cable from the battery. See the Cautions at the beginning of this repair group regarding battery disconnection.

NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.



➤ Connect a digital ammeter between the battery negative post and the negative battery cable and measure the current draw.

A range of about 0 to 100 milliamps is normal, depending on the number of accessories that need constant power. A current of 500 milliamps (0.5 amp) or more indicates a problem. To determine the circuit or component causing the problem, remove one fuse at a time until the current drops to a normal range. Use the wiring diagrams shown in **97 Wiring Diagrams, Fuses and Relays** to locate wiring or component faults.

Open-circuit voltage test

An open-circuit voltage test checks battery voltage by connecting an accurate digital voltmeter to the battery posts after disconnecting the battery ground cable. Before making an open-circuit voltage test on a battery, first load the battery with 15 amps for one minute, for example by turning on the headlights without the engine running. See **Table a** for open-circuit voltage levels and their corresponding percentages of charge.

Table a. Open-Circuit Voltage and Battery Charge

Open-circuit voltage	State of charge
12.6 V or more	Fully charged
12.4 V	75% charged
12.2 V	50% charged
12.0 V	25% charged
11.7 V or less	Fully discharged

The battery is in satisfactory condition if the open-circuit voltage is at least 12.5 volts. If the open-circuit voltage is at this level or above, but the battery still lacks power for starting, make a load voltage test to determine the battery's service condition. If the open-circuit voltage is below 12.5 volts, recharge the battery. If the battery cannot be fully recharged it should be replaced.

Specific gravity, checking

Checking the specific gravity of each of the battery's electrolyte cells and doing a load test as described below can provide specific information about the battery's condition.

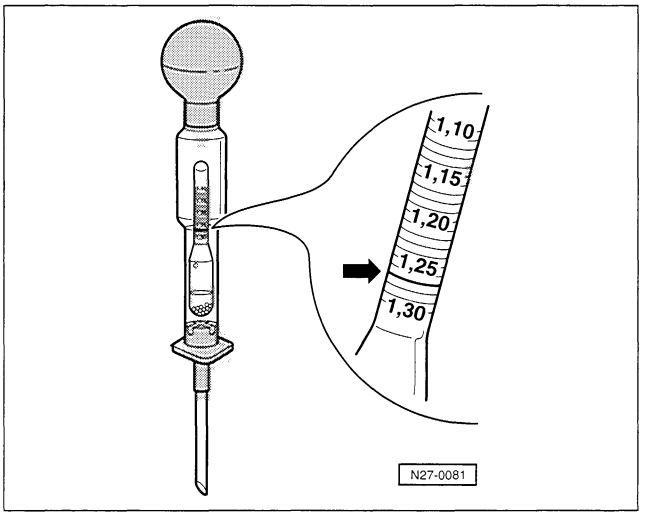
– Turn off ignition.

> ***WARNING —***
> *Always wear protective goggles and clothing when working with battery cells open.*

– Remove all battery cell sealing plugs.

– Check that battery electrolyte temperature is at least 10°C (50°F).

– Immerse hydrometer in a cell and extract sufficient electrolyte so that float swims free in the electrolyte.



➢ Read the specific gravity and compare to specification.

Battery charge condition and specific gravity

- Discharged . . . . . 1.15 kg/dm^3
- Half charged . . . . . 1.22 kg/dm^3
- Full charge . . . . . 1.28 kg/dm^3

– Electrolyte density must be at least 1.24 kg/dm^3. If density is insufficient, install cell caps and charge battery.

– The specific gravity of the individual battery cells must not differentiate by more than 0.03 kg/dm^3. Replace battery if not within specification.

– Install cell caps with O-rings and carefully wipe up any spilled electrolyte.

Load voltage testing

A load voltage battery test is made by connecting a specific resistive load to the battery terminals and then measuring the battery's voltage. The test requires a special tester and can generally be performed quickly and inexpensively by an authorized VW dealer or other qualified repair facility.

The battery should be fully charged and at room temperature for the most accurate results. If the equipment is available, disconnect the negative (–) battery cable. Then apply the specified load for 15 seconds and measure the battery's voltage. If the voltage is below that listed, the battery should be replaced.

Table b lists load current and minimum voltages for original-equipment VW batteries.

> ***WARNING —***
> *Always wear protective goggles and clothing when performing a load test.*

Table b. Battery Load Current and Minimum Voltage

Battery Capacity (Amp-hour)	Cold Cranking Amps (CCA)	Load Current (amps)	Minimum voltage (limit value)
36Ah	340	100	10.0
40Ah-49Ah	220	200	9.2
50Ah-60Ah	265-280	200	9.4
61h-80Ah	300-380	300	9.0
81Ah-110Ah	380-500	300	9.5

Battery charging

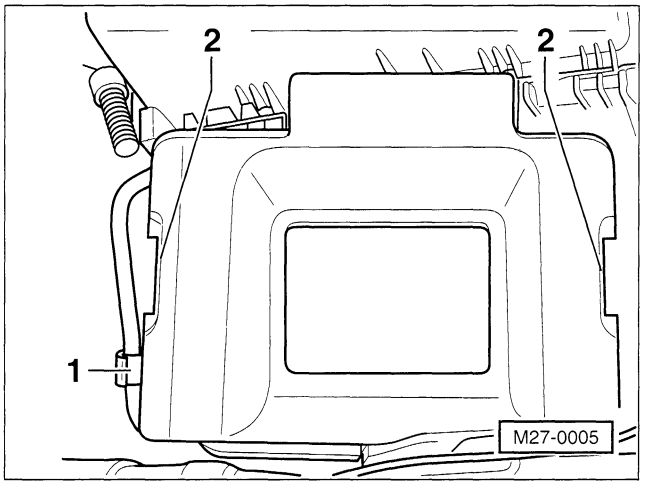
Discharged batteries can be recharged using a battery charger. Prolonged charging causes gassing that will evaporate the electrolyte to a level that can damage the battery.

> ***WARNING —***
> • *The gasses given off by the battery during charging are explosive. Do not smoke. Keep open flames away from the top of the battery, and prevent electrical sparks by turning off the battery charger before connecting or disconnecting it.*
>
> • *Battery cell caps must not be removed while charging.*
>
> • *Batteries are damaged by quick charging. It should only be used as a last alternative when slow charging is not possible.*
>
> • *Never quick charge a totally discharged battery.*
>
> • *Do not allow the battery charging rate to exceed 16.5 volts.*
>
> • *If the battery begins gassing (boiling) violently when charging, reduce the charging rate immediately.*
>
> • *Ensure that the battery is charged in a well ventilated area.*
>
> • *Precision tools must not be kept in the same room where batteries are being charged. Tools may corrode due to chemical reaction.*

Always read and follow the instructions provided by the battery charger's manufacturer. A slow-charging rate (10% of battery capacity) is best to prevent battery damage caused by overheating.

Battery, removing and installing

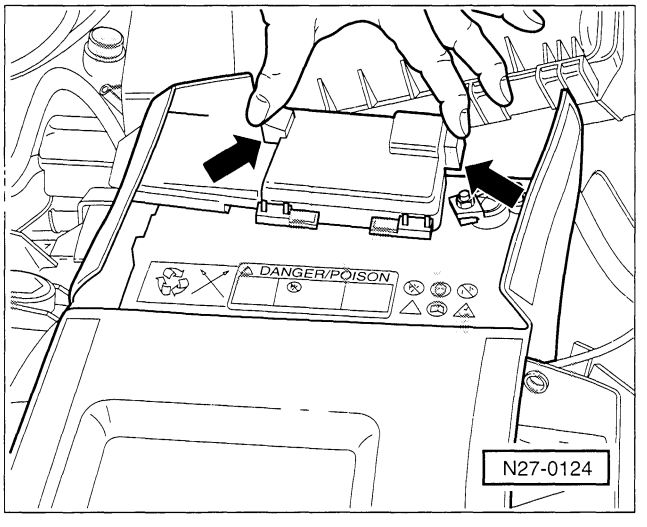
– Switch ignition off.



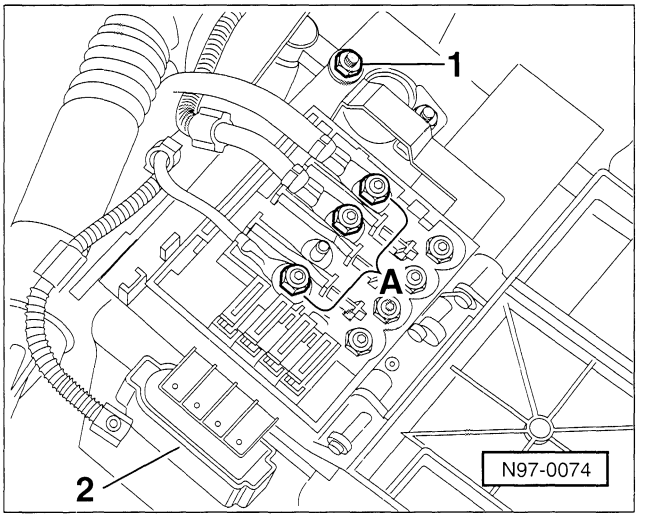
➢ On batteries with a plastic cover, unclip the battery positive cable from cable retainer (**1**) on side of cover. Press retaining tabs (**2**) on sides of cover and remove cover.

– Disconnect battery ground (GND) strap from battery negative (-) terminal.

> ***WARNING —***
> *Be sure to have the anti-theft radio code on hand before disconnecting the battery.*



➢ Fold open top of battery blanket, if installed. Press locking tabs (**arrows**) together to open fuse holder cover.

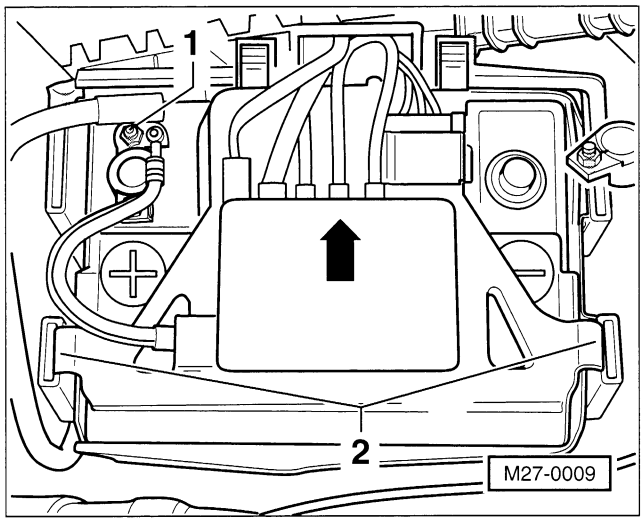


➢ Remove hex nut (**1**) for positive (+) battery terminal lead and strip fuses on top of battery.

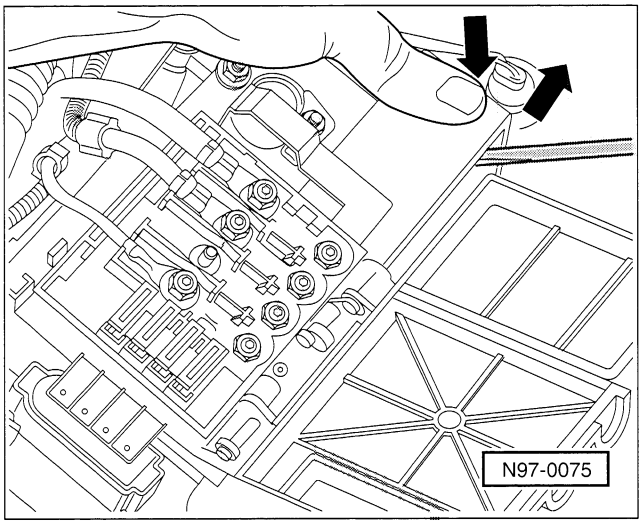
– Remove harness connector (**2**) on top of battery.

– Unclip fuse holder from top of battery.

NOTE —
Different style fuse holders are used, see applicable figure at left.



➤ Unclip earlier style fuse holder retaining tabs on either side and slide fuse holder to rear (**arrow**) off top of battery.

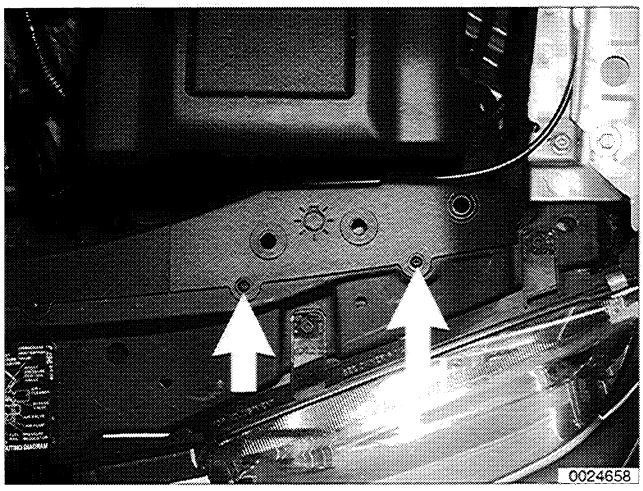


➤ Unlock later style fuse holder from top of battery by relieving tension (in direction of **arrows**) with thumb pressure and using screwdriver to release retaining tab.

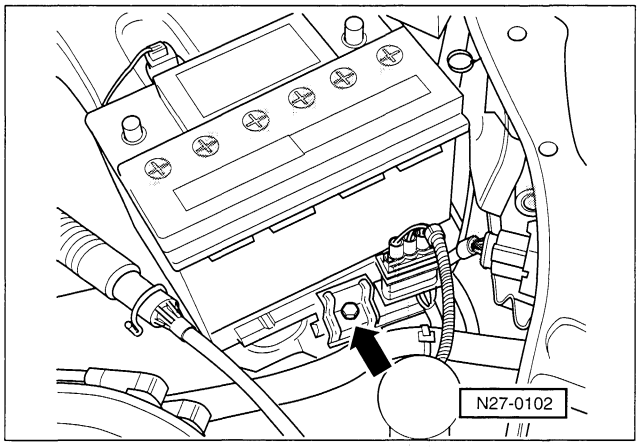
– Lift fuse holder away from battery and secure safely out of way with elastic cord.

– Remove positive (+) battery clamp from battery and position cable safely out of the way.

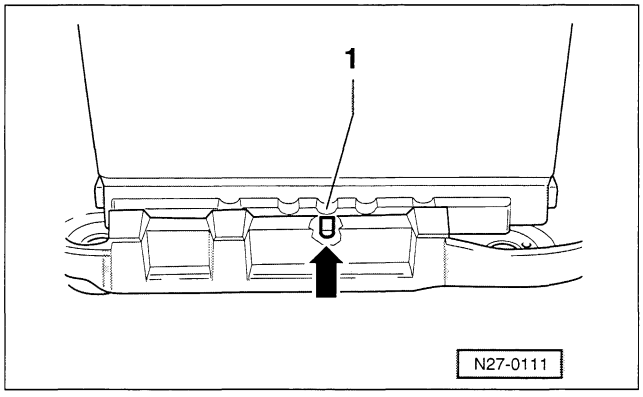
– Remove battery heat insulation jacket (if equipped).



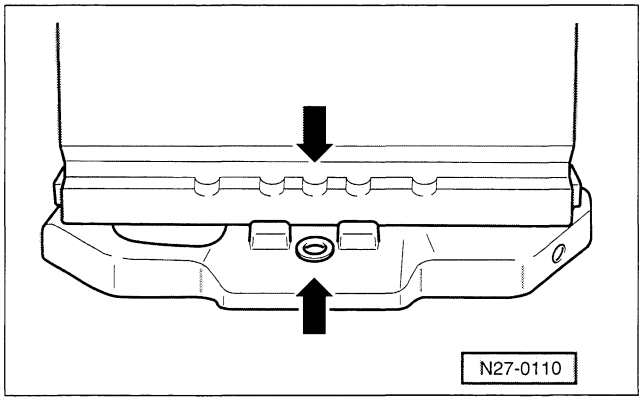
➤ Remove two mounting screws (**arrows**) and plastic cover mounted between battery and rear of headlight.



Remove mounting bolt and battery clamping bracket (**arrow**).



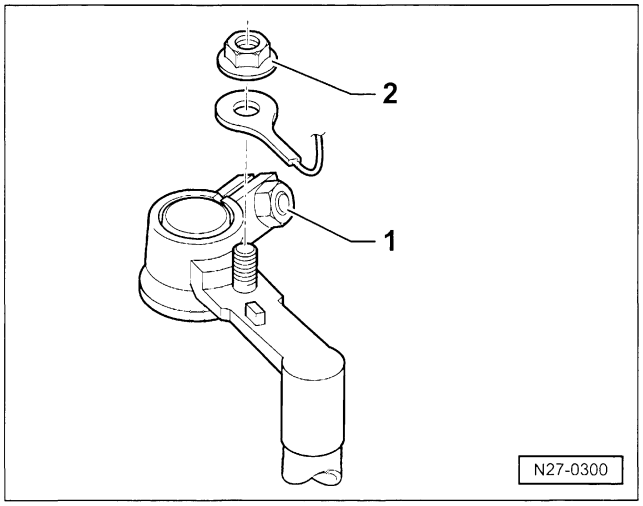
Install battery so lug (**arrow**) of battery tray engages in battery foot strip groove (**1**).



The battery is correctly installed when center groove in battery foot strip (**upper arrow**) aligns with threaded hole (**lower arrow**) in battery carrier.

WARNING —

- *To be sure the battery seats securely, only install batteries with a 10.5 mm battery foot strip.*
- *On batteries with hose for central venting make sure venting hose is not kinked. Only then can battery vent freely.*
- *On batteries without central venting make sure opening on upper side of battery cover is not blocked.*



Install battery clamping bracket and tighten bolts and nuts as specified.

Tightening torque

- Battery clamping bracket bolt . . . . . 25 Nm (18 ft-lb)
- Battery terminal clamp nuts/bolts (**1**) . . . . . 6 Nm (53 in-lb)
- Battery terminal additional clamp nuts/bolts (**2**), ... 6 Nm (53 in-lb)

– Remaining installation is reverse of removal, noting the following points:

  • Be sure the battery is secured properly.
  • Connect all battery positive (+) connections before installing negative (-) battery clamp.

  • Be sure to perform procedure following interruption of voltage supply as described below.

Procedure following interruption of voltage supply

NOTE —
If the Voltage supply is interrupted, the Engine Control Module loses all the "learned" and/or "basic" values. As a result, severe driveability problems may occur depending on vehicle mileage.

Special tools, testers, measuring instruments and auxiliary items required

• VAG 1551/1552 Scan Tool with VAG 1551/3B adaptor cable

Perform the following operations after "Voltage supply open circuit" display appears in scan tool display.

– Switch ON ignition for at least 10 seconds.

– Switch OFF ignition.

– Adapt the Engine Control Module to the Throttle Valve Control Module, see **Scan Tool** section at the back of manual.

– For vehicles equipped with automatic transmissions, the kick down shift point must be adapted (adapt Transmission Control Module (TCM) to ECM), see **Scan Tool** section at the back of manual.

– Test drive until any driveability complaints are eliminated. During the road test the following operating conditions must be fulfilled:

  • The Engine Coolant Temperature must exceed 80 °C.
  • Once the required temperature is reached, the following operating conditions must be attained several times.
  • Closed Throttle position
  • Part Throttle position
  • Wide Open Throttle position
  • Overrun
  • With Wide Open Throttle engine speed must exceed 3500 rpm.

– Completely open and close all power windows. Enter anti-theft radio code and check function of radio, tape player and CD changer. Reset clock and check function of all other electrical consumers.

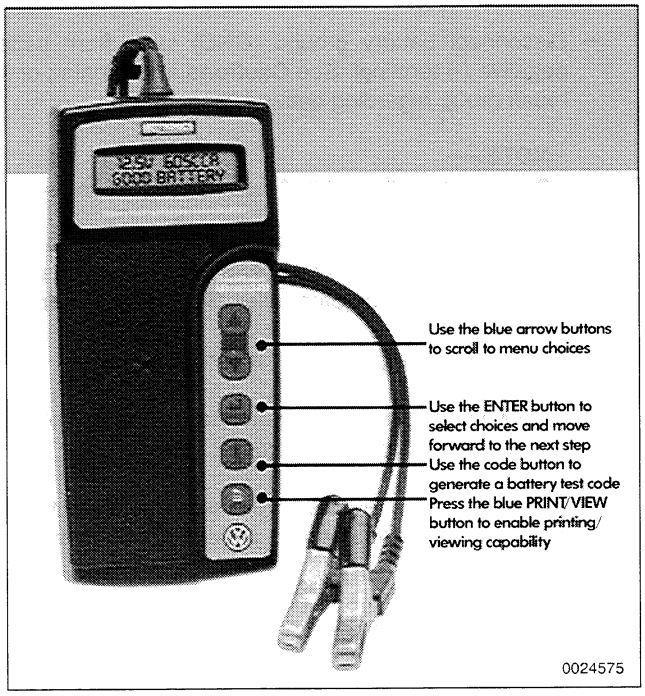
CHARGING SYSTEM SERVICE

Charging system trouble is indicated by an illuminated generator warning light on the instrument panel, or by an under or overcharged battery.

The generator generates electrical current by electrical induction. When the engine is running, part of the current it produces energizes its electromagnetic field. When starting, some other current must be provided to initially energize the field and begin the current generating process. This current is provided by the battery through the generator warning light in the instrument cluster. If the lamp burns out, the generator will not charge the battery properly.

> ***WARNING —***
> - *Always disconnect the negative (–) battery cable before servicing the charging system. The large red wire at the rear of the generator comes directly from the battery and is not fuse protected.*
> - *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased.*

As a quick-check, measure the voltage across the battery terminal with the key off and then again with the engine running. The battery voltage should be about 12.6 volts with key off and approximately 14.0 volts with the engine running. If the voltage does not increase when the engine is running, there is a fault in the charging system.



Testers such as the Volkswagen-approved Midtronics MCR340V are required to accurately test the battery, charging, and starting system. This type of tester also has a printer to record test readings.

> ***NOTE —***
> *The regulated voltage (engine running) should be roughly between 13.8 and 14.5 volts, depending on temperature and operating conditions. If the voltage is much higher than 14.5 volts, the voltage regulator is most likely faulty.*

Charging system, testing

- Inspect poly-ribbed drive belt for cracking, glazing or wear. Replace belt if any faults are found. Check that belt is not slipping and that belt tension is correct.
- Make sure battery is fully charged and capable of holding a charge. Make sure battery terminals are clean and tight.
- Check that charge warning lamp comes on when key is on. If light comes on, proceed to next step. If light does not come on, repair any wiring or bulb faults before continuing test.

NOTE —
The charge warning light must come on when the ignition is switched on or the system may not charge. If any faults are found, see **97 Wiring Diagrams, Fuses and Relays** *for electrical schematics.*

- Check for battery voltage between ground and terminal **B+** (large red wire) at the back of generator. Check that wire is securely fastened.

- Turn ignition key on and check for battery voltage between terminal **D+** and ground. If voltage is not present, check wiring from warning light in instrument cluster.

- If no faults are found up to this point, have generator tested with a load tester, such as the Midtronics MCR340V or equivalent.

NOTE —
If a load test is not possible, an imperfect output test can be done by running the engine at about 2000 rpm and turning on many of the electrical loads such as fans, lights and heated window, wipers, etc. When loaded, the battery should still be 12 volts or higher.

Generator, removing and installing

NOTE —
The alternator is identified as generator by the vehicle manufacturer. Car makers must by law use uniform words and terms (nomenclature) to describe certain components and or systems. The uniform word for alternator is generator. Therefore, the component labeled "Generator (GEN)" in the wiring diagrams is the alternator.

- Disconnect battery ground (GND) strap from battery negative (-) terminal. See **Cautions** at beginning of this repair group regarding battery disconnection.

NOTE —
Be sure to have the anti-theft radio on hand before disconnecting the battery cables.

- Mark running direction on poly-ribbed drive belt and remove belt from generator pulley. See **0 Maintenance**.

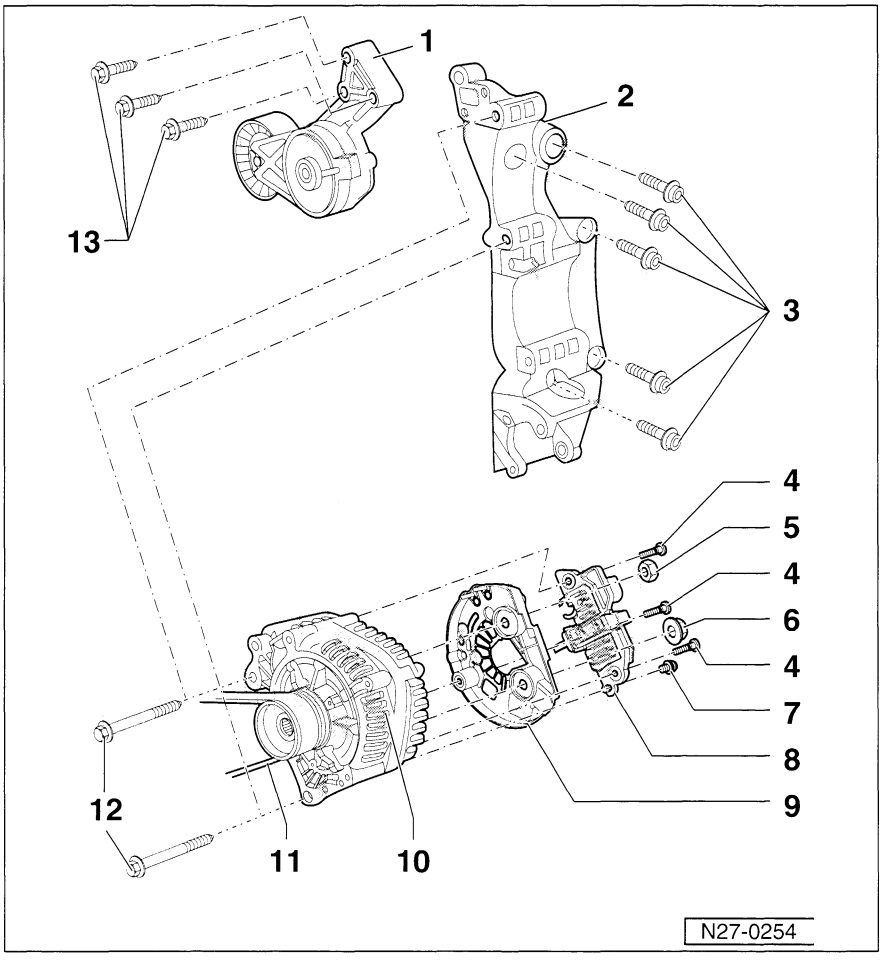
- Disconnect wiring from rear of generator.

- Remove upper and lower generator mounting bolts and remove generator from its bracket.

- Installation is the reverse of removal. Tightening torques are given in the appropriate generator overview on the following pages.

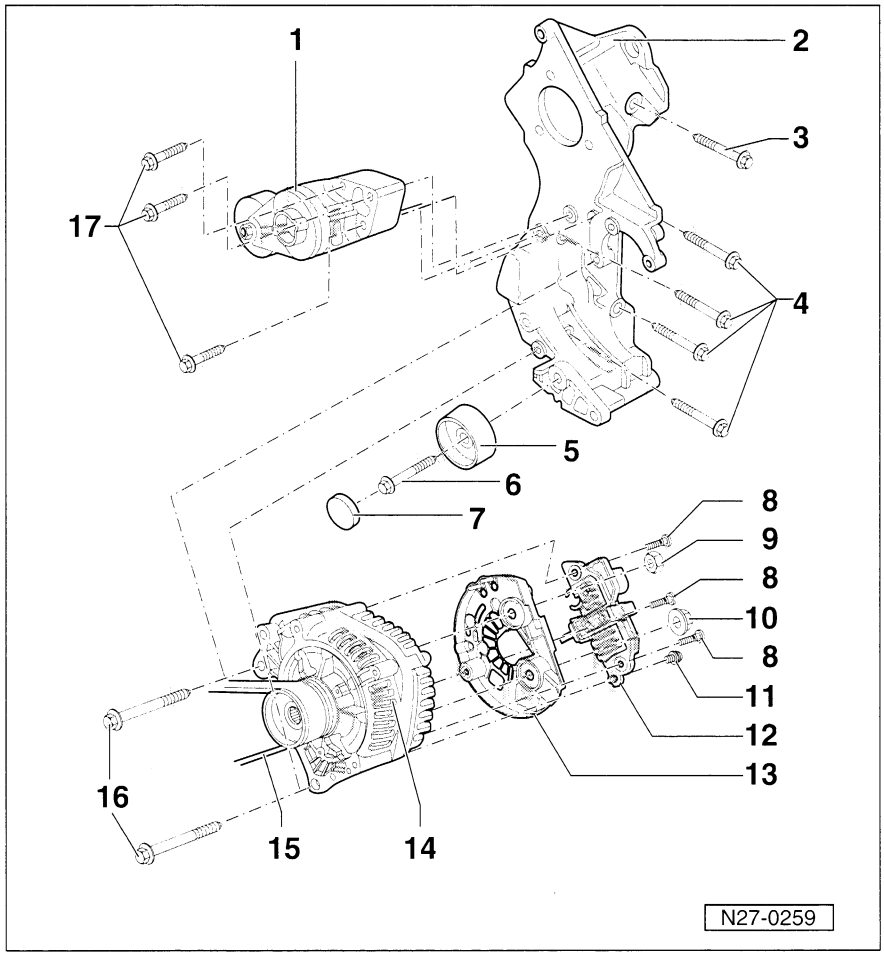
- Be sure to quality check your work, see **Quality Review** at the end of this repair group.

Generator overview (1.8L, 2.0L, 1.9L PD TDI engine)



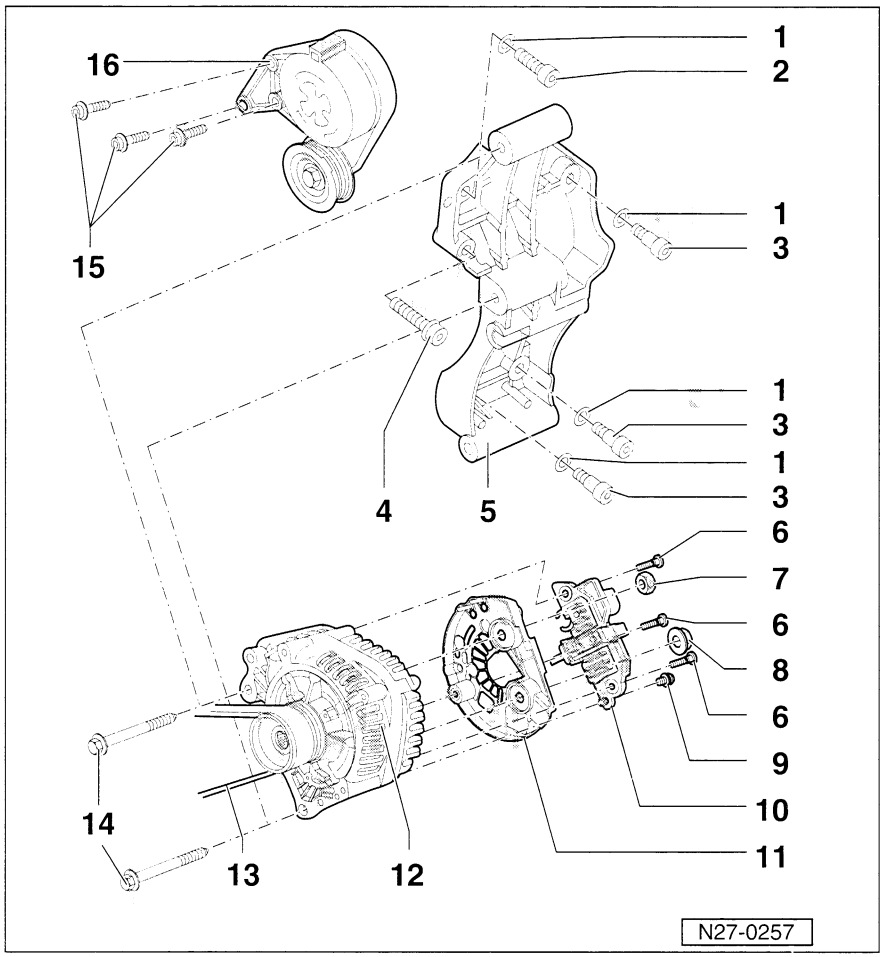
1. **Tensioner assembly**
2. **Bracket**
3. **Bolts, socket head**
   - M10 x 45mm
   - Tighten to 45 Nm (33 ft-lb)
4. **Screws**
   - M3 x 18mm
5. **Nut, hex head (M8)**
6. **Nut, hex head**
   - M8: tighten to 15 Nm (11 ft-lb)
   - M10: tighten to 45 Nm (33 ft-lb)
7. **Screws**
   - M4 x 25mm
8. **Voltage Regulator (VR)**
   - Not serviceable from m.y. 2001
   - See **Regulator brushes, checking**
9. **Protective end cap**
   - Not removable from m.y. 2001
10. **Generator**
    - Tighten M8 nut of B+ wire to generator to 15 Nm (11 ft-lb)
    - Tighten M10 nut of B+ wire to generator to 45 Nm (33 ft-lb)
11. **Ribbed belt**
    - Removing and installing, see **0 Maintenance**
12. **Bolts, generator mounting**
    - M8 x 85mm
    - Tighten to 25 Nm (18 ft-lb)
13. **Bolts, tensioner assembly mounting**
    - M8 x 45
    - Tighten to 25 Nm (18 ft-lb)

Generator overview (1.9L TDI engine)



1. **Tensioner assembly**
2. **Bracket**
3. **Bolts, hex head**
   - M10 x 45mm
   - Tighten to 45 Nm (33 ft-lb)
4. **Bolts, hex head**
   - M10 x 65mm
   - Tighten to 45 Nm (33 ft-lb)
5. **Relay roller**
6. **Bolts, hex head**
   - M8 x 50mm
   - Tighten to 25 Nm (18 ft-lb)
7. **Protective cap**
8. **Screws**
9. **Nut, hex head (M8)**
10. **Nut, hex head (M8)**
11. **Screw**
12. **Voltage Regulator (VR)**
    - Not serviceable from m.y. 2001
    - See **Regulator brushes, checking**
13. **Protective end cap**
    - Not removable from m.y. 2001
14. **Generator**
    - Tighten nut of B+ wire to generator to 15 Nm (11 ft-lb)
15. **Ribbed belt**
    - Removing and installing, see **0 Maintenance**
16. **Bolts, generator mounting**
    - M8 x 85mm
    - Tighten to 25 Nm (18 ft-lb)
17. **Bolts, tensioner assembly mounting**
    - M8 x 45mm
    - Tighten to 25 Nm (18 ft-lb)

Generator overview (2.8L engine)



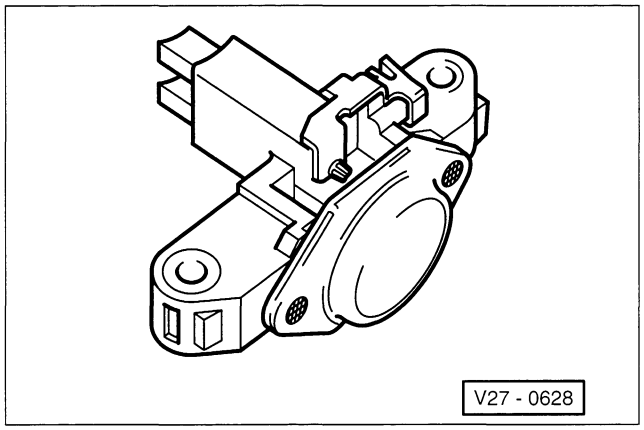
1. **Washers**
2. **Bolt, socket head**
   - M8 x 30mm
   - Tighten to 25 Nm (18 ft-lb)
3. **Bolts, shouldered socket head**
   - M8 x 28mm
   - Tighten to 25 Nm (18 ft-lb)
4. **Bolt, socket head**
   - M8 x 30mm
   - Tighten to 25 Nm (18 ft-lb)
5. **Bracket**
6. **Screws**
7. **Nut, hex head (M8)**
8. **Nut, hex head (M8)**
9. **Screw**
10. **Voltage Regulator (VR)**
    - To remove and install, remove items 6, 7, 8
    - See **Regulator brushes, checking**
11. **Protective cap**
    - Not removable from m.y. 2001
12. **Generator**
    - Tighten nut of B+ wire to generator to 15 Nm (11 ft-lb)
    - Available in 70A, 90A, and 120A
13. **Ribbed belt**
    - Removing and installing, see **0 Maintenance**
14. **Bolt, socket head**
    - M8 x 85mm
    - Tighten to 25 Nm (18 ft-lb)
15. **Bolt, socket head**
    - M8 x 30mm
    - Tighten to 25 Nm (18 ft-lb)
16. **Tensioner assembly**

Regulator brushes, checking

1999 m.y.

– On 1999 m.y. (through 04.99 production) generators, remove screws or bolts securing protective end cap on generator. Remove end cap.

– Remove mounting screws/bolts for voltage regulator and voltage regulator assembly with carbon brushes.



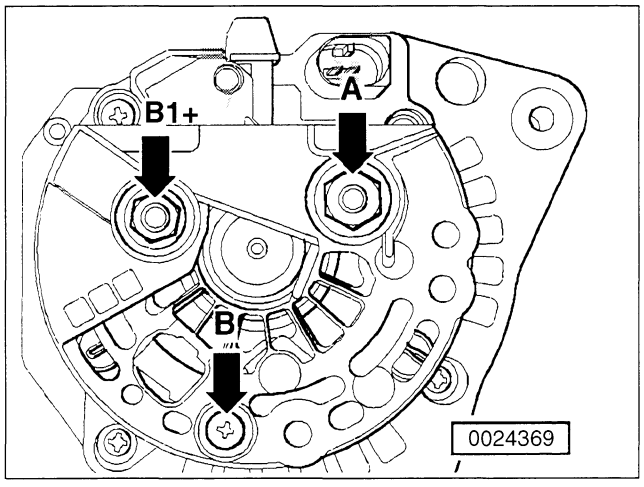
➤ Measure the length of carbon brushes.

Voltage regulator brushes (all)

- Length of new brushes . . . . . 12 mm (1.5 in.)
- Wear limit . . . . . 5 mm (0.19 in.)
- Tolerance (difference between length of each brush) . . . . . + 1 mm (0.03 in.)

2000 m.y.

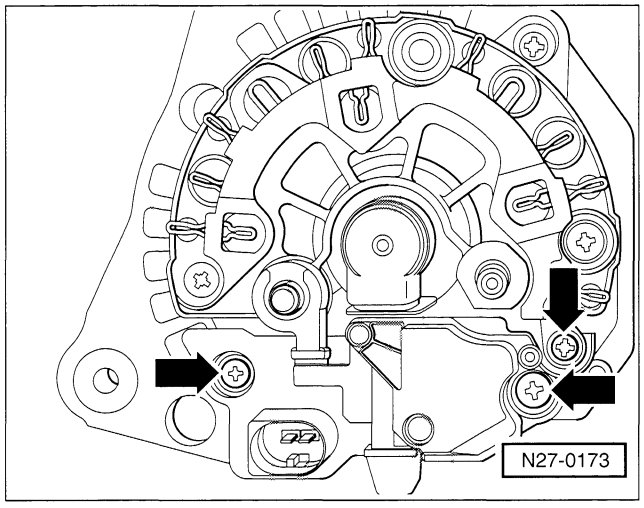
For model year 2000 (from 05.99 production) generators are being implemented with new structures and terminal assignments. They have a modified voltage regulator, and an oval, radially sealed connector mount for the 2-pin harness connector.



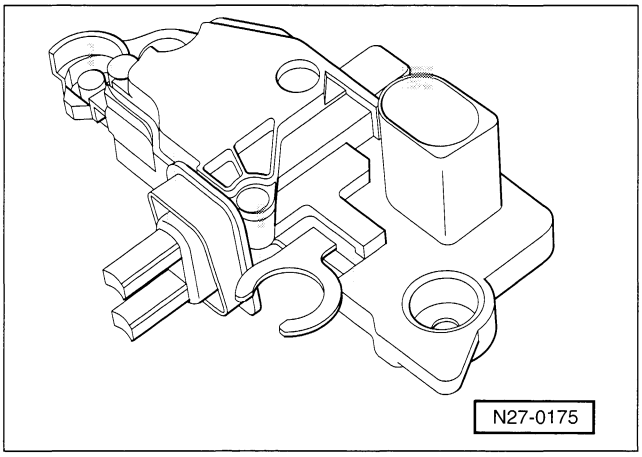
➤ On 2000 and later m.y. compact generators, remove hex nuts (**arrows A** and **B1+**) and mounting screw (**arrows B**) for protective end cap. Remove end cap.

NOTE —

The new compact generator terminal B+ (battery positive) is marked B1+ at the generator terminal.



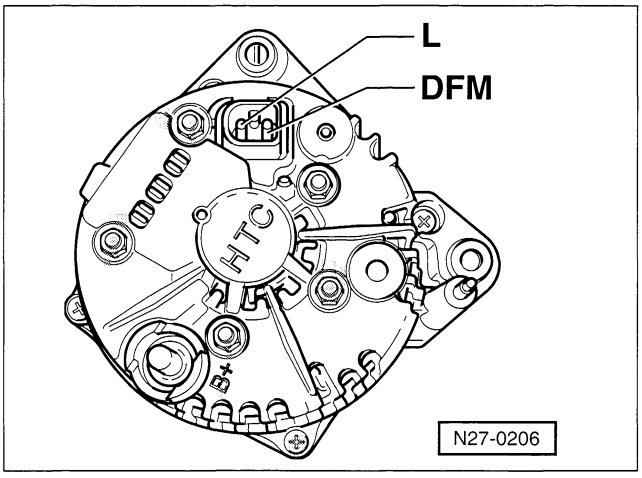
➤ Remove voltage regulator mounting bolts (**arrows**) and voltage regulator assembly with carbon brushes.



➤ Measure length of carbon brushes and compare to specification.

Voltage regulator brushes (all)

- Length of new brushes . . . . . 12 mm (1.5 in.)
- Wear limit . . . . . 5 mm (0.19 in.)
- Tolerance (difference between length of each brush) . . . . . + 1 mm (0.03 in.)



2001 m.y. on

➤ From model year 2001, a modified compact generator is used. The terminal designations are shown at left. The new generators have no removable rear cap to service the voltage regulator. If the voltage regulator is faulty the entire generator will need to be replaced.

STARTER SERVICE

The starter is located below the engine on the left-hand side, bolted to the forward part of transmission. The starter and solenoid are removed together as an assembly. The solenoid can be separated from the starter motor once the starter has been removed. Although the starter is generally replaced as an exchange unit, the solenoid and other parts are available from an authorized Volkswagen dealer.

All vehicles have a lock-out relay for the starter which is controlled by the alarm system. For location of relays, see **97 Wiring Diagrams, Fuses and Relays**.

In addition, vehicles equipped with manual transmissions have a starter lock-out function requiring the clutch pedal to be depressed before the starter can be activated. This system consists of a pedal switch and a relay on the fuse-relay panel.

Vehicles equipped with automatic transmissions have a park/neutral position relay that prevents the vehicles from being started if the gear selector is not in the P (Park) or N (Neutral) position.

Before troubleshooting the starter, make sure the battery is fully charged and the battery cables and ground connections are free of corrosion and in good condition. Troubleshooting information for the starting system appears in **Table c**.

NOTE —
Starter cranking speed is affected by engine oil viscosity, especially in cold weather. Make sure the correct oil is in the engine. See **0 Maintenance.**

Specification

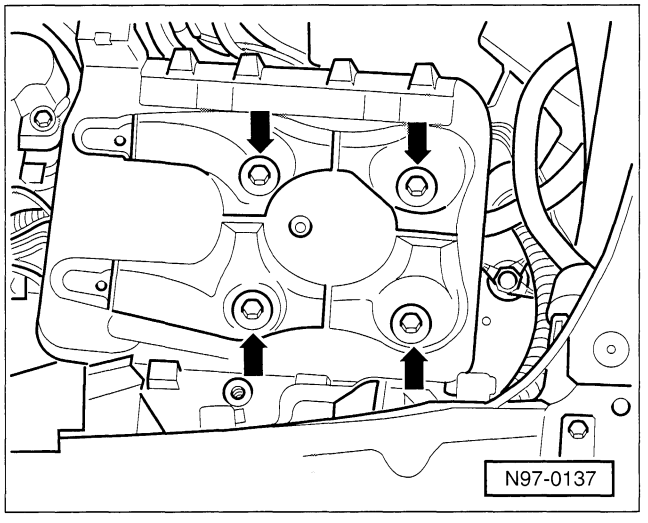
- Starter rating
  - 1.8L and 2.0L engines . . . . . 1.1 kW (1.48 hp)
  - 1.9L and 2.8L engines . . . . . 2.0 kW (2.68 hp)

Table c. Starter System Troubleshooting

Symptom	Probable cause	Corrective action
1. Starter does not operate when ignition switch is turned to START	**a.** Ignition switch or wire leading from ignition switch to solenoid faulty (less than 8 volts to solenoid)	**a.** Test for voltage at terminal 50 of solenoid with ignition at START. If not at least 8 volts, test for voltage at terminal 50 of ignition switch with switch at START. Replace ignition switch or eliminate open circuit between ignition switch and solenoid.
	b. Automatic transmission Park/Neutral position (PNP) relay faulty	**b.** Test relay. See **97 Wiring Diagrams, Fuses and Relays** and **37 Automatic Transmission.**
	c. Starter lock-out switch or relay faulty (manual transmission only)	**c.** Test switch and relay. See **97 Wiring Diagrams, Fuses and Relays.**
2. Starter turns slowly or fails to turn engine	**a.** Dirty, loose, or corroded starter connections	**a.** Clean, and tighten connections. If necessary check voltage drop between the battery and the starter as described in **9 Electrical System—General.**
	b. Dirty, loose, or corroded ground strap between engine and body	**b.** Remove and clean or replace strap.
	c. Starter worn or faulty	**c.** Repair or replace starter.
3. Starter operates, but does not turn engine	**a.** Flywheel or driveplate teeth missing or damaged	**a.** Replace flywheel or driveplate.
	b. Starter drive or armature shaft faulty	**b.** Repair or replace starter.
	c. Solenoid mechanism faulty	**c.** Replace starter solenoid.

Starter, removing and installing

– Disconnect battery ground (GND) strap from battery negative (-) terminal. See **Cautions** at beginning of this repair group regarding battery disconnection.

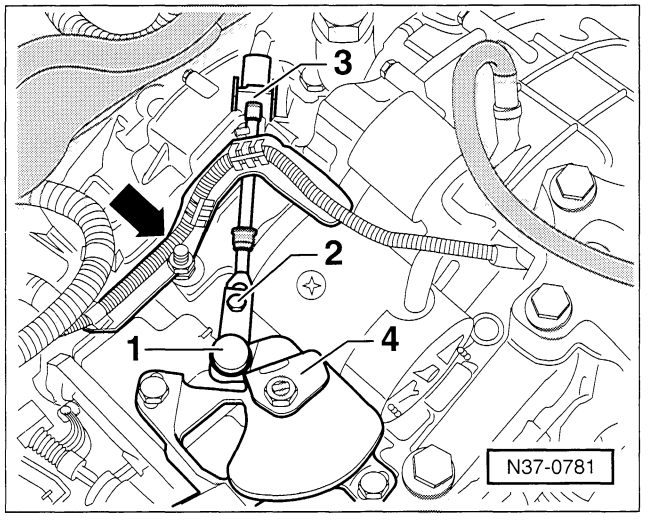


NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.

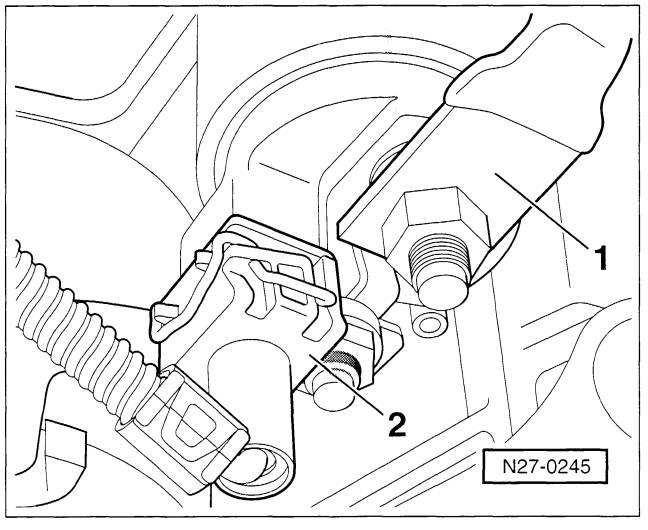
➤ Remove battery as described earlier. Remove battery tray mounting bolts (**arrows**) and battery tray.

Vehicles with 5-speed automatic transmission (code: 09A)

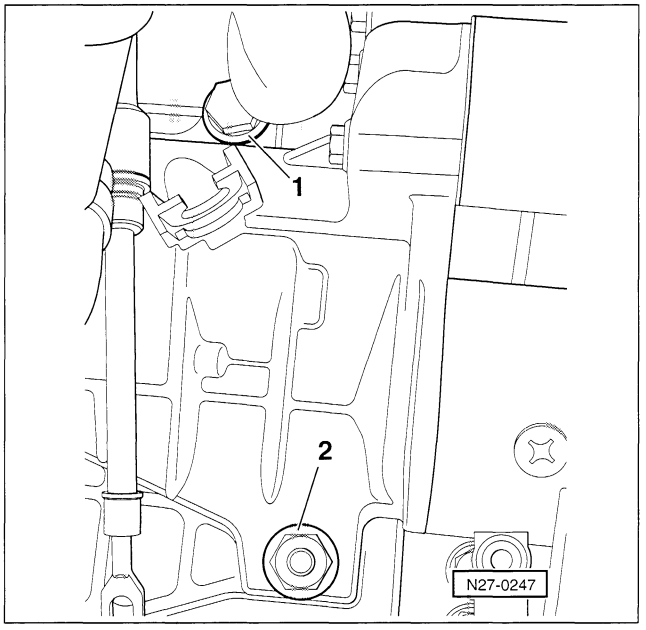
– Remove intake air hose and air filter assembly, see **24 Fuel Injection**.



➤ Ensure transmission is in "Park" and remove bracket (**arrow**) and pry off shift lever cable end (**1**) from shift lever (**4**) with screwdriver. Unclip shifter cable from holder (**3**) and set aside. Do not remove screw (**2**) or kink shifter cable.

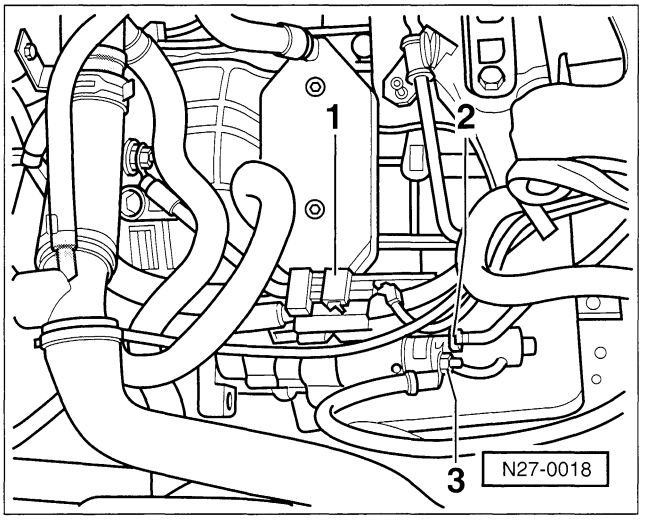


➤ Remove plastic nut cover and nut at solenoid terminal 30 (battery positive (+) and remove cable (**1**). Disconnect electrical connection at terminal 50 (**2**).



➤ Remove upper mounting bolts (**1** and **2**) and lift starter up and out from transmission.

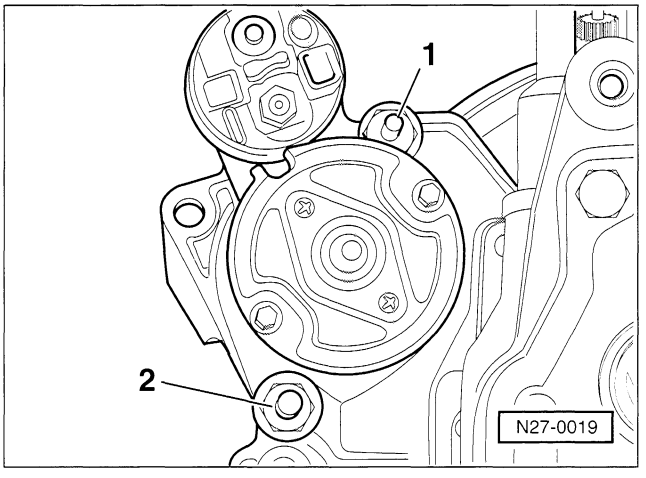
Vehicles with manual transmission or 4-speed automatic (code: 01M)



➤ Disconnect starter harness connector (**1**) and connection at terminal 50 (**2**) and terminal 30 (**3**) for battery positive (+) cable.

– Remove lower sound absorber panel(s) (belly pan).

– Remove brackets and retainers for power steering lines and place connected lines to side.



➤ Remove starter mounting bolts (**1** and **2**) and starter.

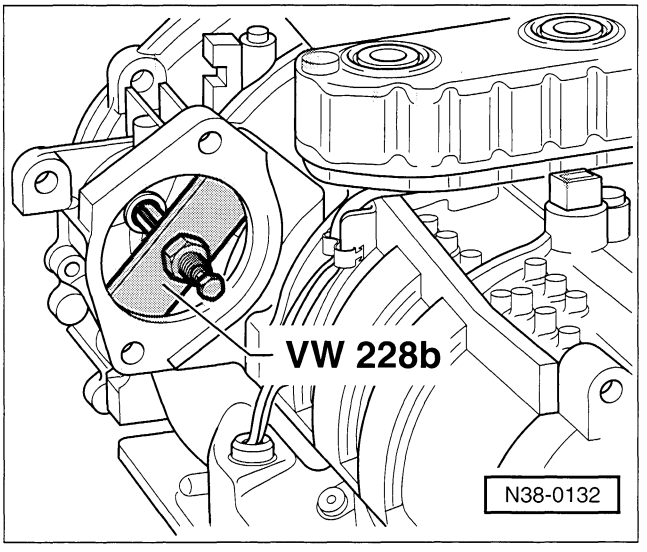
Tightening torque (all vehicles)

- Starter to transmission . . . . . 65 Nm (48 ft-lb)
- Battery positive (+) cable to starter . 13 Nm (10 ft lb)

Starter terminal designation

- Switched battery positive (+) from ignition/starter switch . . . . . terminal 50
- Battery positive (+), hot at all times . . . . . terminal 30

– Installation is the reverse of removal. Be sure to install a new starter bushing as described below.



Starter bushing, removing and installing

– Remove starter as describe above.

➤ Use Volkswagen special tool VW 228b, or similar to extract the starter bushing. (Automatic transmission shown at left, manual is similar).

– Use Volkswagen special tool VW 222a or similar to install a new starter bushing.

CRUISE CONTROL

All cruise control system functions are controlled by the engine control module (ECM). The processing of electronic engine controls and cruise control functions are integrated in the ECM. Other than the cruise control switches on the steering column, the clutch and brake pedal switches and related wiring and fuses, there are no separate cruise control components to be serviced.

As the electronic throttle control operations (with the exception of the 2.0L AEG engine) are monitored by On-Board Diagnostic (OBD), Diagnostic Trouble Codes (DTCs) pertaining to engine electronics that are stored in the DTC memory may be relevant to cruise control function. Always check DTC memory using a scan tool first before troubleshooting the cruise control system. See **ST Scan Tool Codes** at the back of this manual.

If the ECM has been replaced on all but the AEG 2.0L engine the cruise control system may need to be activated using a scan tool such as the VAG 1551, 1552, 5051 or equivalent. **Table D** shows the various activation and deactivation codes for the cruise control system and ECM.

Table d. Cruise control and ECM activation codes

Engine (code) and model year	Activation code	Deactivation code
1.8L (AWD) and 2.8L (AFP) - m.y. 1999	00003	00004
1.9L (ALH) - m.y.1999➤	11463	16167
1.8L (AWD/AWW) - m.y. 2000➤	11463	16167
2.0L (AVH/AZG) - m.y. 2000➤	11463	16167
2.8L (AFP) - m.y. 2000➤	11463	16167

QUALITY REVIEW

When you have finished working under the hood and around other areas of the vehicle, it is advisable to take a moment to quality check or review your work. This helps to insure that the operation or repair has been completed properly with all affected systems functioning within normal parameters. These may include the following:

- Ensure battery is securely mounted, cables connections are tight, and battery cover is in place.

If the battery has been disconnected:

- Re-code radio and set clock.
- Check the operation of power windows and reset as necessary, see **57 Doors**.
- Reset basic setting for automatic transmission (as applicable) using VAG 1551/1552 or a suitable scan tool, or see **37 Automatic Transmission**.
- Reset basic settings for engine and OBD II readiness codes as required using VAG 1551/1552 or a suitable scan tool. See **Scan Tool** section at the back of this manual.

28a Ignition System–Gasoline

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28a

GENERAL

The ignition functions of the 1.8L, 2.0L and 2.8L gasoline engines are controlled by the Motronic engine management system. The Engine Control Module (ECM) computes ignition timing based on inputs from various sensors. Crankshaft speed from the crankshaft position (RPM) sensor (G28) and engine load from the Mass Air Flow (MAF) sensor (G70) are the two main inputs used to calculate the basic ignition timing point. The other sensors, including two knock sensors are used by the ECM to modify and correct the ignition timing point based on changing operating conditions.

WARNING —

Disconnecting the negative (–) battery cable may erase fault codes and basic settings in engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) will need to be re-set using Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program.

Fuel Systems–Gasoline

- 1.8L (AWD, AWW, AWP) . . . . . Motronic ME 7.5
- 2.0L (AEG) . . . . . Motronic 5.9
- 2.0L (AVH, AZG, BBW, BEV) . . . . . Motronic ME 7.5
- 2.8L (AFP, BDF) . . . . . Motronic ME 7.1

NOTE —

- *The Motronic fuel systems are all OBD II compliant. It is recommended that fault diagnosis and troubleshooting be carried out using Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program. See* **ST Scan Tool** *at back of manual for a list of diagnostic trouble codes (DTCs) and scan tool suppliers.*
- *For spark plug and individual ignition coil removal and installation, see* **0 Maintenance**.

Service precautions

Ignition system service and repair work must be carried out carefully. The ignition system contains sensitive electronic components. To guard against system damage, and for personal and general safety, the following warnings and cautions apply to any ignition system troubleshooting, maintenance or repair work.

WARNING —

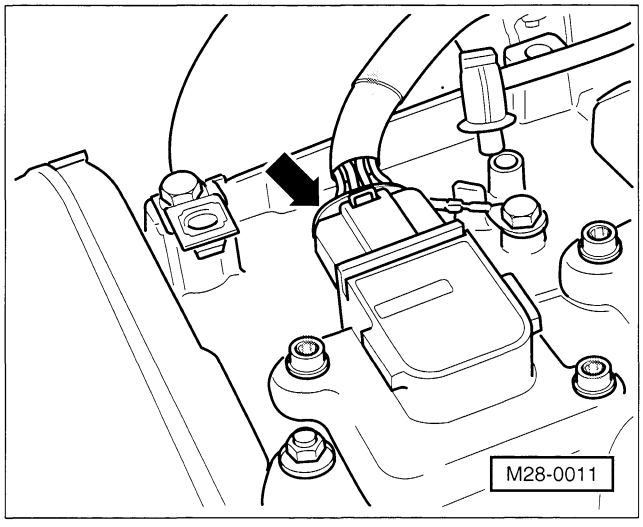
- *Ignition systems operate in a dangerous voltage range that could prove to be fatal if exposed terminals or live parts are contacted. Use extreme caution when working on a vehicle with the ignition on or the engine running.*
- *Connect and disconnect ignition system wires, terminal connectors and test equipment leads only while the ignition is off unless specifically instructed otherwise. Do not touch or disconnect any of the high voltage wires from the coil pack or spark plugs while the engine is running or being cranked by the starter.*

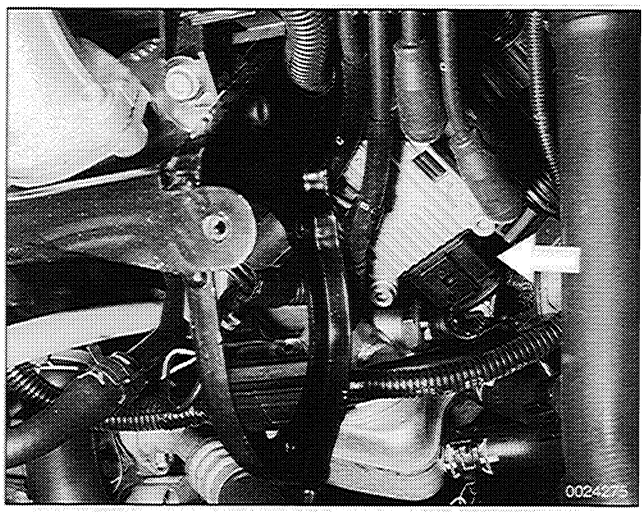
Disabling ignition system

If the engine must be turned at starter speed without starting, the ignition system should be disabled to prevent the discharge of dangerously high voltage. This should be done any time repairs or maintenance are performed on the engine with the ignition key on or if the starter needs to be operated without running the engine. The ignition coils are mounted low on the front of the cylinder block behind the secondary air injection pump.

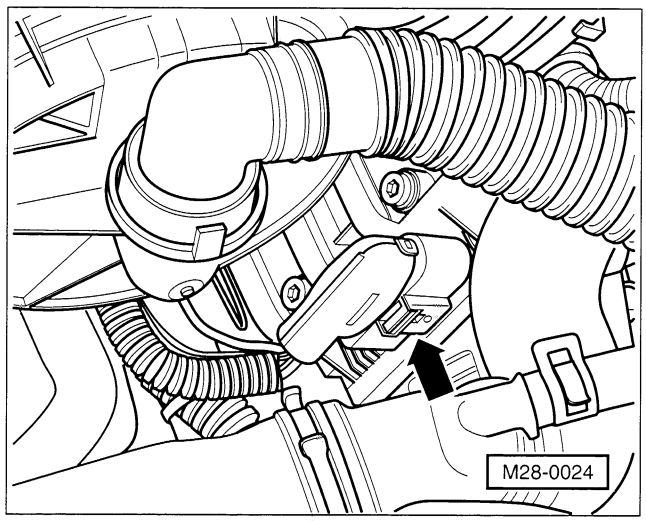
– Disconnect harness connector from ignition coil power output stage or from each individual ignition coil as described below for the various gasoline engines.

➢ **1.8L** engine; disconnect harness connector (**arrow**) from each ignition coil. (AWD engine shown, others similar)

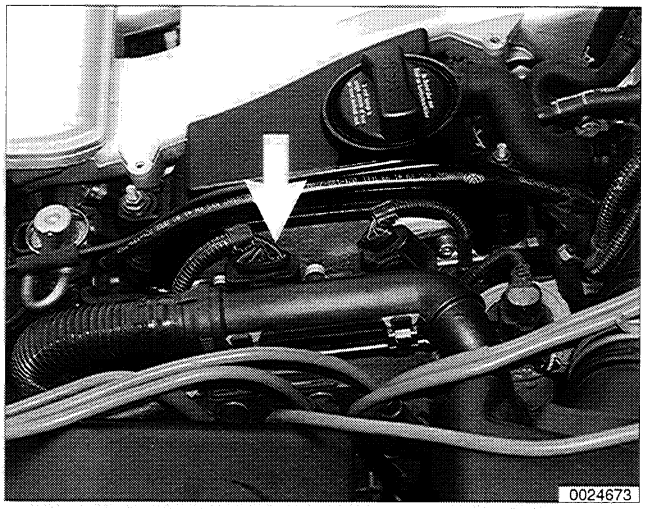




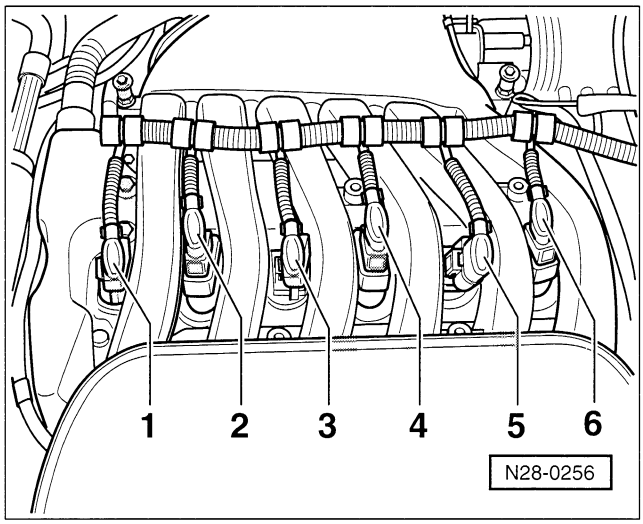
➤ **2.0L (AEG)** engine; disconnect 4-pin harness connector (**arrow**) at ignition coil output stage. Secondary air pump has been removed for clarity in illustration at left.



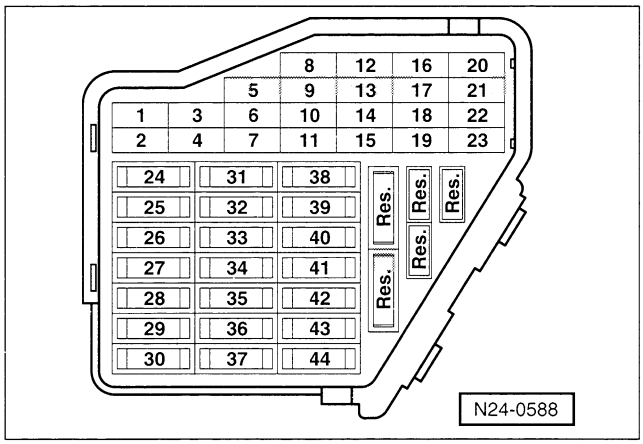
➤ **2.0L (AVH, AZG)** engine; disconnect 6-pin harness connector (**arrow**) at ignition coil output stage.



➤ **2.8L (AFP)** engine; disconnect the 5-pin ignition coil harness connector (**arrow**).



➤ **2.8L (BDF)** engine; disconnect harness connector (**1** through **6**) from each ignition coil.



➤ Remove fuse for fuel injectors.

- 2.8L 24-valve (code: **BDF**) engine; fuse **29**
- All other engines; fuse **32**

IGNITION SYSTEM TROUBLESHOOTING

Poor driveability may have a variety of causes. The fault may lie with the ignition system, the fuel system, parts of the emission control system, or a combination of the three. Because of the interrelated functions of these systems, it is often difficult to know where to begin looking for problems. For this reason, when troubleshooting always consider these systems in unison, as one major system.

A complete failure of the ignition system to produce spark at the spark plugs is self-evident. For other problems such as rough idle, misfiring, or poor starting the cause may not be so clear. The engine management system has a built in diagnostic circuit that monitors the ignition system components and detects and stores system faults. Before troubleshooting the ignition system, always check for diagnostic trouble codes (DTCs) using a suitable scan tool such as VAG 1551/1552 or equivalent

NOTE —

Continued operation of the engine with a misfire will result in serious damage to the catalytic converter.

Quick-check of ignition system

The first step in troubleshooting a no-start condition is to determine whether the problem is caused by the ignition system or some other system, such as a fuel delivery problem. This is done by checking that the spark plugs are firing. If no spark is present, a more detailed testing of the ignition system is necessary.

– Turn the ignition off and use appropriate special tool listed below to remove a spark plug connector or individual coil from a spark plug.

Plug wire/ignition coil removal special tools

- 2.0L (AEG, AVH, AZG) and 2.8L (AFP) . . . . . T10029 or T10112
- 1.8L (AWD). . . . . bolted in (no special tool needed)
- 1.8L (AWW, AWD) . . . . . T10094 or T40039
- 2.8L (BDF) T10095

– Connect the plug connector to a known good spark plug.

– Position the plug so that the outer electrode is grounded on the engine block.

NOTE —
For accurate test results, the battery should be fully charged.

WARNING —
Never let the spark plug gap (between electrode and ground) exceed 5 mm (0.20 in.) when checking for a spark, as the power output stage may be damaged. Always ground the plug on the engine when checking for spark.

– While a helper actuates the starter, look and listen for a spark at the plug. A bright blue spark indicates a healthy ignition system.

– If there is no spark, visually ensure that the engine speed sensor plug is connected properly and that the speed sensor is secured into the mount in the cylinder block. If the above inspection reveals no obvious defects, then test the ignition coil output stage and the ignition coil(s) as described later.

WARNING —
- *Do not hold the spark plug or its connector during the test, even if using insulated pliers.*
- *If ignition system failure is not the problem, the engine may start during this test. Be prepared to switch the ignition off immediately. Running the engine with a spark plug wire disconnected may damage the catalytic converter.*

Specification

- Ignition firing order, (4-cylinder engines) 1-3-4-2
- Ignition firing order, (6-cylinder engine) . . 1-5-3-6-2-4

Spark plug wires/connectors, checking resistance (2.0L and 2.8L AFP engine)

On all engines, spark plug wires suppress radio frequency (RF) interference through the use of resistors built into the ends of the plug wires. On 2.0L and AFP 2.8L engines, the resistance can be measured.

– Disable ignition system as described earlier.

– Disconnect spark plug wire from spark plug using special tool T10029 or T10112 as appropriate. Do not pull on the wires by hand.

– Disconnect spark plug wire from ignition coil.

– Measure resistance of spark plug wires with connectors and compare to specification.

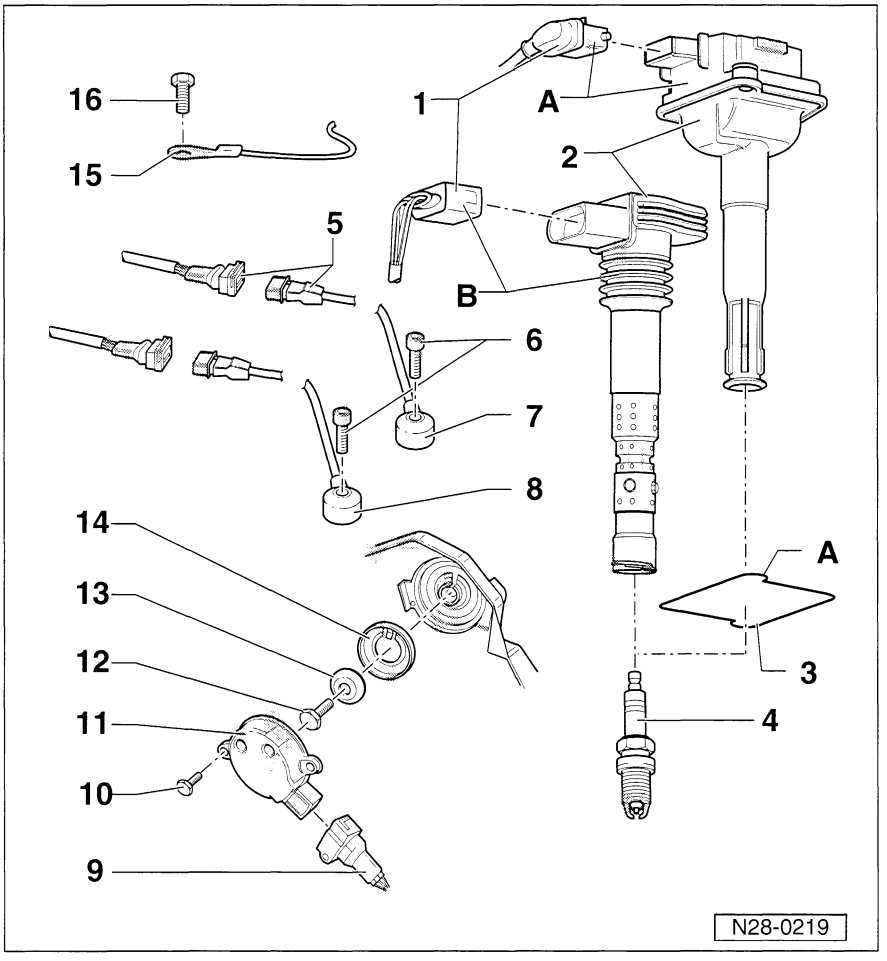
Specification

- Resistance of spark plug wire with connector
  2.0L engine . . . . . 4000 to 8000 ohms
  2.8L engine (code: AFP) . . . . . 4000 to 6000 ohms

IGNITION SYSTEM (1.8L ENGINE)

The ignition system of the 1.8L engine requires little or no periodic maintenance due to the distributor-less nature of its design. Most of the components are monitored by the engine management system and a failure will cause a fault (DTC) to be stored in the engine control module. Engine misfiring can even result in a DTC being stored due to the potential for damage to the catalytic converter.

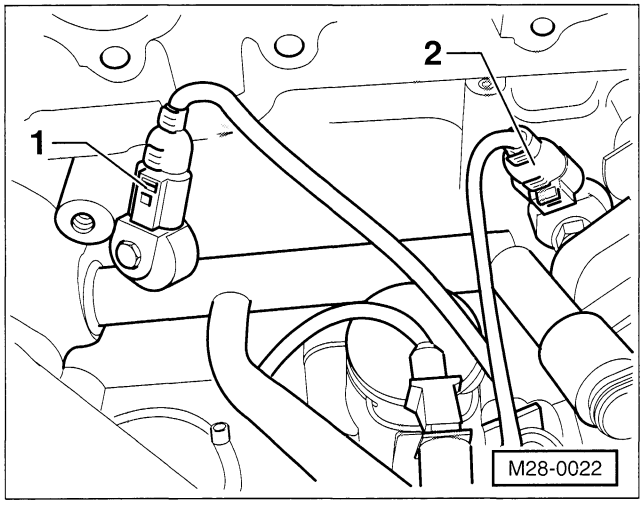
Ignition system components (1.8L engine)



A. Engine code: AWD

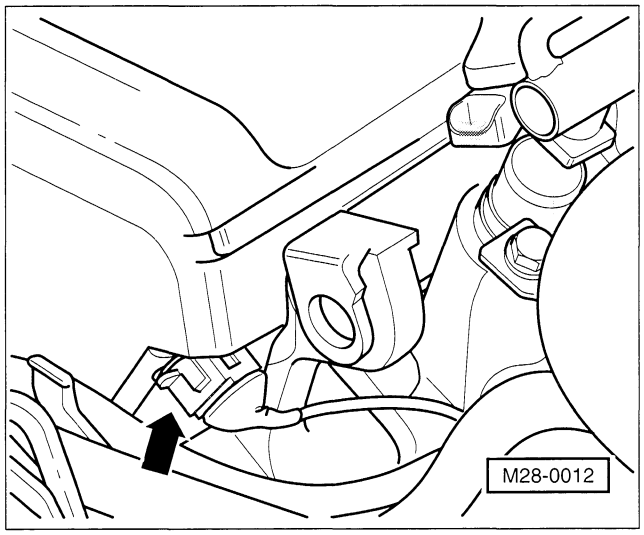
B. Engine code: AWP and AWW

1. **Harness connector, 4-pin black**
   - Separate connectors for each coil
2. **Ignition coil pack (N70, N127, N291, N292)**
   - With power output stages
   - AWD engine; tighten mounting bolts to 10 Nm (7 ft lb)
   - AWW, AWP engines; use T10094 or T40039 ignition coil removal tool
3. **Seal**
   - AWW engine only
   - Integral with coil pack
4. **Spark plug**
   - Tighten to 30 Nm (22 ft-lb)
   - Remove and install with 5/8 (16x mm) spark plug socket
5. **Harness connector, 3-pin**
   - For Knock Sensor (KS) 1, AWD: brown, AWW, AWP: black
   - For Knock Sensor (KS) 2, AWD, AWP, AWW: black
6. **Bolts**
   - Tighten to 20 Nm (14 ft-lb)
   - Tightening torque influences function of knock sensors
7. **Knock Sensor (KS) 1 (G61)**
   - Sensor and connector terminals are gold-plated
   - See **Knock sensor mounting locations**
8. **Knock Sensor (KS) 2 (G66)**
   - Sensor and connector terminals are gold-plated
   - See **Knock sensor mounting locations**
9. **Harness connector, 3-pin black**
   - Check for voltage between terminals 1 and 3 with ignition on; specification: minimum 4.5 volts
10. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
11. **Camshaft Position (CMP) sensor**
    - AWD: CMP 2 (G163)
    - AWP, AWW: CMP (G40)
    - Shutter wheel (rotor) mounted on camshaft, see **Camshaft position sensor location**
12. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
13. **Washer**
    - Conical shape
14. **Shutter wheel**
    - For camshaft position sensor
    - Note installation position
15. **Ground wire**
    - Remove and install only with ignition switched off
16. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)



Knock sensors, mounting locations (1.8L engine)

- Knock Sensor 1 (G61) monitors cylinders 1 and 2 and is mounted to the toothed belt end of cylinder block on the intake side.
- Knock Sensor 2 (G66) monitors cylinders 3 and 4 and is mounted to the transmission end of cylinder block on the intake side.
- Correct torque is critical for proper operation: Tighten to 20 Nm (15 ft-lb).
- Knock sensors begin functioning at engine speeds over 2000 rpm and 40% loads.

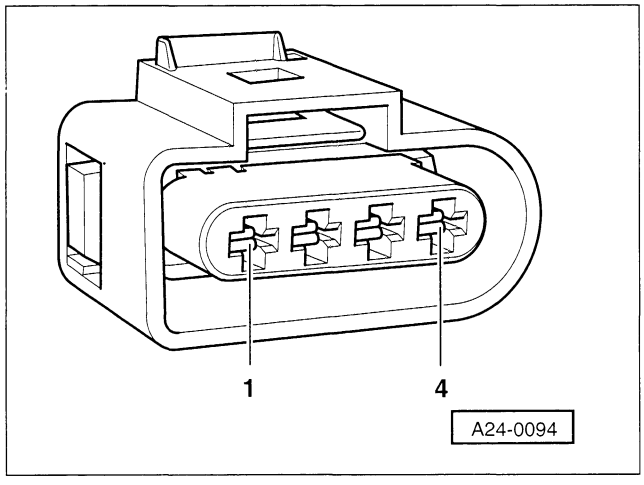


Camshaft position sensor location (1.8L engine)

- Camshaft position sensor is mounted to the front of the cylinder head on the intake side behind the upper toothed belt guard (arrow).
- Shutter wheel/rotor is mounted on the intake end of the camshaft.

Ignition coils and power output stage, testing (1.8L engine)

Individual ignition coils each with a power output stage are mounted above each spark plug. The power output stage takes the low power signal from the ECM and boosts it to a level usable by the ignition coils. The power output stage cannot be directly tested, but the signal from the ECM along with power and ground can be easily tested.



– Disable ignition system by disconnecting 4-pin harness connector from each ignition coil.

Connect an accurate digital voltmeter to disconnected connector at terminals 1 and 4.

– Switch on ignition and read voltage.

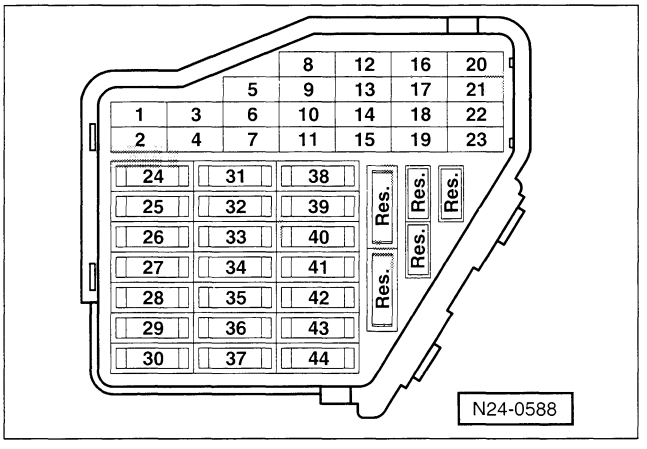
– Repeat for terminals 1 and 2.

– If voltage is present, proceed to next step. If no voltage is present, check for breaks or open circuits in the wiring, see **97 Wiring Diagrams, Fuses and Relays**.

Specification

• Voltage supply
power output stage . . . . . 11.5 Volts minimum

– Switch off ignition.



➤ Remove fuse 32 (for fuel injectors).

– Connect an LED test light (such as VAG 1527B) to disconnected coil harness connector at terminals 2 and 3.

WARNING —

• Use a high-quality digital automotive multimeter and an LED test light to make the tests. An analog (swing-needle) meter and conventional test light should not be used as they can permanently damage electronic components.

• Always connect and disconnect the ECM connector and meter probes with the ignition off to avoid damage to electronic components.

– Operate starter and check for a signal from the ECM. LED test light must flicker.

• If LED test light flickers, signal from ECM is good.
• If test light does not flicker, check for break in wiring, see **97 Wiring Diagrams, Fuses and Relays.** If no faults are found, check ECM for DTCs with a suitable scan tool.

– Repeat procedure for each ignition coil.

NOTE —

• Ignition coils and power output stages are a combined unit.

• Ignition coil primary and secondary resistance cannot be measured.

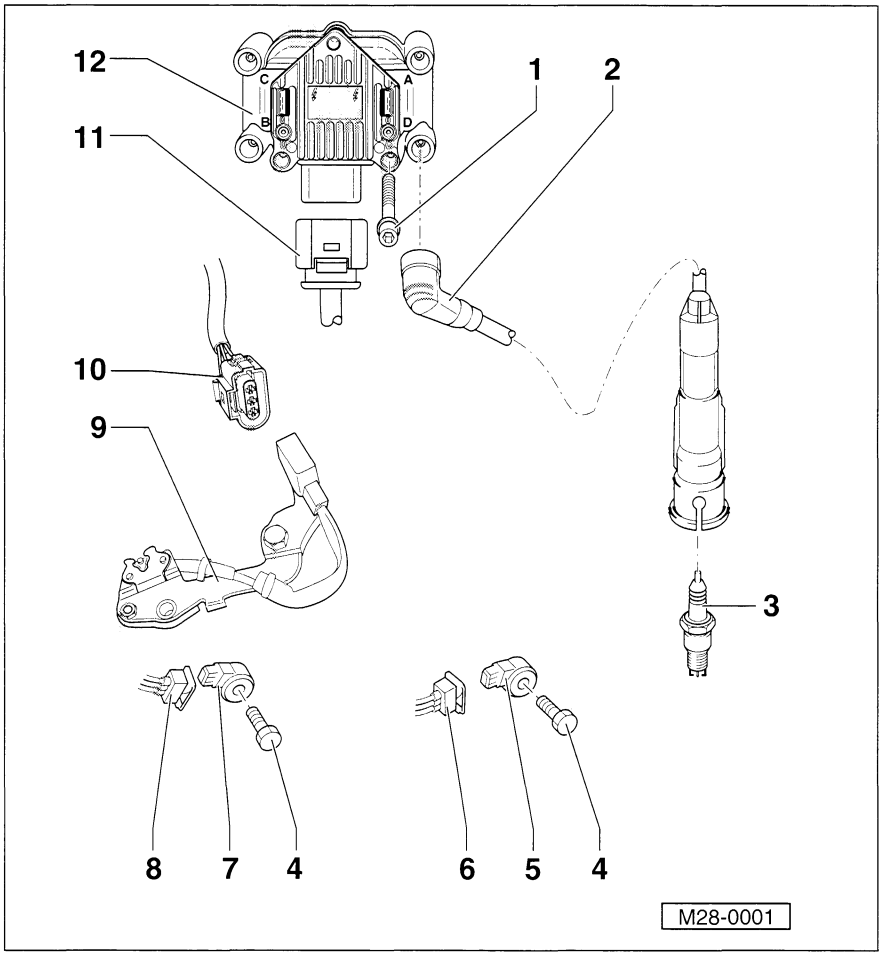
• Ignition coils can be very sensitive to moisture which can cause mis-firing. If replacing, always check with and Authorized Volkswagen dealer or other knowledgeable parts Professional to be sure of obtaining the latest version.

If no faults are found with the supply voltage, impulse signal or wiring, then the faulty ignition coils should be replaced.

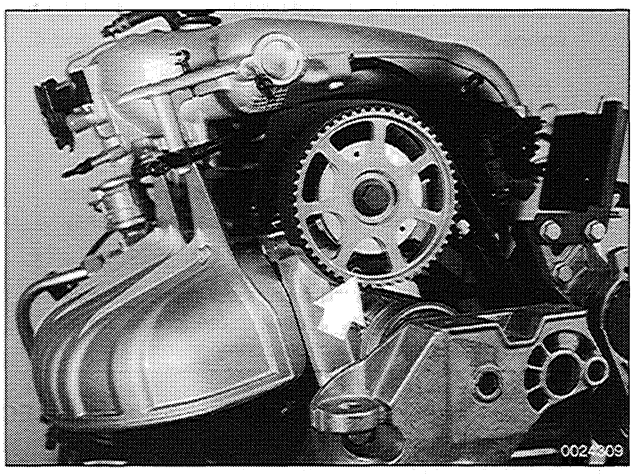
IGNITION SYSTEM (2.0L ENGINE)

The ignition system of the 2.0L engines require little or no periodic maintenance due to the distributor-less nature of the system. Most of the components are monitored by their respective engine management system and a failure will cause a fault (DTC) to be stored in the engine control module. Engine misfiring can even result in a DTC being stored due to the potential for damage to the catalytic converter.

Ignition system components (2.0L AEG engine)



1. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
2. **Ignition (spark plug) wire**
   - RF suppressor
   - Resistance: 4-8kΩ
   - Remove with special tool T10029 or T10112
3. **Spark plug**
   - Tighten to 25 Nm (18 ft-lb)
   - Remove and install with 5/8 (16x mm) spark plug socket
4. **Bolt**
   - Tighten to 20 Nm (15 ft-lb)
   - Tightening torque influences knock sensor function
5. **Knock Sensor 2 (G66)**
   - Sensor and connector terminals are gold-plated
   - Resistance: ∞Ω
6. **Harness connector, 2-pin brown**
   - With gold-plated terminals
7. **Knock Sensor 1 (G61)**
   - Sensor and connector terminals are gold plated
   - Resistance: ∞Ω
8. **Harness connector, 2-pin black**
   - With gold-plated terminals
9. **Camshaft Position (CMP) sensor (G40)**
   - Mounted on cylinder head behind camshaft sprocket, see **Camshaft position sensor location**
   - Shutter wheel (rotor) mounted on camshaft sprocket
10. **Harness connector, 3-pin black**
    - Check for voltage between terminals 1 and 3 with ignition on; specification: minimum 4.5 volts
    - For camshaft position sensor (G40)
11. **Harness connector, 4-pin black**
12. **Ignition coil pack (N152)**
    - With integral power output stage (N122)
    - Marked for ignition cables:
      A = Cylinder 1
      B = Cylinder 3
      C = Cylinder 2
      D = Cylinder 4



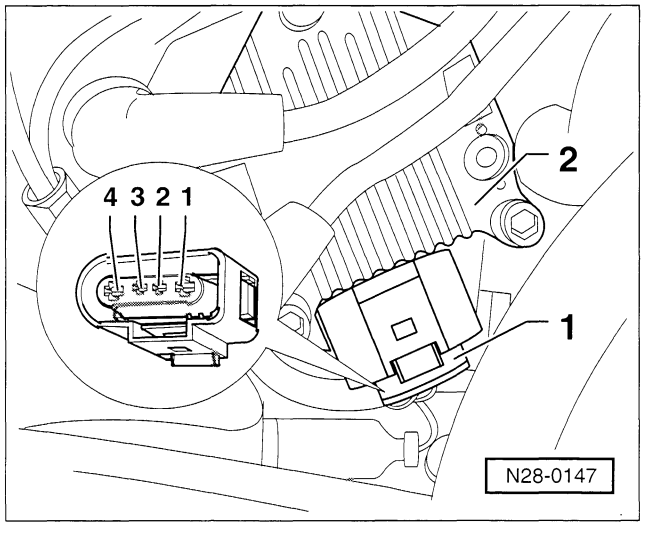
Camshaft position sensor location (2.0L AEG engine)

- Camshaft position sensor is mounted to the front of the cylinder head behind the camshaft drive sprocket (**arrow**).
- Shutter wheel/rotor is permanently mounted on the camshaft drive sprocket.

Ignition coils and power output stage, testing (2.0L AEG engine)

Double-ended ignition coils are mounted in a common housing together with a power output stage. AEG engines use 2 double-ended coils. The power output stage takes the low power signal from the ECM and boosts it to a level usable by the ignition coils. The signal to fire a spark plug results in both spark plugs on that particular coil firing at the same time. One spark is "wasted" by the un-used cylinder because it occurs at a time when it is not needed. The other simultaneous spark is used to fire the mixture in the normal manner. The un-used spark causes no additional wear on the spark plug because it occurs at a time when there is minimal heat and pressure on the spark plug. The power output stage cannot be directly tested, but the signal from the ECM along with power and ground can be easily tested. The ignition coil can also be checked as follows.

– Disconnect 4-pin harness connector from ignition coil power output stage as shown earlier.



Connect a voltmeter to disconnected connector at terminals 2 and 4.

– Switch on ignition and read voltage. If voltage is present, proceed to next step. If no voltage is present, check for breaks, high resistance or open circuits in the wiring, **see 97 Wiring Diagrams, Fuses and Relays.**

Specification

- Voltage supply power output stage. . . . . 11.5 Volts minimum

– Switch off ignition.

– Remove fuse 32 (for fuel injectors) as shown earlier.

– Connect an LED test light (such as VAG 1527B) to disconnected harness connector at terminals 2 and 4.

> ***WARNING —***
> - *Use a high-quality digital automotive multimeter and an LED test light to make the tests. An analog (swing-needle) meter and conventional test light should not be used as they can permanently damage electronic components.*
> - *Always connect and disconnect the ECM connector and meter probes with the ignition off to avoid damage to electronic components.*

– Operate starter and check for a signal from the ECM. LED test light must flicker.

– Repeat steps 6 and 7 with the LED test light in terminals 3 and 4.

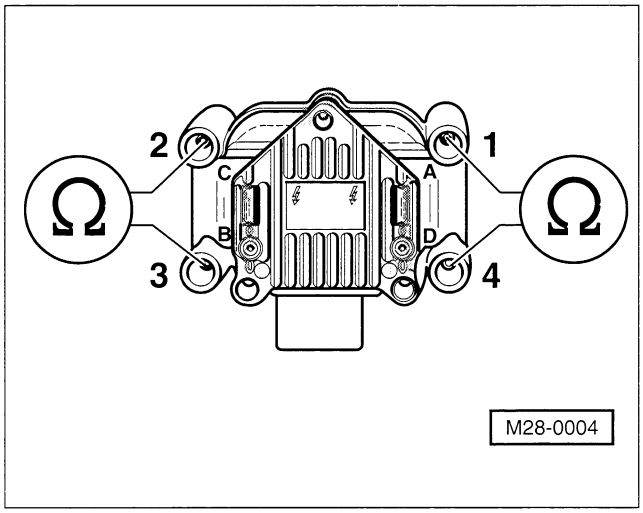
- If LED test light flickers, signal from ECM is good.
- If test light does not flicker, check for break in wiring, **see 97 Wiring Diagrams, Fuses and Relays.** If no faults are found, check ECM for DTCs with a suitable scan tool.

Ignition coil secondary (high voltage) side, checking

– Label and disconnect spark plug wires from coil terminals.

➢ Connect an accurate ohmmeter between terminals 3 and 2 and take reading. Repeat for terminals 1 and 4.

– Compare to specification.



Specification

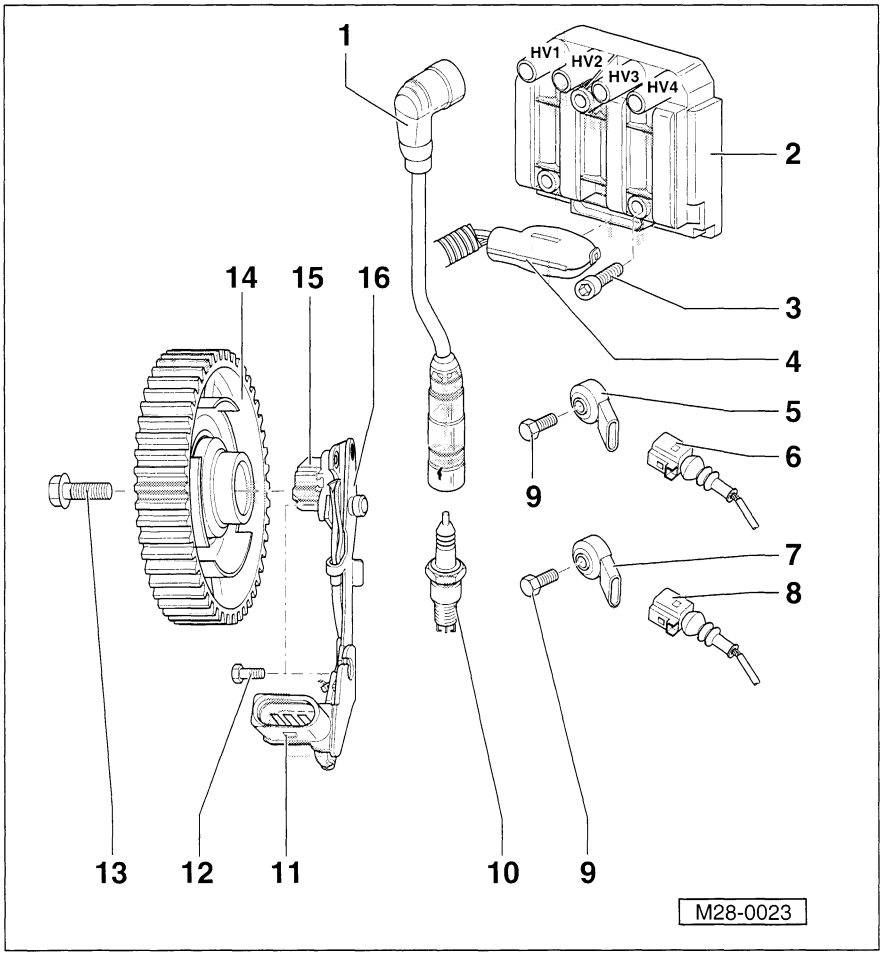
- Ignition coil secondary resistance at 20°C (68°F) . . . . . 4000 to 6000 ohms

– Check coil connections for open circuits and short circuits to ground.

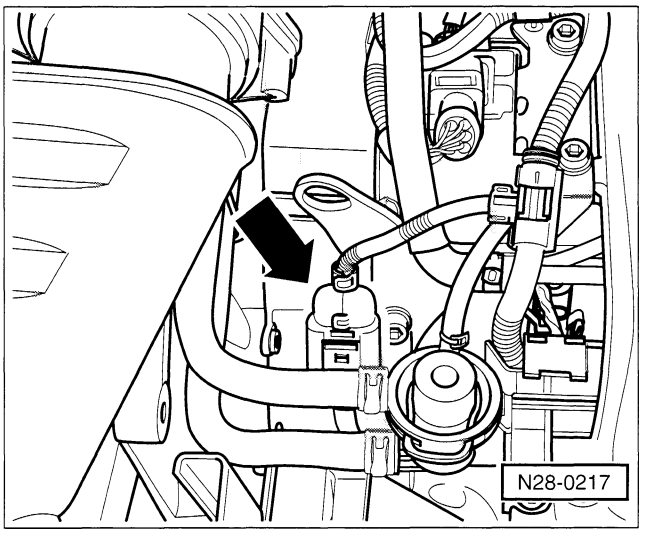
– Reconnect all terminals disconnected for testing and replace all parts removed. Install new components as needed.

> ***NOTE —***
> - *Ignition coils and power output stages are a combined unit.*
> - *Ignition coil primary resistance cannot be measured.*

Ignition system components (2.0L AVH, AZG, BEV engine)

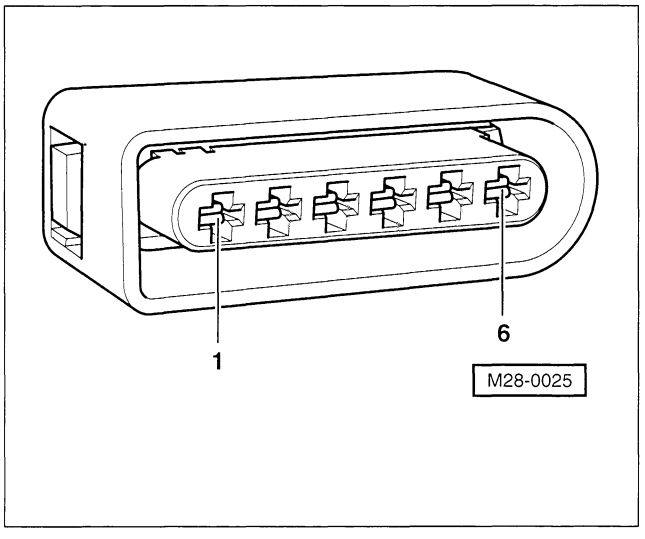


1. **Ignition wire**
   - With suppressor end and spark plug connector
   - Resistance: 4-8kΩ
   - Remove with special tool T10112
2. **Ignition coil s (N70, N127, N291, N292)**
   - With integral power output stage
   - Marked for ignition cables:
     HV1 = Cylinder 1
     HV2 = Cylinder 2
     HV3 = Cylinder 3
     HV4 = Cylinder 4
   - See **Ignition coils, checking supply voltage and activation**
3. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
4. **Harness connector, 6-pin**
5. **Knock Sensor (KS) 1 (G61)**
   - Sensor and connector terminals are gold plated
   - Resistance: ∞Ω
6. **Harness connector, 2-pin**
   - For knock sensor 1
   - Gold plated terminals
   - Mark before disconnecting
7. **Knock sensor 2 (G66)**
   - Sensor and connector terminals are gold-plated
   - Resistance: ∞Ω
8. **Harness connector, 2-pin**
   - For knock sensor 2
   - Gold plated terminals
   - Mark before disconnecting
9. **Bolt**
   - Tighten to 20 Nm (15 ft-lb)
   - Tightening torque influences knock sensor function
10. **Spark plug**
    - Tighten to 25 Nm (18 ft-lb)
    - Remove and install with 5/8 (16x mm) spark plug socket and extension
11. **Harness connector, 3-pin**
    - With gold-plated terminals
    - For CMP sensor
12. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
13. **Bolt**
    - Tighten to 100 Nm (74 ft-lb)
    - Counter-hold with tool 3415 to loosen and tighten
14. **Camshaft sprocket**
    - With integral shutter wheel (rotor) for camshaft position sensor
15. **Camshaft Position (CMP) sensor (G40)**
    - See **Camshaft position sensor location**
16. **Bracket**



Camshaft position sensor (arrow) location (2.0L AVH, AZG, BEV engine)

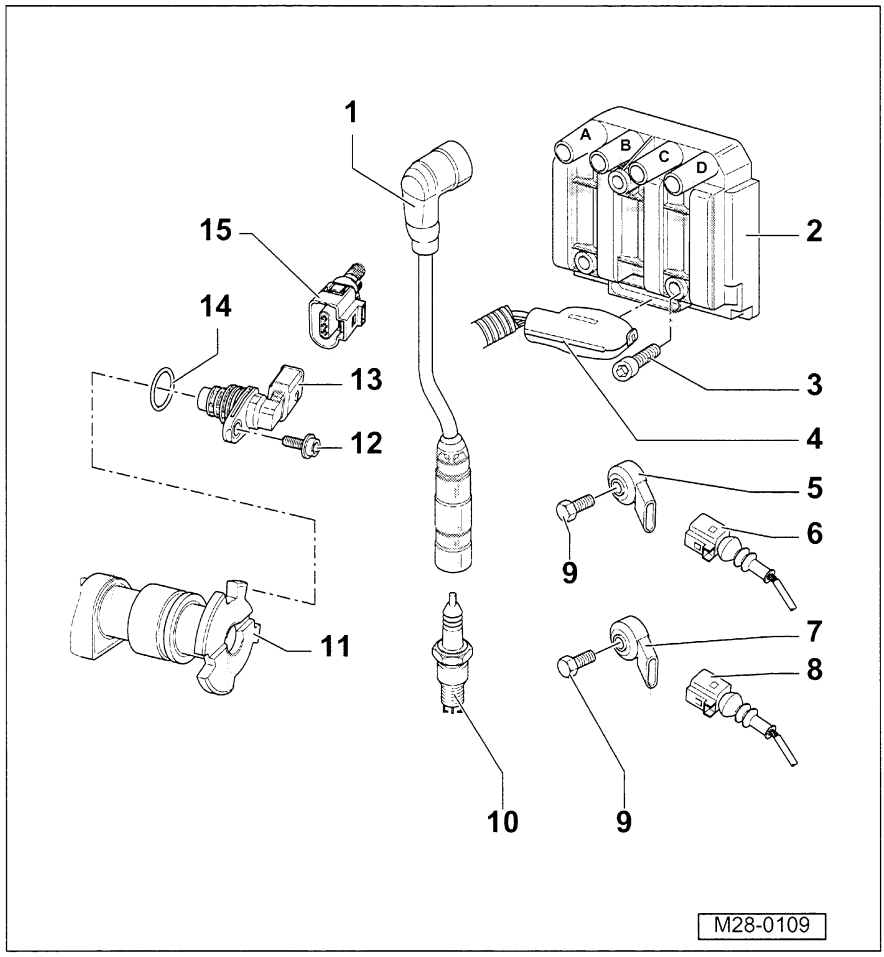
Ignition coils, checking supply voltage and activation (2.0L AVH, AZG, BEV engine)



With ignition off, disconnect the 6-pin harness connector from ignition coils.

- Turn ignition on and read voltage using a digital voltmeter at terminals 1 and 6 of the connector.
  Specification: min. 11.5 volts
- To check activation, first remove fuse 32 to stop voltage supply to fuel injectors (prevent engine from running).
- During activation test do not touch the connecting parts of the ignition coils or test cables.
- Use an LED test light (VAG 1527 B or equivalent) and test across the following terminals while a second technician operates the starter. The LED should flicker.
  - terminals 1 & 2 (ignition output 1)
  - terminals 1 & 3 (ignition output 2)
  - terminals 1 & 4 (ignition output 3)
  - terminals 1 & 5 (ignition output 4)
- If test light does not flicker, check wiring for open circuits, short to ground or positive, using wiring diagrams.
- Each wire should have a maximum resistance of 1.5Ω.
- If voltage is present at terminals 1 and 6 and all wiring is OK, replace ignition coils with output stage.
- Switch off ignition before reconnecting harness connector.

Ignition system components (2.0L BBW engine)

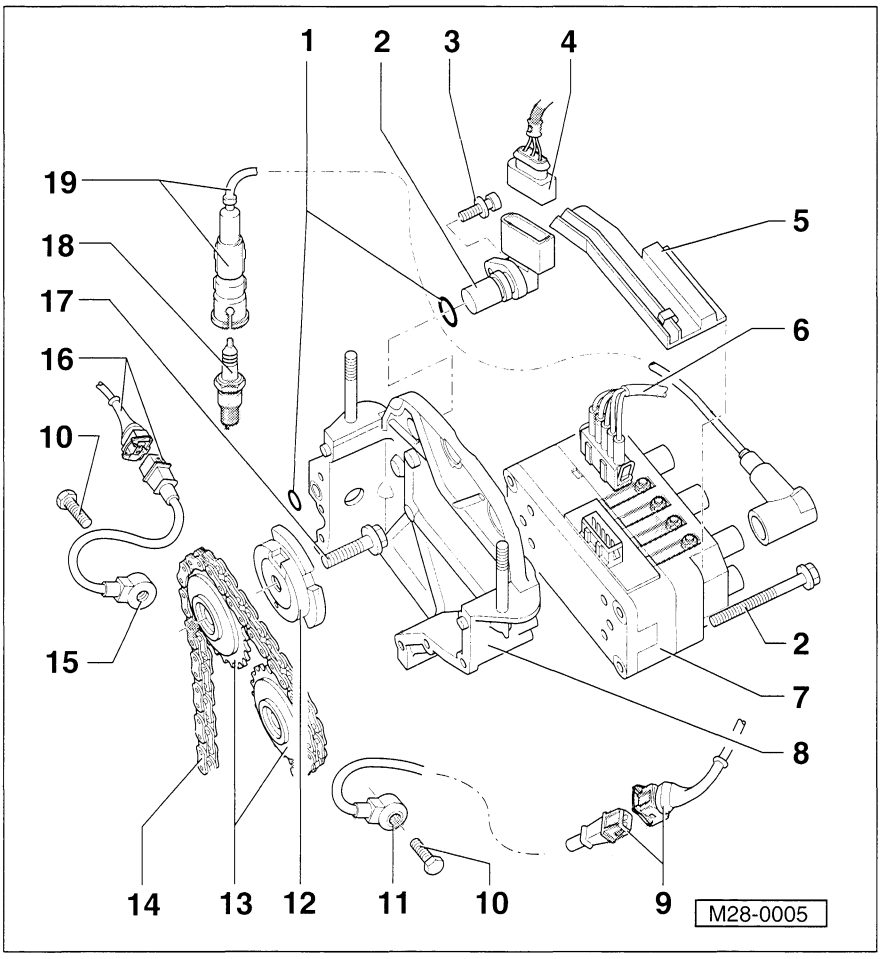


1. **Ignition wire**
   - With suppressor end and spark plug connector
   - Resistance: 4-8kΩ
   - Remove with special tool T10112
2. **Ignition coil s (N70, N127, N291, N292)**
   - With integral power output stage
   - Marked for ignition cables:
     A = Cylinder 1
     B = Cylinder 2
     C = Cylinder 3
     D = Cylinder 4
3. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
4. **Harness connector, 6-pin**
5. **Knock Sensor (KS) 1 (G61)**
   - Sensor and connector terminals are gold plated
   - Resistance: ∞Ω
6. **Harness connector, 2-pin**
   - For knock sensor 1
   - Gold plated terminals
   - Mark before disconnecting
7. **Knock sensor 2 (G66)**
   - Sensor and connector terminals are gold-plated
   - Resistance: ∞Ω
8. **Harness connector, 2-pin**
   - For knock sensor 2
   - Gold plated terminals
   - Mark before disconnecting
9. **Bolt**
   - Tighten to 20 Nm (15 ft-lb)
   - Tightening torque influences knock sensor function
10. **Spark plug**
    - Tighten to 25 Nm (18 ft-lb)
    - Remove and install with 5/8 (16x mm) spark plug socket and extension
11. **Camshaft**
    - With integral shutter wheel (rotor) for camshaft position sensor
12. **Bolt**
    - Tighten to 9 Nm (80 in-lb)
13. **Camshaft Position (CMP) sensor (G40)**
    - In cylinder head (valve) cover
14. **O-ring**
    - Always replace
15. **Harness connector, 3-pin**
    - With gold-plated terminals
    - For CMP sensor

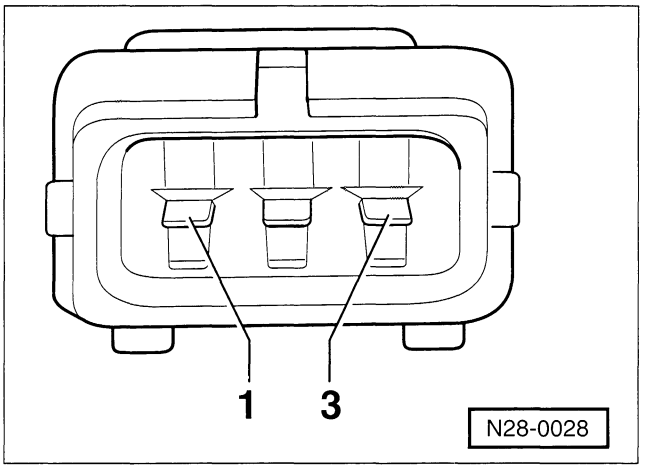
IGNITION SYSTEM (2.8L ENGINE)

The ignition system of the 2.8L engine requires little or no periodic maintenance due to it's distributor-less nature of. Most components are monitored by their respective engine management systems and a failure will cause a fault (DTC) to be stored in the engine control module. Engine misfiring can result in DTCs being stored due to the potential for damage to the catalytic converter.

Ignition system components (2.8L AFP engine)

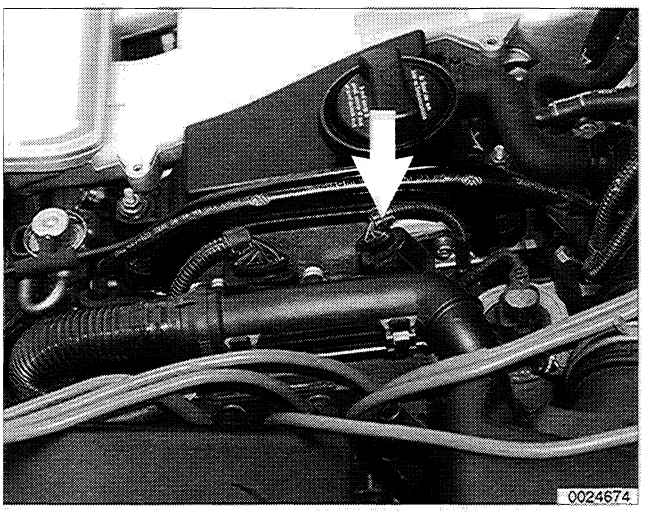


1. **O-ring seals**
   - Always replace
2. **Camshaft Position (CMP) sensor (G40)**
   - Mounted on camshaft sprocket cover at exhaust side camshaft
   - Shutter wheel (rotor) mounted on exhaust side camshaft
   - Terminals are gold-plated
   - See **Camshaft position sensor, location**
3. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
4. **Harness connector, 3-pin black**
   - For CMP sensor (G40)
   - Sensor and connector terminals are gold-plated
   - Check for voltage between terminals 1 and 3 with ignition on; specification: minimum 4.5 volts
5. **Cable guide**
   - For ignition coil wiring
6. **Harness connector, 5-pin black**
   - For ignition coil N152
7. **Ignition coil pack (N152)**
   - With power output stages
   - Marked for ignition cables
   - Use caution to avoid incorrect installation
8. **Cover, upper camshaft sprocket**
9. **Harness connector, 3-pin brown**
   - Terminals are gold plated
   - For KS2
   - See **Knock sensor, checking resistance**
10. **Bolts**
    - Tighten to 20 Nm (15 ft-lb)
    - Tightening torque influences knock sensor function
11. **Knock Sensor (KS) 2 (G66)**
    - Location: intake side of cylinder block
    - Terminals are gold-plated
    - See **Knock sensor, checking resistance**
12. **Shutter wheel**
    - For camshaft position sensor
    - Note installation position
    - Contact area between camshaft sprocket and shutter wheel must be clean and dry at installation
13. **Camshaft chain sprockets**
14. **Camshaft drive chain, upper**
15. **Knock Sensor (KS) 1 (G61)**
    - Location: exhaust side of cylinder block
    - Sensor and connector terminals are gold-plated
16. **Harness connector, 3-pin white**
    - Terminals are gold plated
    - For KS1
    - See **Knock sensor, checking resistance**
17. **Camshaft chain sprocket bolt**
    - Tighten to 100 Nm (74 ft-lb)
    - Note 24 mm hex on camshaft to counter-hold
    - Do not use plastic alignment tool 3268 to counter-hold
    - Lightly oil bolt head contact surface before installing
18. **Spark plug**
    - Tighten to 25 Nm (18 ft lb)
    - Remove and install with 5/8 (16x mm) spark plug socket
19. **Spark plug wire**
    - With RF suppressor and spark plug connector
    - Resistance: 4-6kΩ
    - Individual lengths for each cylinder
    - Remove with special tool T10029
    - Do not pull on wire
    - Attached to coil pack with water resistant sealant



Knock sensor, checking resistance (2.8L AFP engine)

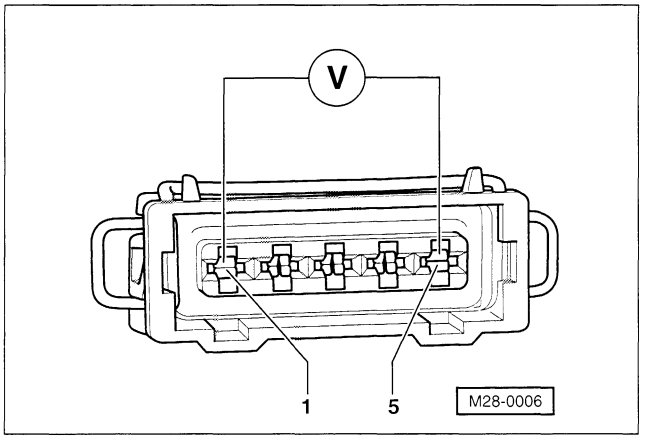
- Measure resistance between knock sensor terminals
  1 & 2
  1 & 3
  2 & 3
- Specified value: ∞Ω



Camshaft position sensor (G40), location (2.8L AFP engine)

Ignition coils and power output stage, testing (2.8L AFP engine)

Double-ended ignition coils are mounted in a common housing together with a power output stage. AFP engines use 3 double-ended coils. The power output stage takes the low power signal from the ECM and boosts it to a level usable by the ignition coils. The signal to fire a spark plug results in both spark plugs on that particular coil firing at the same time. One spark is "wasted" by the un-used cylinder because it occurs at a time when it is not needed. The other simultaneous spark is used to fire the mixture in the normal manner. The un-used spark causes no additional wear on the spark plug because it occurs at a time when there is minimal heat and pressure on the spark plug. The power output stage cannot be directly tested, but the signal from the ECM along with power and ground can be easily tested as follows.



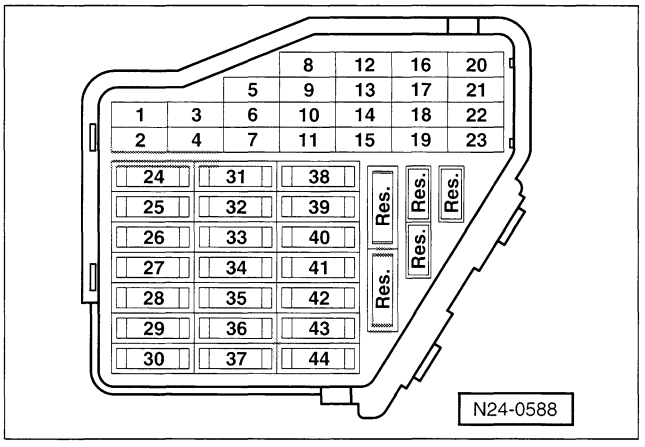
– Disable ignition system by disconnecting 5-pin harness connector from ignition coil power output stage as shown earlier.

Connect a digital voltmeter across connector terminals 1 and 5 of harness connector.

– Switch on ignition and read voltage. If voltage is present, proceed to next step. If no voltage is present, check for breaks, high resistance or open circuits in the wiring, **see 97 Wiring Diagrams, Fuses and Relays.**

Specification

- Voltage supply
  power output stage . . . . . 11.5 Volts minimum



➤ Switch off ignition and remove fuse 32 (for fuel injectors).

– Connect an LED test light (such as VAG 1527B) to the disconnected harness connector at terminals 2 and 5.

WARNING —

- *Use a high-quality digital automotive multimeter and an LED test light to make the tests. An analog (swing-needle) meter and conventional test light should not be used as they can damage components.*
- *Always connect and disconnect the ECM connector and meter probes with the ignition off to avoid damage to components.*

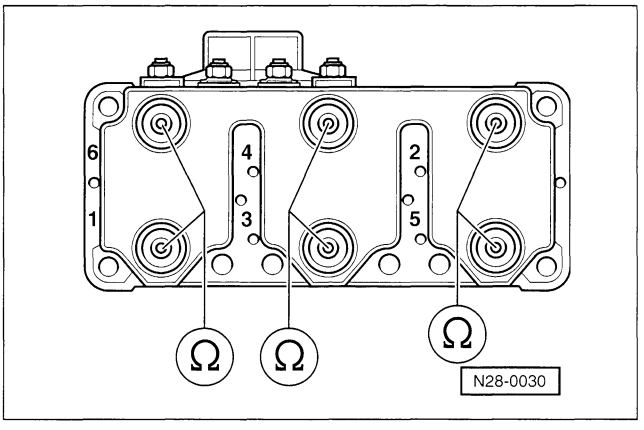
– Operate starter and check for a signal from the ECM. LED test light must flicker.

– Repeat steps 6 and 7 with the LED test light in terminals 3 and 5, and 4 and 5.

- If LED test light flickers the signal from ECM is good.
- If test light does not flicker, check for break in wiring, **see 97 Wiring Diagrams, Fuses and Relays.** If no faults are found, check ECM for DTCs with a suitable scan tool. See **ST Scan Tool** section at back of book.

Ignition coil secondary (high voltage) side, checking (2.8L AFP)

– Label and disconnect spark plug wires from coil pack.



➤ Connect an accurate ohmmeter between terminals 1 and 6 and take reading. Repeat for terminals 3 and 4 and for terminals 2 and 5.

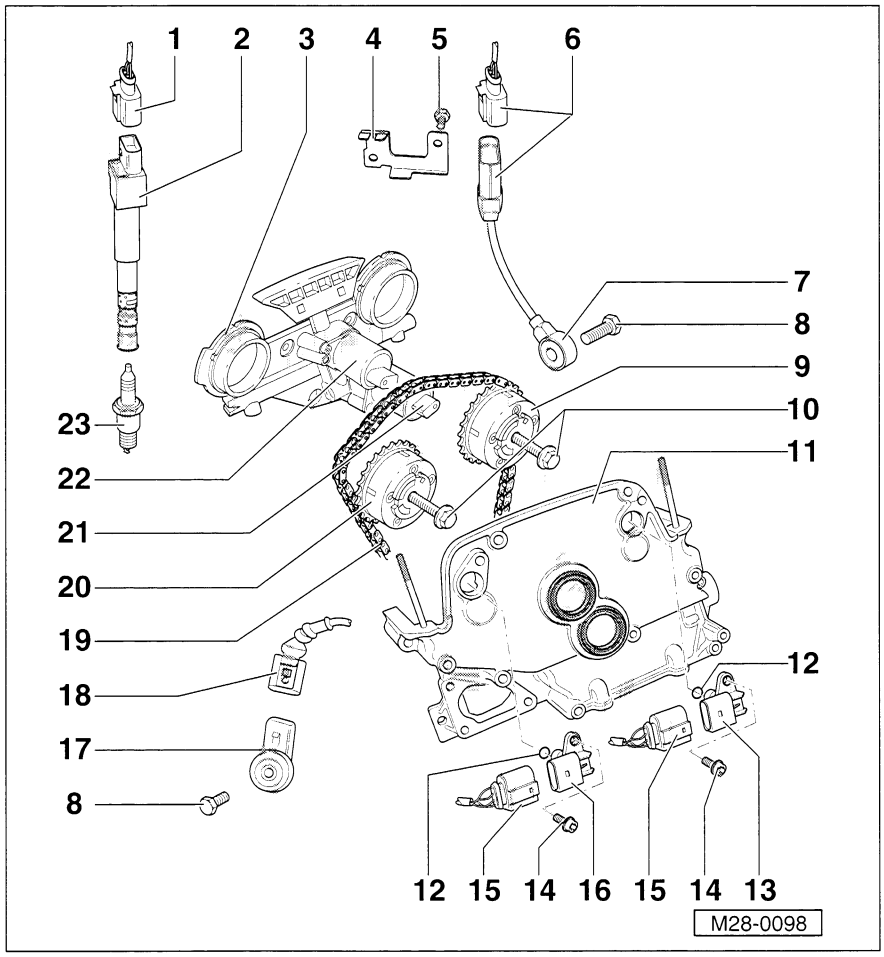
Specification

- Ignition coil (AFP engine) secondary resistance
  at 20°C (68°F) . . . . . 3600 to 4400 Ω

– Check coil connections for open circuits and short circuits to ground.

– Reconnect all terminals disconnected for testing and replace all parts removed. Install new components as needed.

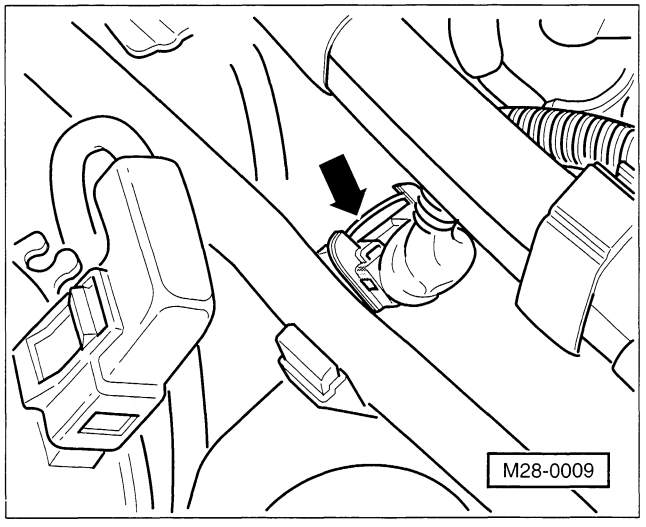
Ignition system components (2.8L BDF engine)



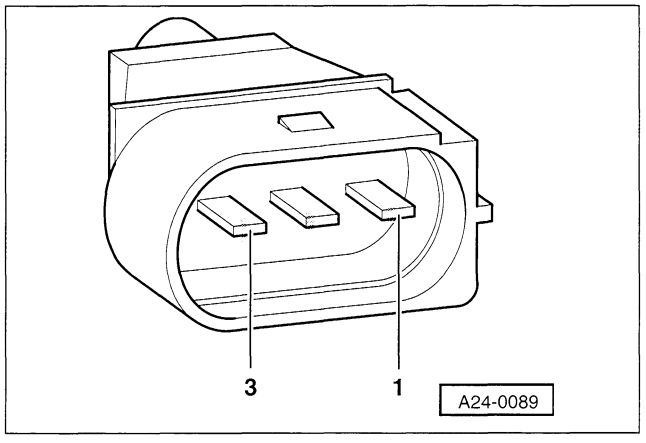
1. **Harness connector, 4-pin black**
   - Mark connector and component before removal
2. **Ignition coil packs (N70, N127, N291, N292, N323, N324)**
   - With power output stages
   - Use T10095 puller to remove
3. **Control housing**
   - To remove, see **15d Cylinder Head and Valvetrain (2.8L)**
4. **Bracket, harness connector**
   - On right side of cylinder head
5. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
6. **Harness connector, 3-pin black**
   - Gold plated terminals
   - For knock sensor 1
7. **Knock Sensor (KS) 1 (G61)**
   - Gold plated terminals
   - See **Knock sensor, checking resistance**
   - Make sure contact surfaces of sensor and cylinder block are clean and corrosion free
8. **Bolt**
   - Tighten to 20 Nm (15 ft-lb)
   - Tightening torque influences function of knock sensor
9. **Exhaust camshaft sprocket and timing adjuster**
   - Marking: 32A
   - Do not turn engine over when adjuster is removed
   - With sensor wheel for CMP sensor 2 (G163)
10. **Bolt**
    - Tighten to 60 Nm (44 ft-lb) + ¼ turn (90°)
    - Always replace
    - Contact surface of sensor wheel on bolt head must be dry for assembly
    - Remove and install with 32mm open end wrench on camshaft as a counter-hold, see **15d Cylinder Head and Valvetrain (2.8L)**
11. **Cover, upper camshaft sprocket**
12. **Seal**
    - Always replace
13. **Camshaft Position (CMP) sensor 2 (G163)**
    - For exhaust camshaft
    - Gold plated terminals
14. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
15. **Harness connectors, 3-pin black**
    - Gold plated terminals
    - For CMP sensors
    - To test signal voltage: Pull off connector and attach voltmeter leads to terminal 1 (+) and terminal 3 (-). Turn ignition on: Specification: min. 4.5 volts
16. **Camshaft Position (CMP) sensor (G40)**
    - For intake camshaft
    - Gold plated terminals
17. **Knock Sensor (KS) 2 (G66)**
    - Gold plated terminals
    - See **Knock sensor, checking resistance**
18. **Harness connector, 2-pin black**
    - Gold plated terminals
    - For knock sensor 2
19. **Camshaft drive chain, upper**
    - Mark direction of rotation before removing
20. **Intake camshaft sprocket and timing adjuster**
    - Marking: 24E
    - Do not turn engine over when adjuster is removed
    - With sensor wheel for CMP sensor (G40)
21. **Camshaft adjustment valve (N318)**
    - For exhaust camshaft
    - Mark connector and component before removal
22. **Camshaft adjustment valve (N205)**
    - For intake camshaft
    - Mark connector and component before removal
23. **Spark plug**
    - Tighten to 25 Nm (18 ft-lb)
    - Remove and install with 3122B spark plug socket, or equivalent

Knock sensors, checking resistance (2.8L BDF)

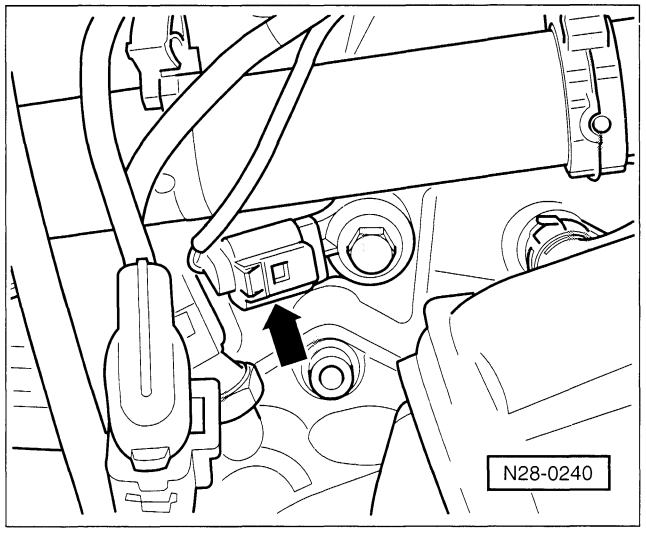
NOTE —
Knock sensors can be functionally checked using Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program.



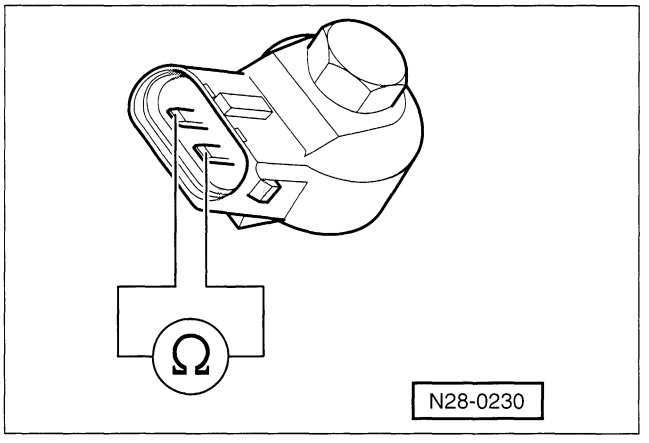
- Remove harness connector from knock sensor 1 (G61), located on right of cylinder head.



- Measure resistance between knock sensor terminals:
  1 & 2
  1 & 3
  2 & 3
  - Specified value: ∞Ω



- Remove harness connector from knock sensor 2 (G66), located on intake side of cylinder head.

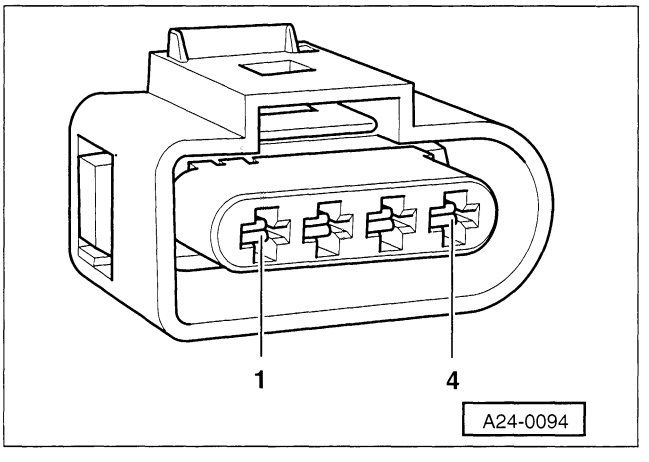


➢ Measure resistance between knock sensor 2 terminals: 1 & 2

- Specified value: ∞Ω

Ignition coils and power output stage, testing (2.8L BDF engine)

Individual ignition coils each with a power output stage are mounted above each spark plug. The power output stage takes the low power signal from the ECM and boosts it to a level usable by the ignition coils. The power output stage cannot be directly tested, but the signal from the ECM along with power and ground can be easily tested.



– Disable ignition system by disconnecting 4-pin harness connector from each ignition coil.

➢ Connect an accurate digital voltmeter to disconnected connector at terminals 1 and 3.

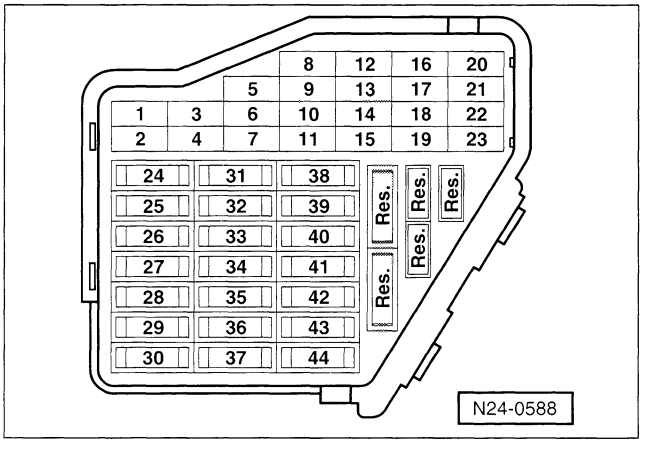
– Switch on ignition and read voltage.

– Repeat for terminals 2 and 3.

– If voltage is present, proceed to next step. If no voltage is present, check for breaks or open circuits in the wiring, see **97 Wiring Diagrams, Fuses and Relays**.

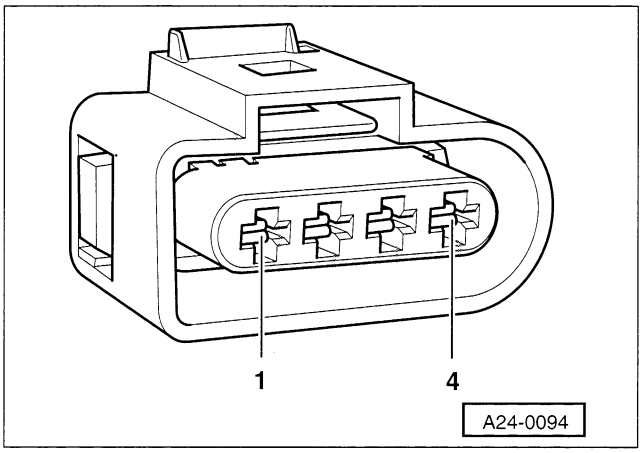
Specification

- Voltage supply power output stage . . . . . 11.5 Volts minimum



– Switch off ignition.

➢ Remove fuse 29 (for fuel injectors).



➤ Connect an LED test light (such as VAG 1527B) to disconnected coil harness connector at terminal 4 and engine ground.

WARNING —

- *Use a high-quality digital automotive multimeter and an LED test light to make the tests. An analog (swing-needle) meter and conventional test light should not be used as they can permanently damage electronic components.*
- *Always connect and disconnect the ECM connector and meter probes with the ignition off to avoid damage to electronic components.*

– Operate starter and check for a signal from the ECM. LED test light must flicker.

- If LED test light flickers, signal from ECM is good.
- If test light does not flicker, check for break in wiring, see **97 Wiring Diagrams, Fuses and Relays.** If no faults are found, check ECM for DTCs with a suitable scan tool.

– Repeat procedure for each ignition coil.

NOTE —

- *Ignition coils and power output stages are a combined unit.*
- *Ignition coil primary and secondary resistance cannot be measured.*

If no faults are found with the supply voltage, impulse signal or wiring, then the faulty ignition coils should be replaced.

28b Ignition System–Diesel

GENERAL 28b-1
Service Precautions 28b-2

DIESEL GLOW PLUG SYSTEM 28b-2
Glow plug system, testing (1999 - 2001) 28b-3
Glow plug system, testing (2002 - 2003) 28b-4
Glow plug system, testing (2004 - 2005) 28b-4
Glow plugs,
checking and replacing (all engines) 28b-5

COOLANT GLOW PLUGS/AUXILIARY HEATER 28b-6
Checking and replacing coolant glow plugs . . . 28b-7

QUALITY REVIEW 28b-8

GENERAL

The ignition system of a diesel engine is based on heat generated by the compression of air in the cylinder. Fuel is injected into this hot air at a precise time to obtain ignition and the exact time is varied by the injection pump to obtain ignition advance. Diesel engines are therefore said to be compression-ignition engines. As a result of this design, diesel engines do not require spark plugs and their associated components. A cold diesel engine can be difficult to start, however, because the compression heat generated is quickly dissipated into the surrounding structure leaving the combustion chamber too cold to support combustion. Extra heat is required to overcome this cold starting limitation. The Volkswagen 1.9L diesel engine uses glow plugs to provide the additional heat required during a cold start.

WARNING —
Disconnecting the negative (–) battery cable may erase fault codes and basic settings in engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) will need to be re-set using Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program.

Fuel Systems–Diesel

- 1.9L (AHL)
  Electronic Diesel Control . . . . . TDI
- 1.9L (BEW)
  Electronic Diesel Control,. . . . . Pump Injection TDI

NOTE —

The TDI engine management system found on both versions of the 1.9L engine has a built in diagnostic circuit that detects and stores a limited number of system faults related to the glow plug system. These faults are known as Diagnostic Trouble Codes (DTCs). It is recommended that fault diagnosis and troubleshooting be carried out using Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program.

Service precautions

Ignition system service and repair work must be carried out carefully. The ignition system contains sensitive electronic components. To guard against system damage, and for general safety, the following warnings apply to any ignition system troubleshooting, maintenance or repair work.

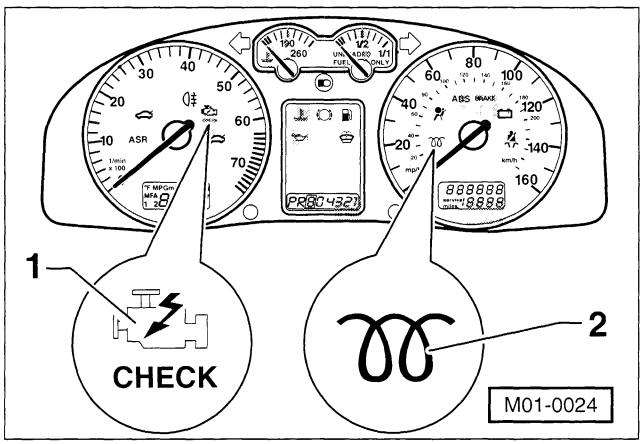
WARNING —

- *Glow plug systems operate at high current levels. For this reason, always insure that electrical connections that have been disturbed during testing are properly secured when done.*
- *Disconnecting engine management components with the key in the "on" position during some procedures will cause diagnostic trouble codes to be stored in the engine control module. Erasing these DTCs and resetting the readiness code will require Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program.*

DIESEL GLOW PLUG SYSTEM

The TDI diesel engine uses four glow plugs. Because of the TDI combustion chamber design, the glow plugs are installed in a vertical manner and are fitted with push-on electrical connectors similar to spark plug connectors. The glow plugs assist combustion during cold starts by providing additional heat for ignition. Due to the efficiency of the TDI engine design, the additional heat that the glow plugs provide is not needed until temperatures drop to approximately 48°F (9°C). This function is known as preglow. In addition to preglowing, the glow plugs will continue to operate after the engine is started. This is known as afterglowing or extended glow period and is used to reduce engine noise, improve idle quality and reduce hydrocarbon emissions. The afterglow function is enabled after every start, both hot and cold, regardless of whether or not preglowing has occurred, until the specified time has expired or the engine speed exceeds 2,500 rpm. Both the TDI and the PD TDI function in the same way with the same operating parameters.

The glow plug system is controlled by the Engine Control Module (ECM) and the Engine Coolant Temperature (ECT) sensor. The period of preglow depends on the temperature of the engine coolant as determined by the ECT.

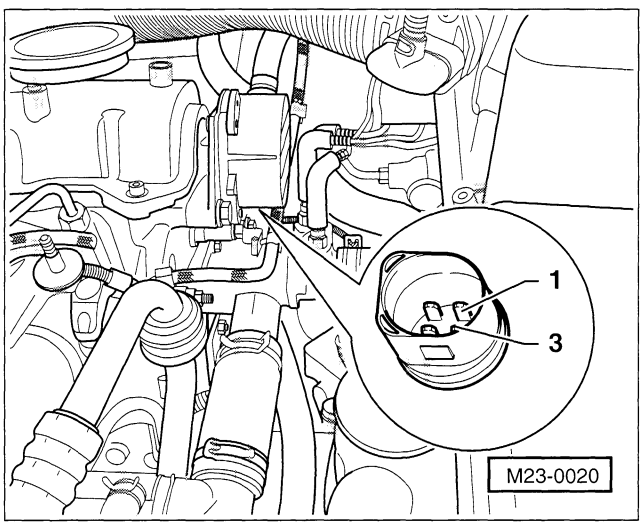


A dash mounted indicator light signals the driver that preglowing is operating. Preglowing is not linked to operation of the driver's door as in some earlier Volkswagen diesel systems.

➤ Glow plug warning light (**2**) and Malfunction indicator light (**1**) shown on instrument cluster.

> ***WARNING —***
> *Disconnecting engine management components for this procedure will cause diagnostic trouble codes to be stored in the engine control module. Erasing these DTCs and resetting the readiness code will require Volkswagen scan tool VAG 1551/1552 or equivalent.*

NOTE —
For more information on troubleshooting diesel cold starting problems, see **23 Fuel Injection—Diesel.**

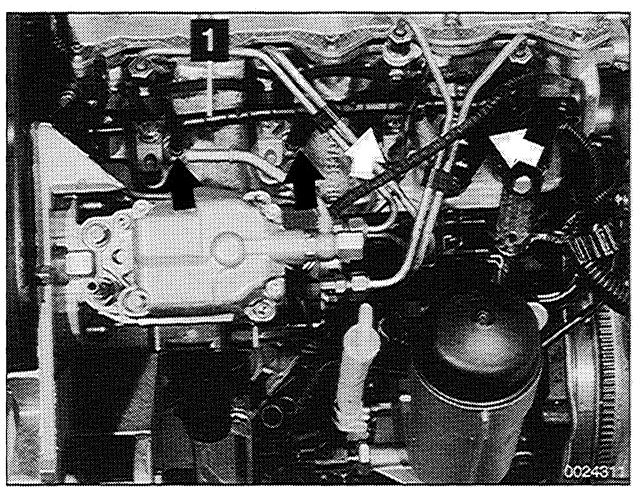


Glow plug system, testing (1999 - 2001)

– Remove upper engine cover.

➤ Disconnect the harness connector (**arrow**) from the combined Engine Coolant Temperature (ECT) sensor and instrument panel gauge sensor (G62/G2).

NOTE —
Disconnecting the ECT harness connector simulates a cold engine when the ignition key is switched on.



➤ Disconnect the bus connector (**1**) from the glow plugs (**arrows**) by gently pulling it off.

– Connect an accurate voltmeter between the bus connector for cylinder #1 and ground.

– Turn on the key and observe battery voltage. Voltage should be present for approximately 20 seconds.

– Repeat for remaining cylinders.

– If no voltage is present, check glow plug fuses, glow plug relay, and/or associated wiring. See **97 Wiring Diagrams, Fuses and Relays.**

NOTE —
Glow plug fuses are located in the fuse holder on the battery cover.

– If fuses OK, check DTC memory with scan tool and repair any indicated malfunctions. Reset readiness codes if DTC memory is erased.

– If voltage is present, switch off ignition. System is functioning; check individual glow plugs.

Glow plug system, testing (2002 - 2003)

Vehicles from m.y. 2002 use a Glow Period Control Module (J370). It is not possible to optically and acoustically check the activation. Checking is only possible by connecting a current pick-up clamp to the glow plug wiring.

– Remove upper engine cover.

– Start engine and run at idle. Be sure that all electrical accessories (e.g. lights, rear window heating, etc.) and A/C are switched off. Engine must be also be cold.

NOTE —
The system test must be done within 3 minutes of starting the cold engine.

– Connect VAG 1715 multimeter (or equivalent) in sequence to glow plug wiring using a inductive current pick-up clamp. Compare to specification.

Specification
• Glow plug current (each) . . . . . min. 6 amps

– If the specification is not met, check wiring glow plug as described below and wiring.

– After repairs are completed, check DTC memory using diagnostic scan tool (VAG 1551/1552 or equivalent) and erase DTC memory.

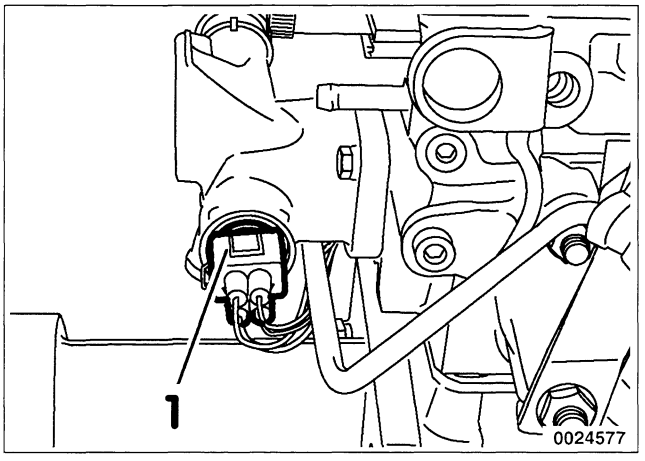
Glow plug system, testing (2004 - 2005)

– Before starting, make ensure the following:
- The glow plug strip fuse in battery fuse holder is good.
- Battery voltage is a minimum of 11.5 volts.
- All electrical consumers are switched off.
- Engine Control Module (J248) is good.

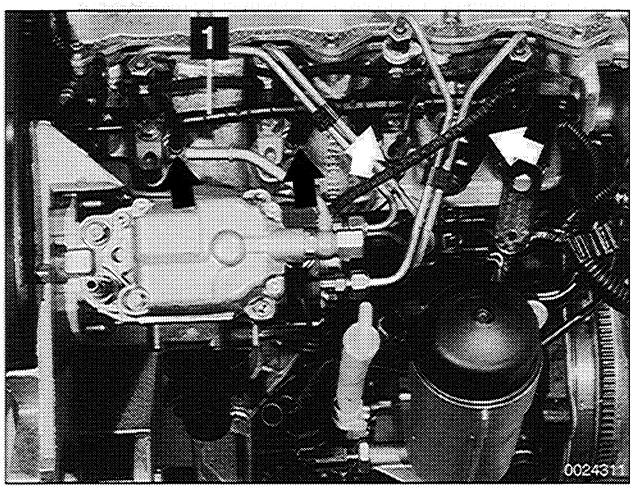
– Remove upper engine cover.

➤ Disconnect the harness connector (**1**) from the combined Engine Coolant Temperature (ECT) sensor and instrument panel gauge sensor (G62/G2).

NOTE —
Disconnecting the ECT harness connector simulates a cold engine when the ignition key is switched on.



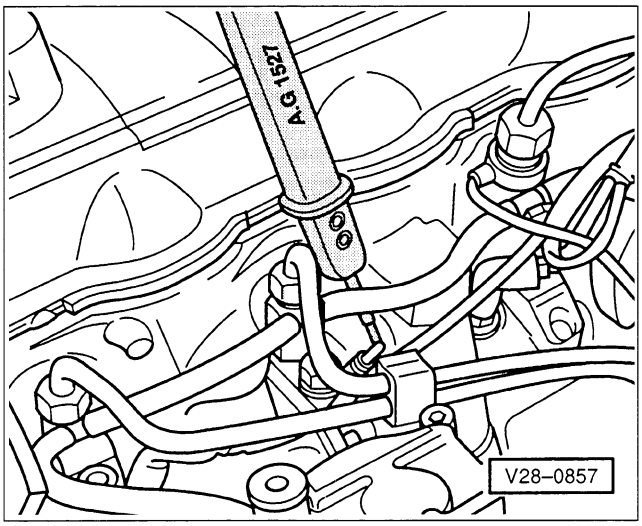
DIESEL GLOW PLUG SYSTEM



- Disconnect the bus connector (**1**) from the glow plugs (**arrows**) by gently pulling it off (1.9 TDI engine shown, PD TDI engine similar).
- Connect an accurate voltmeter between the bus connector for cylinder #1 and ground.
- Turn on the key and observe battery voltage. Voltage should be present for approximately 20 seconds.
- Repeat for remaining cylinders.
- If no voltage is present, check glow plug fuses, glow plug relay, and/or associated wiring. See **97 Wiring Diagrams, Fuses and Relays.**

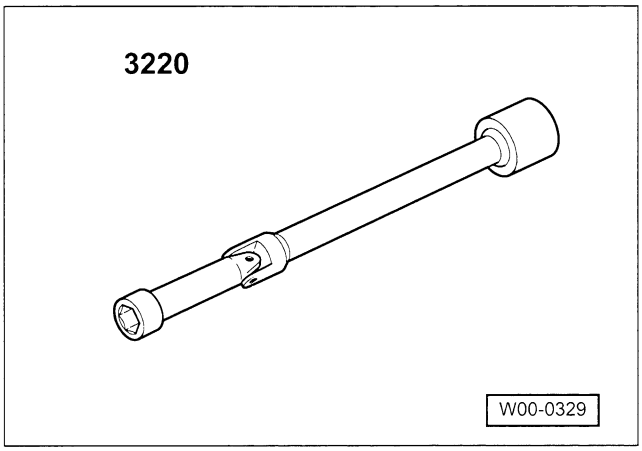
NOTE —
Glow plug fuses are located in the fuse holder on the battery cover.

- If fuses OK, check DTC memory with scan tool and repair any indicated malfunctions. Reset readiness codes if DTC memory is erased.
- If voltage is present, switch off ignition. System is functioning; check individual glow plugs.



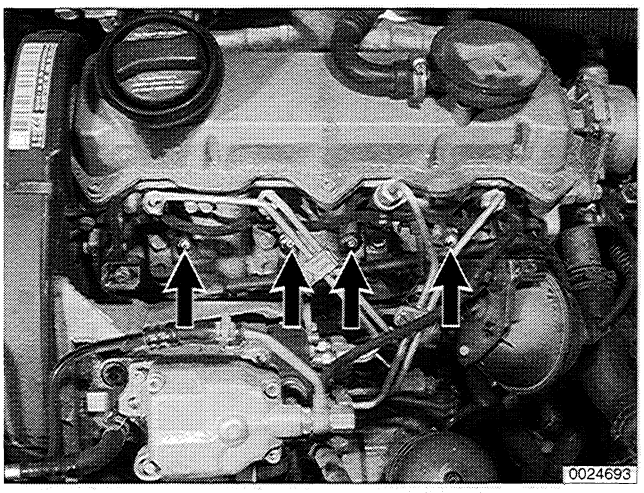
Glow plugs, checking and replacing (all engines)

- Switch ignition off.
- Disconnect glow plug harness connector.
- Connect a suitable test light to battery positive and touch the other end to the disconnected terminal on the glow plug. TDI glow plug #2 shown in illustration with test light VAG 1527, PD TDI is similar. The low resistance of the glow plug will provide a ground path for the test light and cause the test light to light up if the glow plug is good.

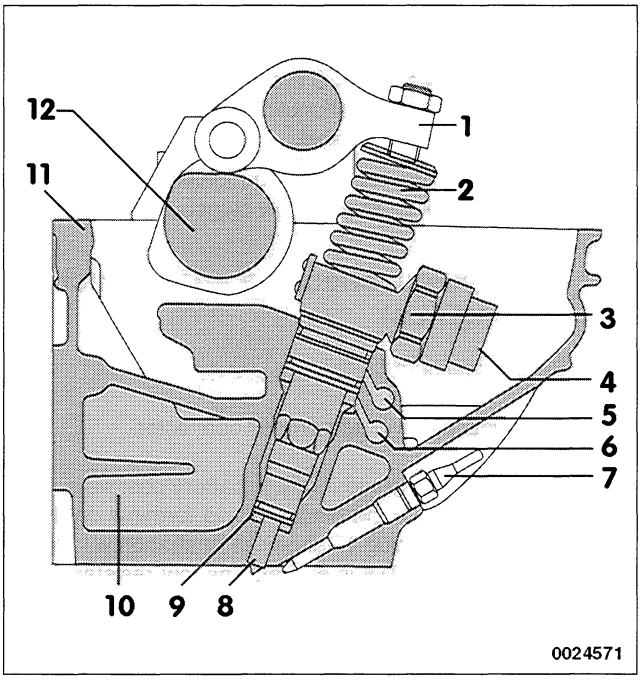


- Glow plug removal and installation is easily accomplished with special tool 3220.

NOTE —
Experience has shown that a 10 mm, 6 point deep socket, a universal joint, and an appropriate extension make a suitable substitute for removal and installation of the glow plugs.



➢ On TDI engines, glow plugs (**arrows**) that are defective can be replaced using Volkswagen special tool 3220 or other tools as noted above.



➢ On PD TDI engines, replace defective glow plugs using Volkswagen special tool 3220 or other tools as noted above. Glow plugs (**7**) are partially obscured by cylinder head casting, but are still accessible from the front.

NOTE —
*For addition information on the TDI and PD TDI Diesel engines, see **2 General Information.***

– Torque replacement glow plugs to specification.

Tightening torque
- Glow plug in cylinder head . . . . . 15 Nm (11 ft-lb)

NOTE —
Advanced testing of the glow plug system requires the use of Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program.

COOLANT GLOW PLUGS/AUXILIARY HEATER

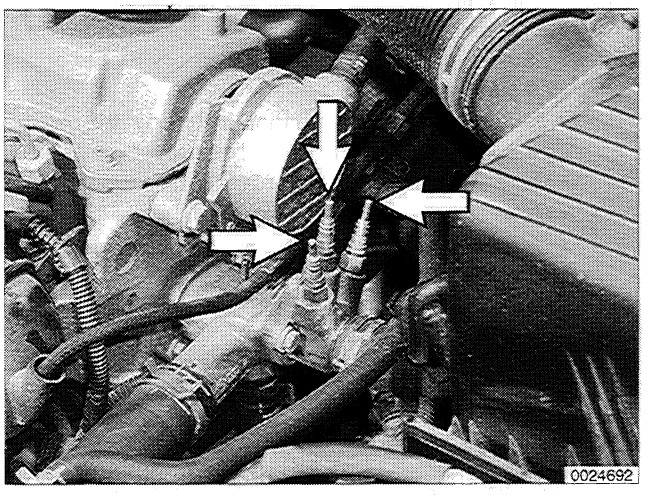
Because of its outstanding efficiency, the 1.9L TDI and PD TDI engines develop very little waste heat. In certain circumstances, there may not be sufficient heat with manual transmission vehicles to warm the vehicle interior. An auxiliary heater consisting of three coolant glow plugs is installed to provide additional coolant heat when needed. The coolant glow plugs are operated by two coolant glow plug relays which are controlled by the engine control module. The coolant glow plug relays are located under the hood.

The coolant glow plugs can operate in one of three modes depending on the amount of heat required. Coolant glow plug #1 can operate separately, or #2 and #3 together, or all three at the same time.

Checking and replacing coolant glow plugs

Complete testing of the coolant glow plug system requires the use of Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program. The coolant glow plugs can, however, be checked in the same manner as the glow plugs used for starting.

– Visually inspect the fuse for the coolant glow plugs in the fuse holder on battery cover. See **97 Wiring Diagrams, Fuses and Relays**. Replace as required.



➤ Pull the electrical connectors off of the coolant glow plugs to expose the terminal end (**arrows**).

- Coolant glow plugs (heater elements) in the flange on the end of the cylinder head with the electrical connectors in place. TDI version shown, PD TDI engine is similar.

– Connect a suitable test light to battery positive and touch the other end to the end of the coolant glow plug. The light will glow due to the low resistance of the glow plug if it is good. Faulty coolant glow plugs will not light the test light.

– If defective glow plugs are found, unscrew and replace as necessary. Coolant will leak out of the system when unscrewing glow plugs.

WARNING —

- *Hot coolant can scald and result in serious personal injury. Do not work on the cooling system until it has fully cooled.*
- *At normal operating temperature the cooling system is pressurized. Allow the system to cool as long as possible before opening—a minimum of an hour—then release the cap very slowly to allow safe release of pressure.*
- *Releasing the cooling system pressure lowers the coolant's boiling point, and the coolant may boil suddenly. Use heavy gloves and wear eye and face protection to guard against scalding.*
- *Use extreme care when working at or near the cooling fan when the engine is hot. The fan can come on at any time–even if the ignition key is off.*
- *Use extreme care when draining and disposing of engine coolant. Coolant is poisonous and lethal. Children and pets are attracted to coolant because of its sweet smell and taste. See a doctor or veterinarian immediately if any amount of coolant is ingested.*

– Re-attach electrical connectors and replace lost coolant.

QUALITY REVIEW

When you have finished working under the hood and around other areas of the vehicle, it is advisable to take a moment to quality check or review your work. This helps to insure that the operation or repair has been completed properly with all affected systems functioning within normal parameters. These may include the following:

- Make sure that there are no fuel or coolant leaks.
- Make sure that the coolant is at the proper concentration and level.
- Ensure that all cable ties and hose clamps that were removed as part of the repair are replaced.
- Be sure to wipe up any diesel fuel spills using soap and water as necessary, especially on any rubber or painted surfaces.
- Make sure that all components involved in the repair are positioned correctly and function properly.
- Make sure that the radiator fans cycles properly.
- Make sure all tools and shop cloths are removed.
- Clean grease and fingerprints from painted surfaces, steering wheel and shifter.
- Road test vehicle as required to confirm proper cooling system operation.

30 Clutch

GENERAL 30-1

CLUTCH PEDAL (02J AND 02M) 30-2
Clutch pedal, assembly 30-3
Over-center spring, removing and installing . . . 30-4
Clutch pedal, removing and installing 30-6

CLUTCH HYDRAULIC SYSTEM 30-6
Clutch hydraulic system assembly (02J) 30-7
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Clutch release mechanism, (02J) 30-16
Clutch release mechanism, (02M) 30-17

CLUTCH SERVICING (02J AND 02M) . . . 30-18
Clutch assembly 30-18

QUALITY REVIEW 30-20

GENERAL

Servicing of the clutch assembly requires that the transmission be removed from the vehicle and separated from the engine. Special tools and equipment are required to remove the transmission and service the clutch, and bleed the clutch hydraulic system. See **34 Manual Transmission** for transmission removal procedures. Read the procedures through to fully understand the scope and nature of the job.

WARNING —

- *The cars covered by this manual use an airbag system that automatically deploys the airbags in the event of a frontal or side impact. The airbags are inflated by an explosive device. Handled improperly or without adequate safeguards, the system can be very dangerous. Special precautions must be observed prior to any work at or near the steering wheel or steering column, including the pedal assembly. See* **69 Seatbelts, Airbags**.
- *To guard against personal injury or airbag system failure, only trained Volkswagen service technicians should test, disassemble or service the airbag system.*

Transmission Types

- 02J . . . . . 5-speed manual transmission
- 02M . . . . . 6-speed manual transmission

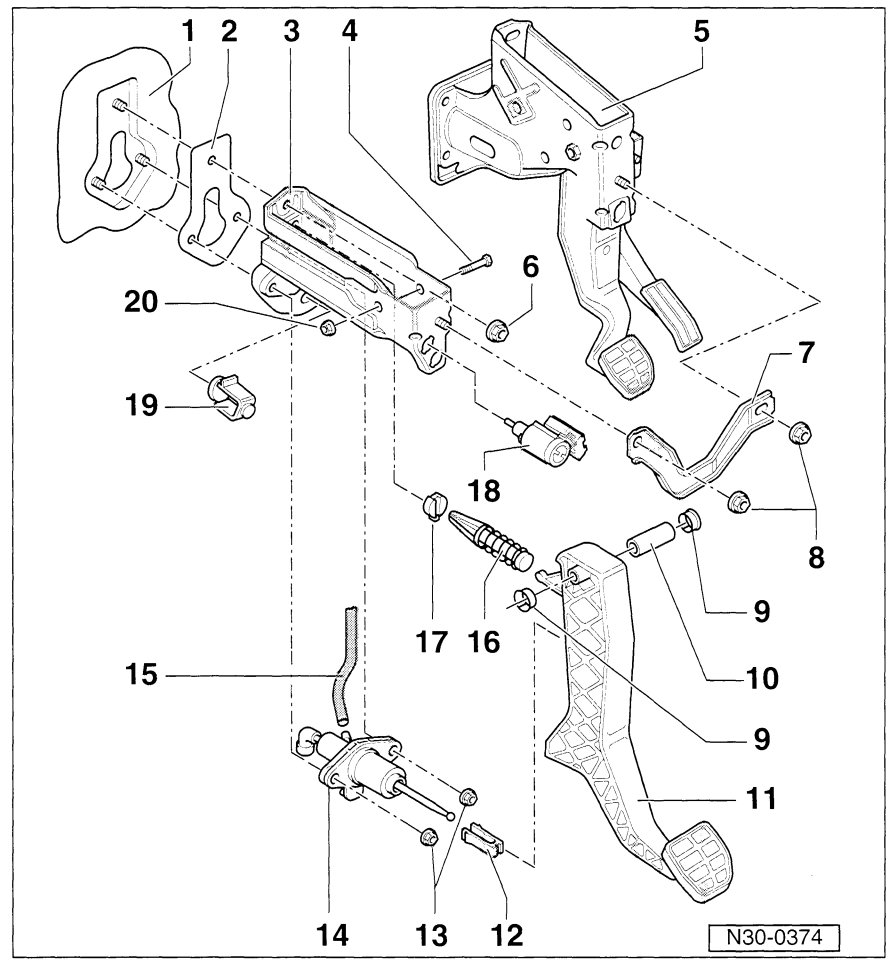
WARNING —

- *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using a VAG 1551/1552 or equivalent scan tool.*
- *Before working on the pedal cluster, obtain anti-theft radio code and then disconnect battery ground (–) strap.*
- *Part numbers are listed for reference only. Consult an authorized Volkswagen Dealer or aftermarket parts specialist for the latest parts information.*

CLUTCH PEDAL (02J AND 02M)

The following section shows components of the pedal assembly for vehicles equipped with both the 02J and 02M transmissions. Always lubricate all bearings and friction surfaces with poly-resin (polyurea) grease (VW/Audi Part number G 052 142 A2 or G 000 450 A2). Always replace self-locking nuts and circlips as noted.

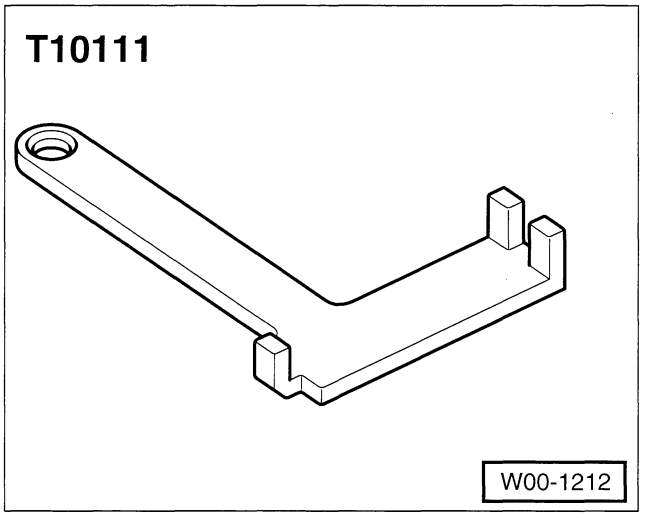
Clutch pedal, assembly



1. **Bulkhead**
   - With support for mounting bracket and clutch master cylinder
2. **Seal**
   - Always replace
3. **Mounting bracket (support)**
   - For clutch pedal
4. **Pivot bolt**
5. **Mounting bracket (support)**
   - For brake and accelerator pedals
6. **Nut, hex self-locking**
   - Always replace
   - Tighten to 25 Nm (18 ft-lb)
7. **Connecting bracket**
8. **Nut, hex self-locking**
   - Always replace
   - Tighten to 25 Nm (18 ft-lb)
9. **Pivot bushings**
10. **Fulcrum pin**
11. **Clutch pedal**
    - See **Removing and installing**
12. **Pushrod retainer**
    - See **Removing and installing**
13. **Nut, hex self-locking**
    - Always replace
    - Tighten to 25 Nm (18 ft-lb)
14. **Clutch master cylinder**
    - See **Removing and installing**
15. **Fluid supply hose**
    - From brake fluid reservoir
16. **Over-center spring**
    - See **Removing and installing**
17. **Over-center spring seat**
    - Installs in mounting bracket
    - Remove and install clutch master cylinder to replace
18. **Clutch pedal position switch F36**
    - When removing and installing switch, push pedal down as far as possible by hand
    - Remove switch before removing clutch pedal; rotate switch 45° counter-clockwise and pull out through mounting hole
    - Install switch by inserting into mounting hole and rotating 45° clockwise to the stop
19. **Clutch pedal stop**
20. **Nut, hex self-locking**
    - Always replace
    - Tighten to 25 Nm (18 ft-lb)

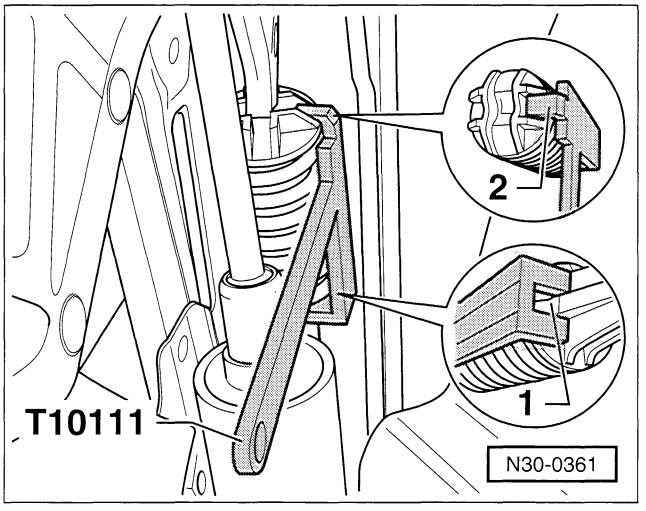
Over-center spring, removing and installing

An over-spring is used on the clutch pedal linkage to reduce the amount of force required for clutch operation. This allows for the use of high clamping force clutches without substantially increasing the pedal effort.



➤ Assembly clamp T10111 is required for removal and reinstallation of over-center spring.

– Remove left side lower under-dash (close-out) panels.



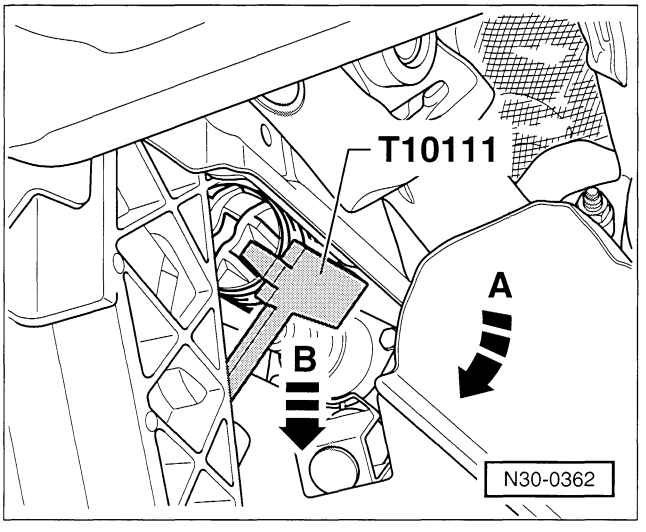
➤ Insert assembly clamp T10011 onto over-center spring from right side of clutch pedal mounting bracket.

– Engage claw end of assembly clamp onto front part of over-center spring as shown (**1**). Ensure that assembly clamp is seated correctly on over-center spring.

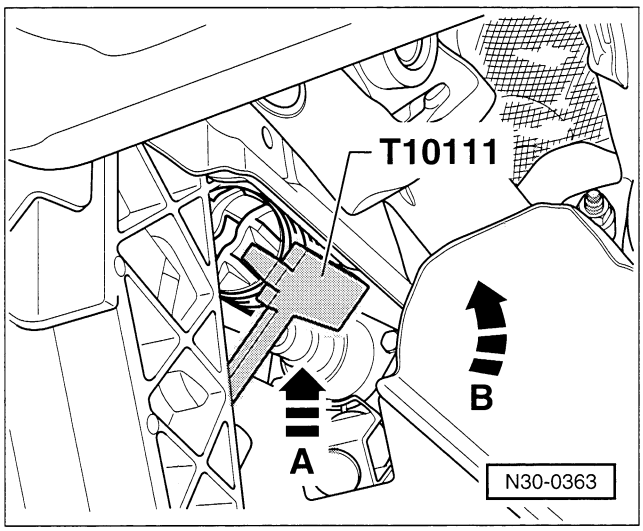
– While pushing slightly on clutch pedal, hook the rear tab of assembly clamp onto the cut-out on the rear end of over-center spring as shown (**2**).

– Push clutch pedal further until over-center spring can be pulled out of support mountings and clutch pedal.

– Move clutch pedal to the at-rest position.

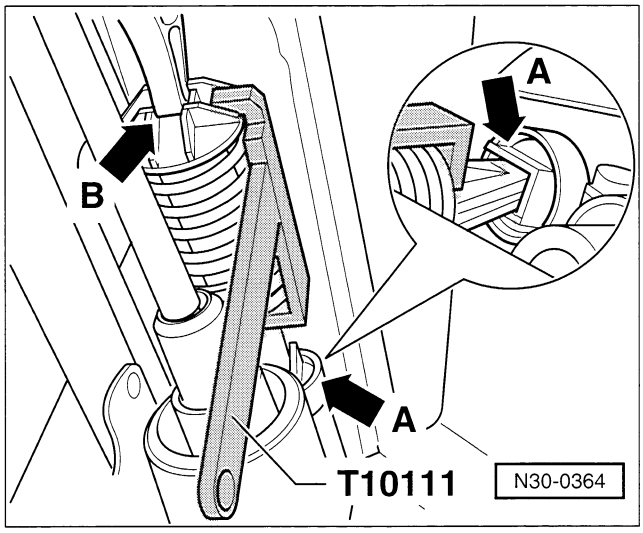


➤ Turn over-center spring and T10011 in direction of arrow (**A**) and ease downward and out in direction of arrow (**B**).



– Begin installation by moving clutch pedal to the at-rest position.

➤ Turn over-center spring with attached T10011 in direction of arrow (**A**) and ease upward in the direction of arrow (**B**).



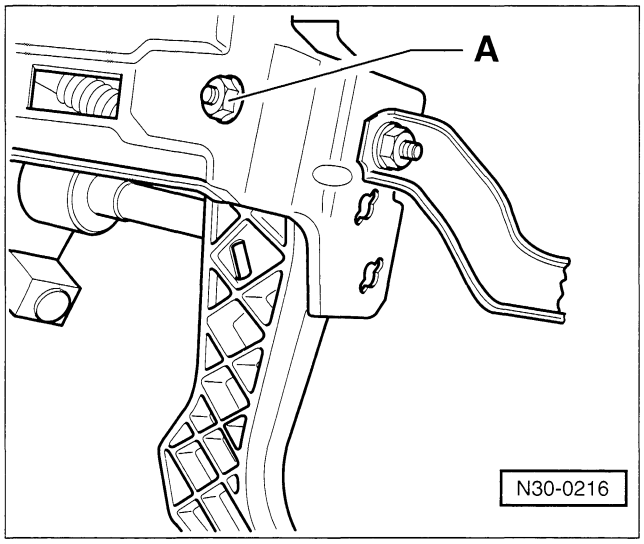
➤ Install over-center spring onto forward spring seat in clutch pedal mounting (**A**).

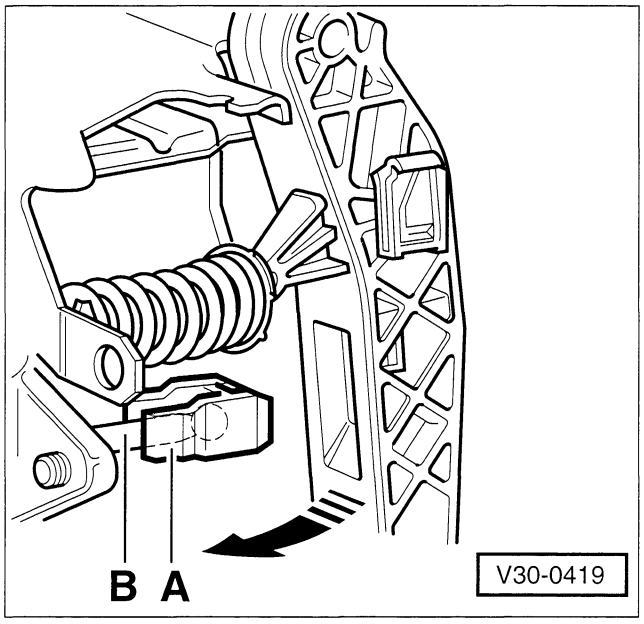
– Depress clutch pedal until over-center spring (with T10011) is positioned against clutch pedal bearing tab (**B**).

– Remove assembly clamp while at the same time returning clutch pedal to the at-rest position.

– Operate clutch pedal several times to insure that spring is properly seated.

– Re-install left side lower under-dash (close-out) panels.





Clutch pedal, removing and installing

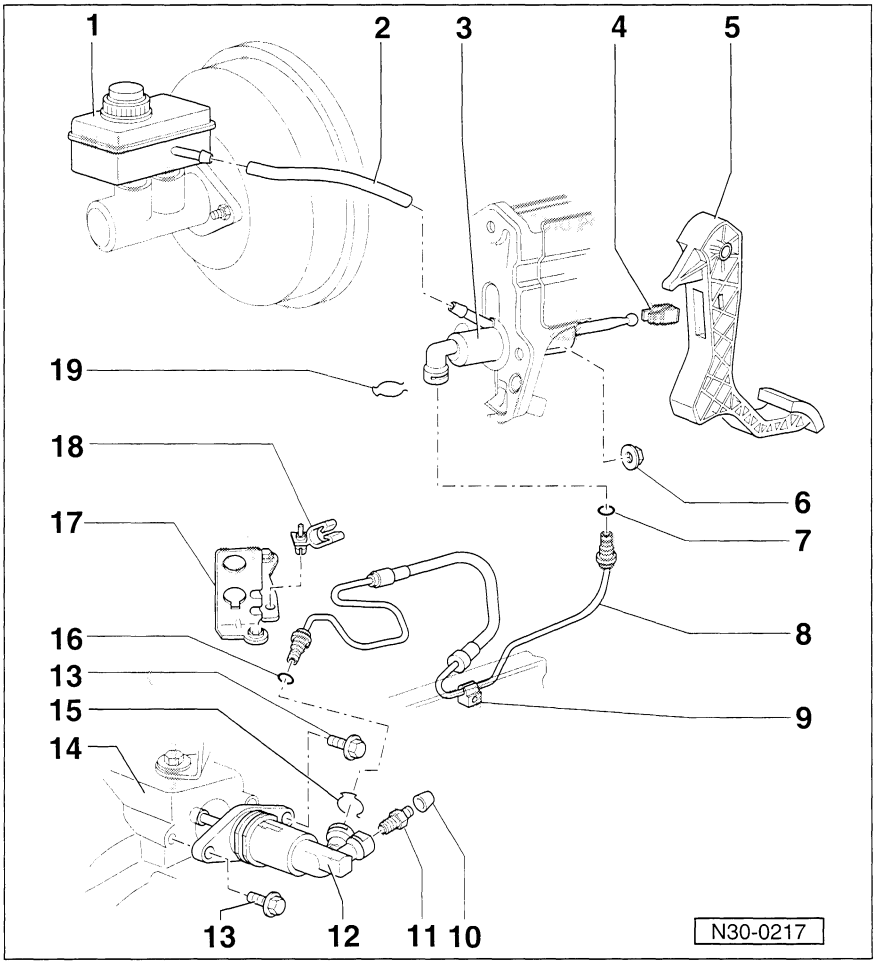
- Remove left side lower under-dash (close-out) panels.
- Remove clutch pedal position switch as noted.
- Remove clutch pedal over-center spring as previously described.
- Separate clutch pedal from clutch master cylinder, see **Clutch master cylinder, removing and installing.**
- Push master cylinder operating rod toward engine compartment onto stop.
- Remove pivot bolt self-locking nut (**A**) and pull pivot bolt out only enough to allow pedal to be removed.
- Remove clutch pedal from below.
- Install clutch pedal and pivot bolt.
- Install clutch over-center spring as described earlier.
- Ensure that clutch master cylinder pushrod retainer (**A**) is correctly installed on clutch master cylinder push rod (**B**). Depress clutch pedal (**dashed arrow**) to ensure proper engagement of retainer.
- Install clutch pedal position switch, see **Clutch pedal assembly.**
- Re-install left side lower under-dash (close-out) panels.
- Check and adjust brake fluid level as needed. Bleed clutch system if required.
- Be sure to quality check your work, see **Quality Review** at the end of this repair group.

CLUTCH HYDRAULIC SYSTEM

Although the clutch pedal assembly inside the vehicle is the same for both the 02J and the 02M transmissions, the actuation of the clutch is via two different slave cylinder arrangements.

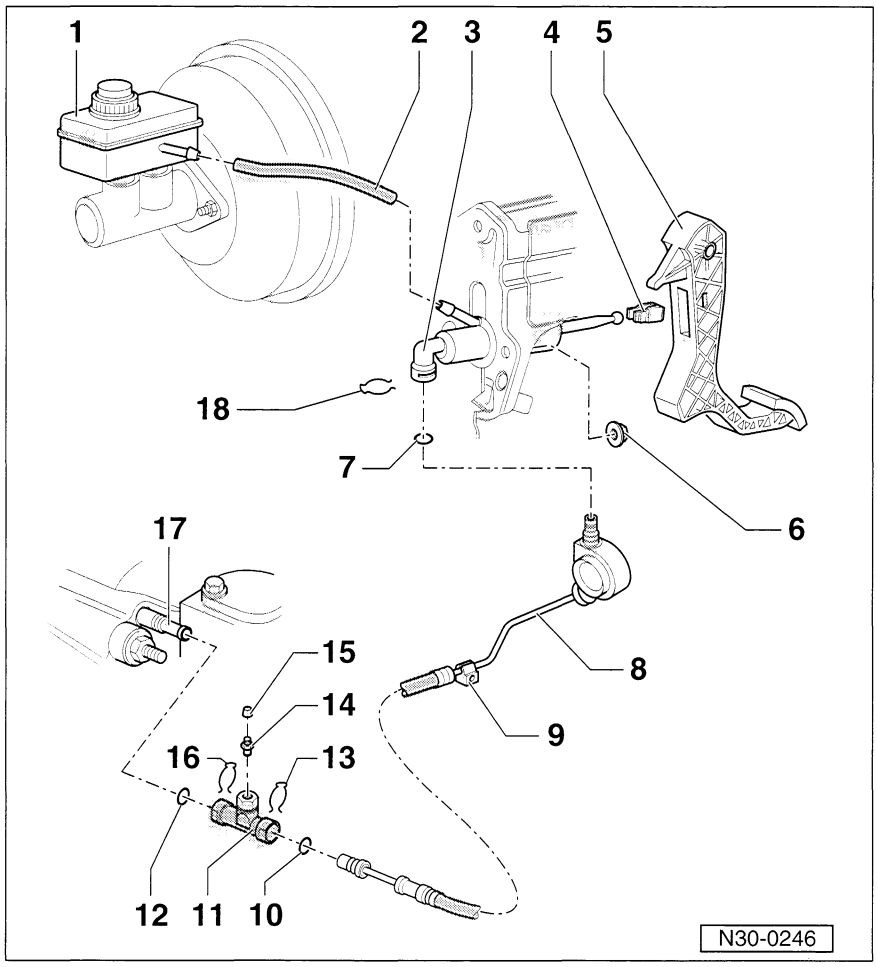
The differences between the two systems are shown in the following section.

Clutch hydraulic system, assembly (02J)

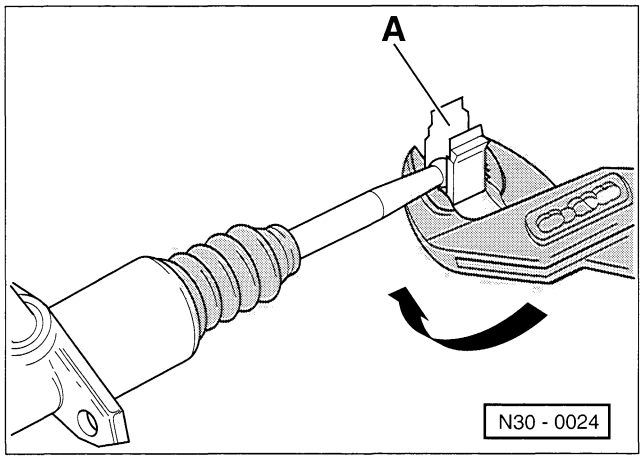


1. **Brake fluid reservoir**
   - Brake system and clutch hydraulics share a common reservoir
   - System design keeps brake fluid at safe level if faults occur in clutch hydraulic system
   - Fluid level should be between **MIN** and **MAX** markings on reservoir
2. **Supply hose**
   - From reservoir to clutch master cylinder
3. **Clutch master cylinder**
   - See **Removing and installing**
4. **Pushrod retainer**
   - Replace with master cylinder or pedal removed
   - See **Pushrod retainer, removing**
   - See **Pushrod retainer, installing**
5. **Clutch pedal**
   - See **Removing and installing**
6. **Nut, hex self-locking**
   - Always replace
   - Tighten to 25 Nm (18 ft-lb)
7. **O-ring seal**
   - Always replace
   - Moisten with brake fluid before installation
   - Pull onto line/hose connection
8. **Hydraulic line/hose assembly**
9. **Bracket**
   - Attached to body
10. **Bleeder valve dust cap**
    - Always reinstall when finished bleeding
11. **Bleeder valve**
    - See **Clutch hydraulic system, 02J and 02M, bleeding**
12. **Clutch slave cylinder**
    - Remove the following components before removing clutch slave cylinder (See **34 Manual Transmission**):
      - gear selector cable from selector lever
      - relay lever and actuating arm for gate selector cable
    - Adjust gear selector mechanism after reinstalling above
13. **Bolt, shouldered hex**
    - Tighten to 25 Nm (18 ft-lb)
14. **Transmission housing**
15. **Securing clip**
    - Pull clip out and onto stop to release hydraulic line hose assembly
16. **O-ring seal**
    - Always replace
    - Moisten with brake fluid before installation
    - Pull onto line/hose connection
17. **Support bracket**
    - Size, shape and placement vary with engine type
18. **Hose bracket**
    - Secure to cable support bracket
19. **Securing clip**
    - Pull clip out and onto stop to release hydraulic line hose assembly

Clutch hydraulic system, assembly overview, 02M

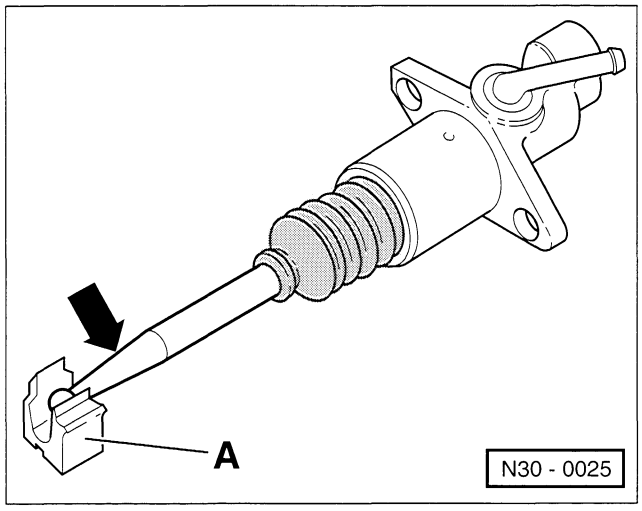


1. **Brake fluid reservoir**
   - Brake system and clutch hydraulics share a common reservoir
   - System design keeps brake fluid at safe level if faults occur in clutch hydraulic system
   - Fluid level should be between **MIN** and **MAX** markings on reservoir
2. **Supply hose**
   - From reservoir to clutch master cylinder
3. **Clutch master cylinder**
   - See **Removing and installing**
4. **Pushrod retainer**
   - Replace with master cylinder or pedal removed
   - See **Pushrod retainer, removing**
   - See **Pushrod retainer, installing**
5. **Clutch pedal**
6. **Nut, hex self-locking**
   - Always replace
   - Tighten to 25 Nm (18 ft-lb)
7. **O-ring seal**
   - Always replace
   - Moisten with brake fluid before installation
   - Pull onto line/hose connection
8. **Hydraulic line/hose assembly**
9. **Bracket**
   - Attached to body
10. **O-ring seal**
    - Always replace
    - Moisten with brake fluid before installation
    - Pull onto line/hose connection
11. **Bleeder housing/coupling**
12. **O-ring seal**
    - Always replace
    - Moisten with brake fluid before installation
    - Pull onto line/hose connection
13. **Securing clip**
    - Pull clip out and onto stop to release hydraulic line hose assembly
14. **Bleeder valve**
    - See **Clutch hydraulic system, 02J and 02M, bleeding**
15. **Bleeder valve dust cap**
    - Always reinstall when finished bleeding
16. **Securing clip**
    - Pull clip out and onto stop to release hydraulic line hose assembly
17. **Clutch slave cylinder**
    - Located within bellhousing of transmission
    - Requires removal of transmission for access. See **34 Manual Transmission**
18. **Securing clip**
    - Pull clip out and onto stop to release hydraulic line hose assembly



Pushrod retainer, removing

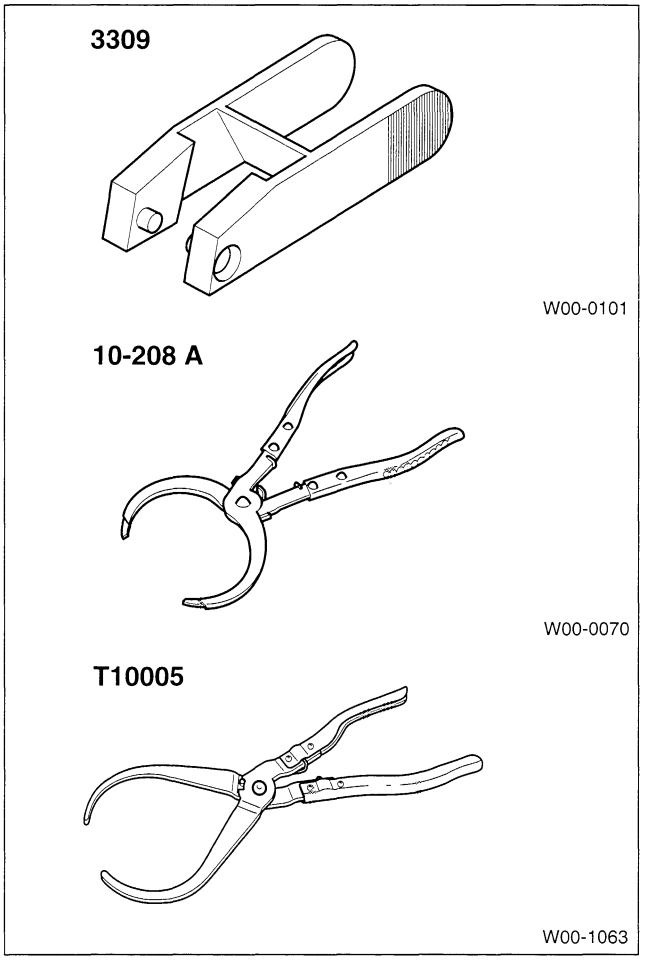
- Pry retainer (**A**) off in direction of **arrow**



Pushrod retainer, installing

- Press pushrod into retainer (**A**) in direction of **arrow**

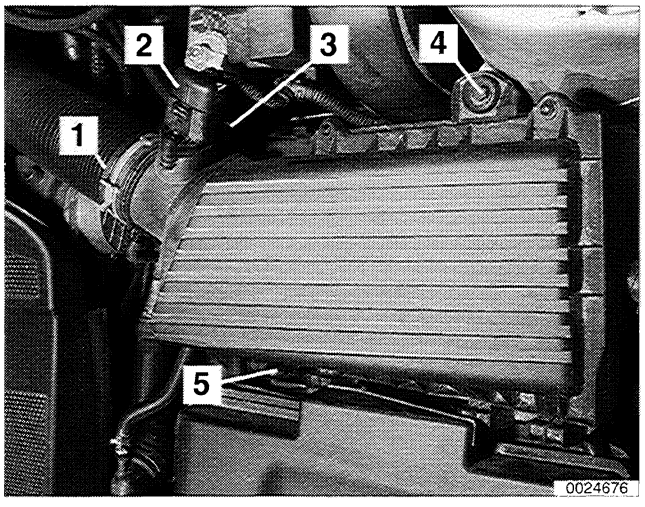
Clutch master cylinder, removing and installing (02J and 02M)



Several special tools are required for this procedure. Release tool 3309 and valve shim pliers 10-208A (or their equivalent) are used together. Special tool T10005 has sufficient reach and can be used by itself without 3309.

– Disconnect battery ground (GND) strap from battery negative (–) terminal. See the **Cautions and Warnings** at the beginning of this repair group regarding battery disconnection.

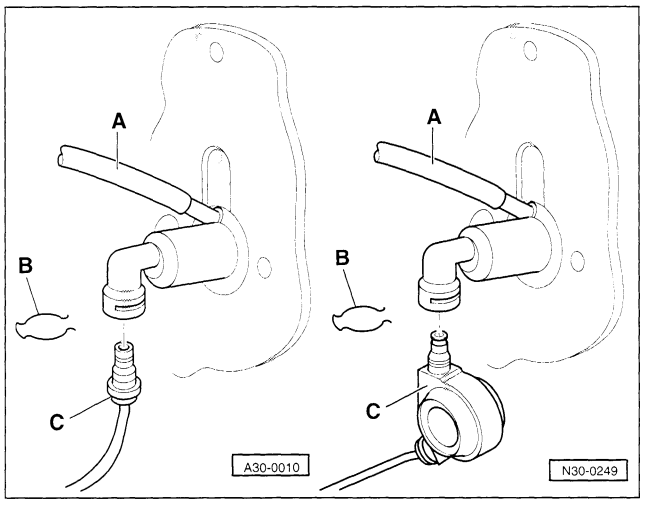
NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.



Remove intake air hose (**1**) and harness connector (**2**) from Mass Air Flow (MAF) sensor.

– Remove vacuum hose (**3**) to air cleaner near MAF, where equipped.

– Remove air cleaner mounting bolts (**4** and **5**) and pull out complete air cleaner assembly.



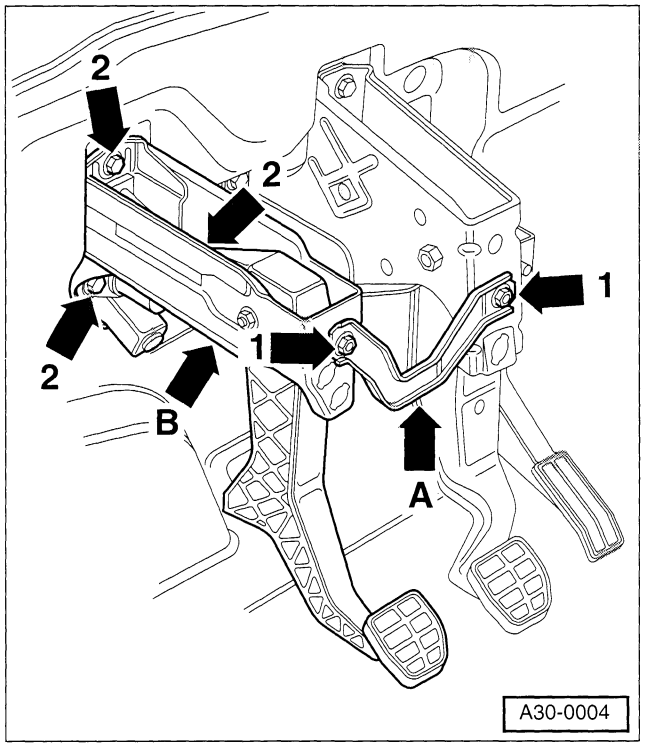
➤ Remove supply hose (**A**) from brake fluid reservoir and seal end to prevent dirt or moisture from entering.

– Pry out clip (**B**) for brake line and hose assembly (**C**) at master cylinder.

– Pull line/hose assembly (**C**) out of rear of master cylinder and seal ends to prevent dirt or moisture from entering.

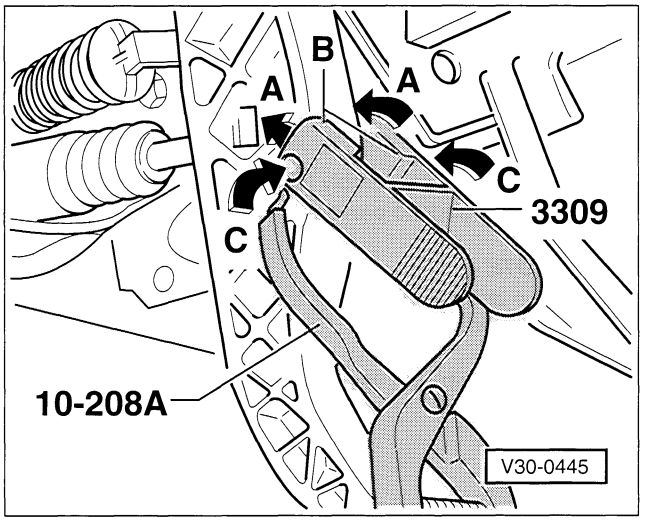
NOTE —
*Two different versions of the line/hose assembly (**C**) are used.*

– Remove left side lower under-dash (close-out) panels.



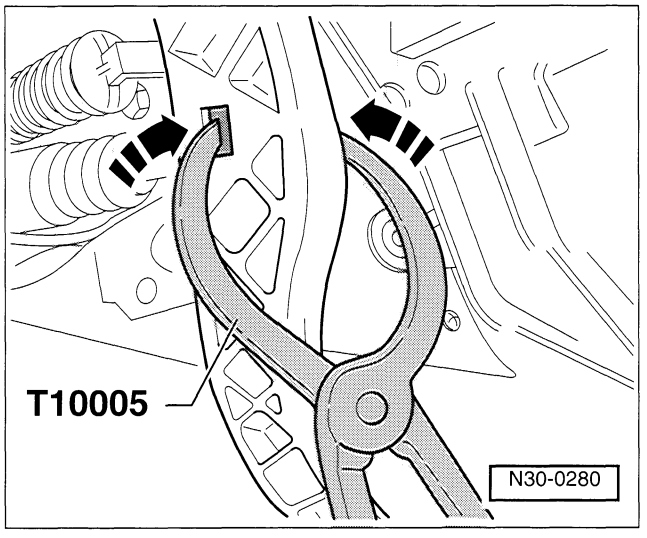
➤ Remove clutch pedal mounting bracket:

- Remove self-locking nuts (**1**) for clutch and brake pedal mount connecting bracket (**A**)
- Remove self-locking nuts (**2**) for clutch pedal mounting bracket (**B**).
- Take out mounting bracket complete with clutch master cylinder.



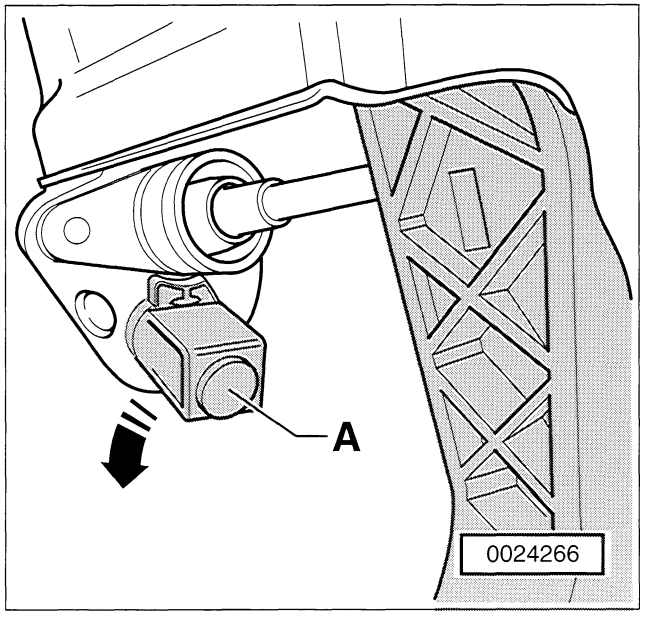
– Depending on the available special tools, separate clutch master cylinder push rod retainer from clutch pedal.

➢ Using special tools **3309 & 10-208A**, insert release tool 3309 in clutch peal cutout (**A**) with inscription "**top/oben**" (**B**) pointing away from clutch pedal. Position pliers, tool 10-208A (or similar), in recesses (**C**) on sides of release tool. Squeeze pliers which will press release tool release pushrod retainer from pedal.

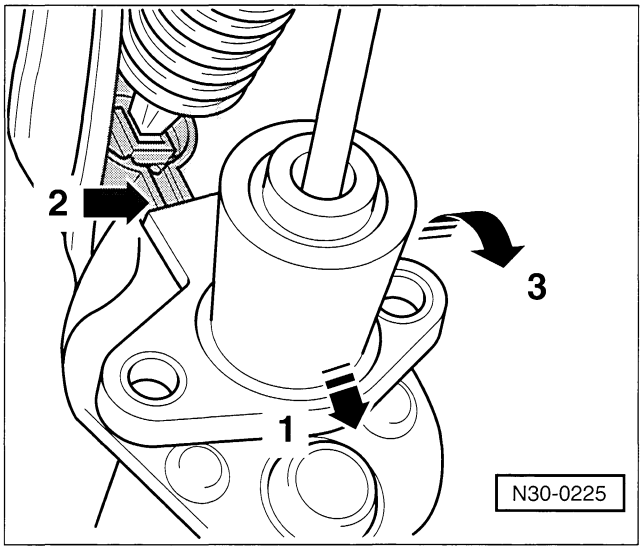


– Depending on the available special tools, separate clutch master cylinder push rod retainer from clutch pedal.

➢ Using special tool **T10005**, pull clutch pedal slightly towards the at-rest position and insert the tips of tool T10005 into the retainer recesses (**dashed arrows**). Squeeze pliers while pulling slightly on pedal.

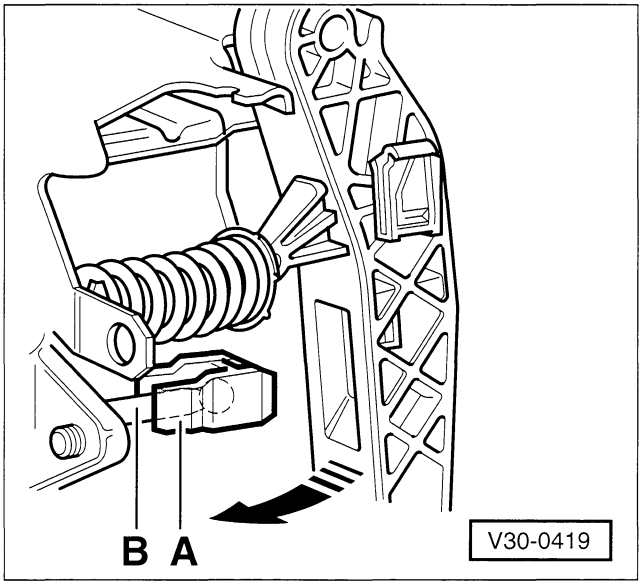


➢ Turn clutch pedal stop (**A**) counter-clockwise (**dashed arrow**) and remove.

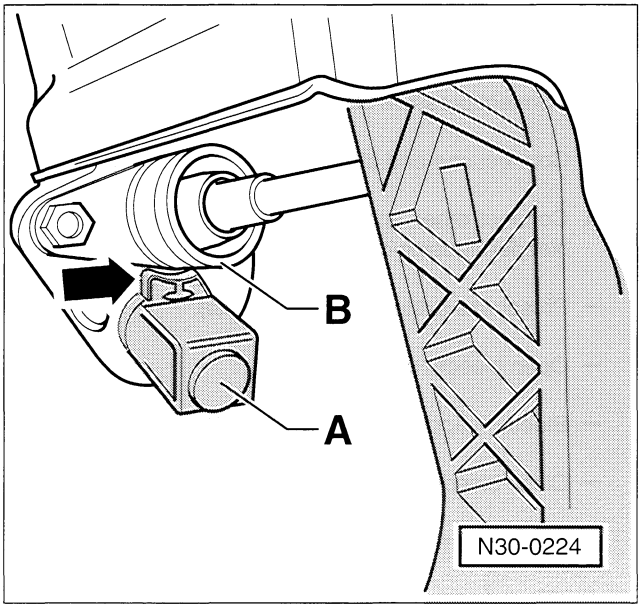


➤ Push clutch master cylinder down onto stop (**dashed arrow 1**) and swing downward (**dashed arrow 3**) out of mounting bracket. The upper part of the master cylinder (**arrow 2**) must not be blocked by the over-center spring mount.

Clutch master cylinder Installation is the reverse of removal, noting the following points:



➤ Ensure that pushrod retainer (**A**) is properly positioned on clutch master cylinder pushrod (**B**). Push pedal down slightly (**dashed arrow**) to engage retainer in pedal.



➤ Install clutch pedal stop (**A**) by fitting into mounting hole and turning clockwise. Ensure that locking tab (**arrow**) is correctly positioned and locked against clutch master cylinder (**B**).

– Bleed clutch hydraulic system after installation of clutch master cylinder. See **Clutch hydraulic system, bleeding**.

Tightening torque

- Clutch master cylinder mounting nuts (always replace) . . . . . 25 Nm (18 ft-lb)

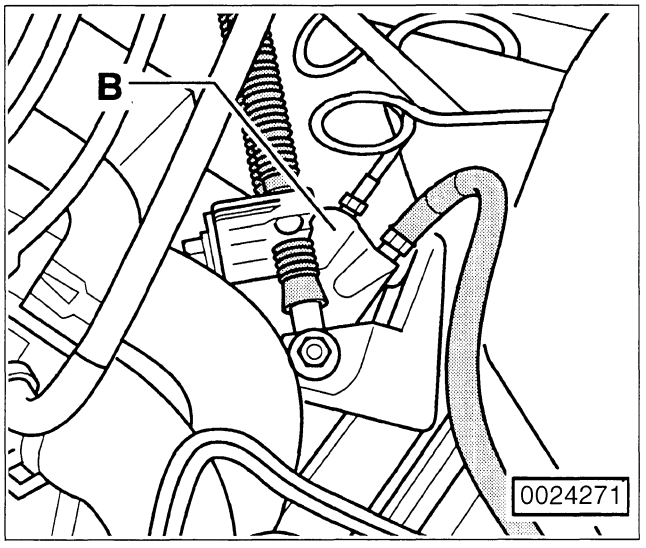


Clutch hydraulic system bleeding (02J and 02M)

Factory specifications call for pressure bleeding of the clutch hydraulic system. Slight difference in bleeding procedures are due to slave cylinder configuration.

➢ Latest version pressure bleeder VAS 5234 is used in conjunction with VAG 1238/B3 bleeder hose. Earlier pressure bleeders such as VAG 1869, US 1116 and equivalents are also suitable. Follow manufactures instructions as needed.

– To bleed clutch hydraulic system, connect VAG 1238/B3 hose to bleeder valve. If special tool is not available, use approximately 670 mm (26 in.) of hose sized to fit over the bleeder valve on the slave cylinder or bleeder housing/coupling.

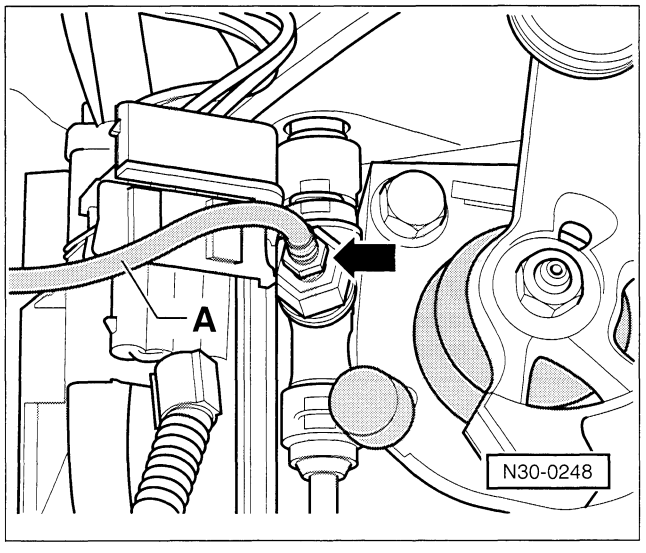


02J Transmission

– Connect pressure bleeder to clutch hydraulic system.

– Connect one end of bleed hose to collection bottle.

➢ Connect other end of bleed hose to slave cylinder (**B**) and open bleeder valve to bleed system.



02M Transmission

– Connect pressure bleeder to clutch hydraulic system.

– Connect one end of bleed hose to collection bottle.

➢ Connect other end of bleed hose to bleeder valve on bleeder housing/coupling (**arrow**).

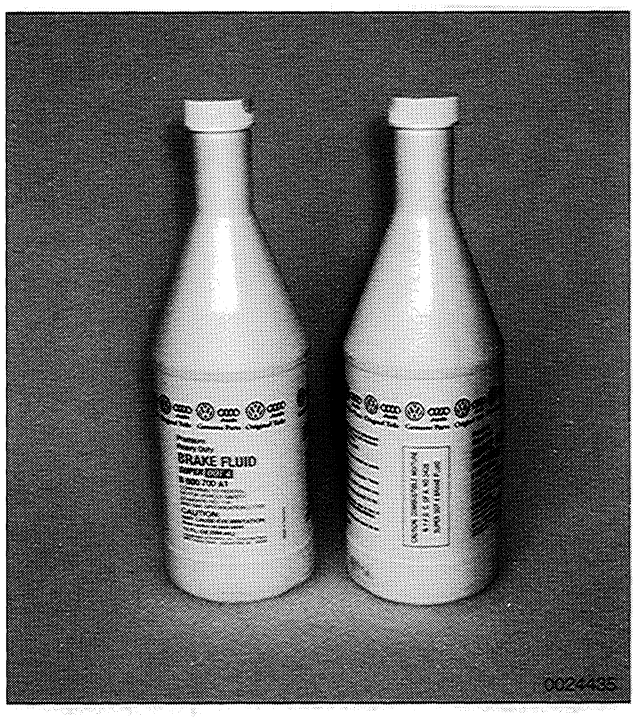
– Pressurize system to 2 bar (30 psi).

– Open bleeder valve.

– Bleed off approximately 100 cc (3½ oz).

– Close bleeder valve.

– Quickly pump clutch pedal 10 to 15 times.



– Bleed off an additional 50 cc (1¾ oz).

– Close bleeder valve.

02J and 02M transmissions

– Pump clutch pedal several times after completing bleeding process.

➤ Check and top off hydraulic (brake) fluid in reservoir as needed.

Hydraulic (brake) fluid specification

- DOT 4 Super (Volkswagen B 000 700 A1, B 000 700 A7, or B 000 700 A8)
  Minimum wet boiling point . . . . . 329°F (165°C)
  Dry boiling point (exceeds) . . . . . 500°F (260°C)

– Check for proper clutch operation and ensure correct engagement and shifting.

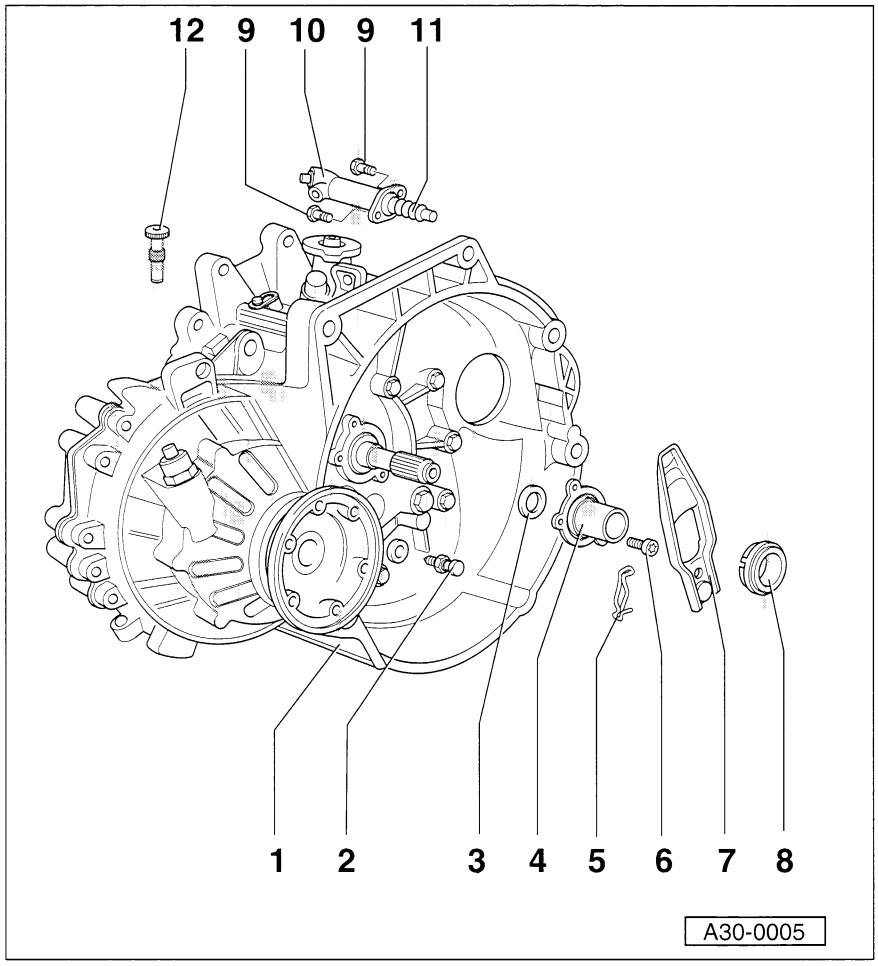
CLUTCH RELEASE MECHANISM

The following section shows the clutch release mechanism components from the engine side of the transmission for the 02J and 02M. Removal and installation procedures for the clutch slave cylinder depend on the transmission type.

Replacement of the other clutch release components will require transmission removal. See **34 Manual Transmission** for transmission removal and reinstallation procedures.

Clutch release mechanism (02J)

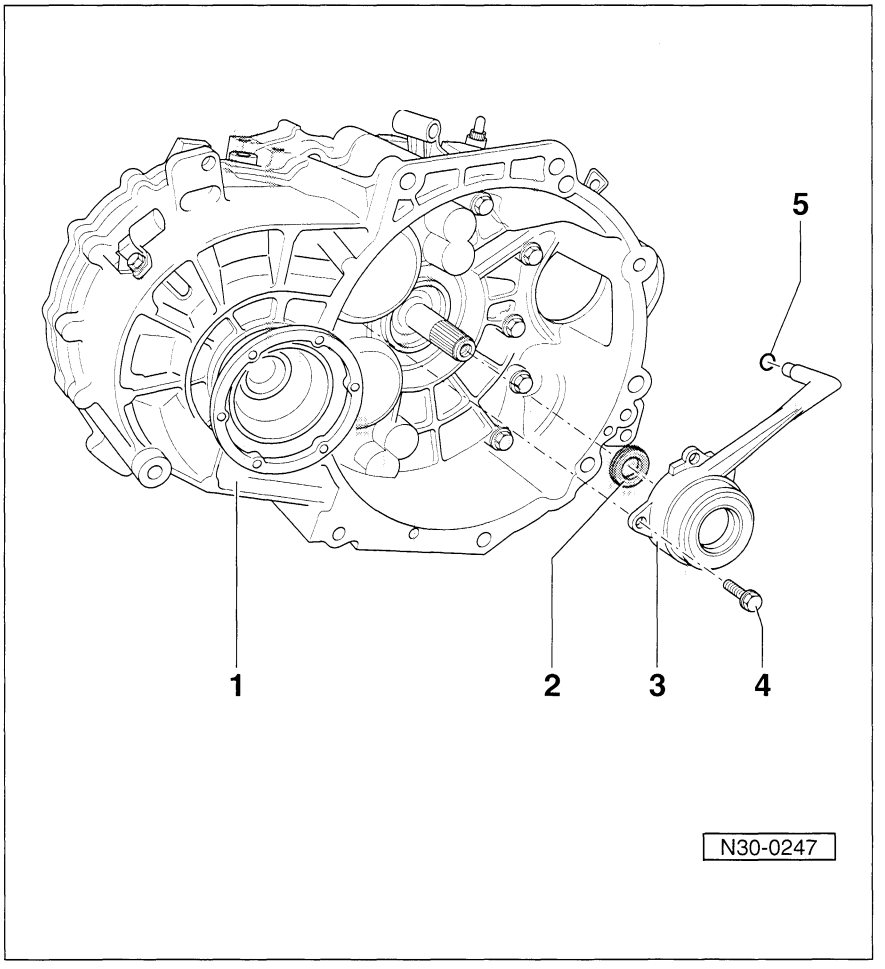
On vehicles equipped with the 02J transmission, the clutch slave cylinder can be replaced with the transmission installed in the vehicle. Replacement of most other clutch release components will require transmission removal for access. See **34 Manual Transmission** for transmission removal and reinstallation procedures.



1. **Transmission housing**
2. **Ball stud**
   - Pivot point for clutch release lever
   - Tighten to 25 Nm (18 ft-lb)
   - Lubricate with MoS_2
3. **Input shaft oil seal**
4. **Guide sleeve**
   - With vulcanized O-ring
   - If damaged, replace guide sleeve and O-ring
   - Lubricate guide sleeve in area of release bearing with MoS_2 (moly) grease
5. **Retaining spring**
   - Secures clutch release lever to ball stud
6. **Bolt, polygon socket head**
   - Tighten to 20 Nm (15 ft-lb)
7. **Clutch release lever**
8. **Release (throw-out) bearing**
   - Do not wash bearing out, only wipe clean
   - Always replace noisy bearings
   - Lubricate surfaces which contact release lever with MoS_2 (moly) grease
9. **Bolt, hex**
   - Tighten to 20 Nm (15 ft-lb)
10. **Clutch slave cylinder**
    - Can be removed from transmission without disconnecting hydraulic line.
    - If hydraulic line must be disconnected for servicing or cylinder replacement, always bleed clutch hydraulic system.
11. **Slave cylinder plunger**
    - Lubricate end of plunger with MoS_2 (moly) grease
12. **Assembly bolt/pin**
    - Secures clutch release lever in full off position for installing transmission.
    - Remove after transmission has been installed
    - Usually made from a red plastic material. An M8 x 35 bolt can be used in place of assembly bolt/pin.

Clutch release mechanism, (02M)

On vehicles equipped with the 02M transmission, the clutch slave cylinder cannot be replaced with the transmission installed in the vehicle. Replacement of this component along with the remaining clutch release components will require transmission removal. See **34 Manual Transmission** for transmission removal and replacement procedures.

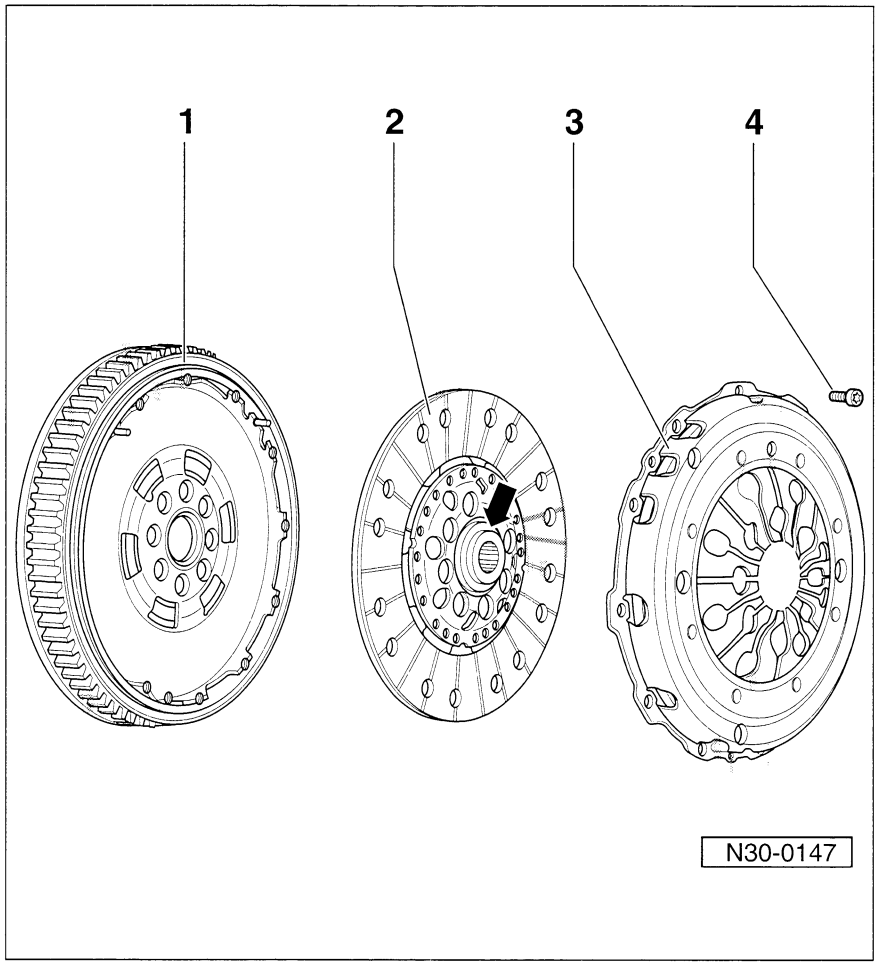


1. **Transmission housing**
2. **Input shaft oil seal**
3. **Slave cylinder with release bearing**
   - Replacement requires removal of transmission
   - Bearing and slave cylinder comprise one assembly, replace as one unit
   - If bearings are noisy, complete assembly must be replaced
   - Do not wash bearing out, only wipe clean
4. **Bolt shouldered hex**
   - Tighten to 12 Nm (9 ft-lb)
5. **O-ring seal**
   - Always replace
   - Moisten with brake fluid before installation
   - Pull onto line/hose connection

CLUTCH SERVICING, (02J AND 02M)

NOTE —
*Transmission must be removed prior to servicing clutch. See **34 Manual Transmission***

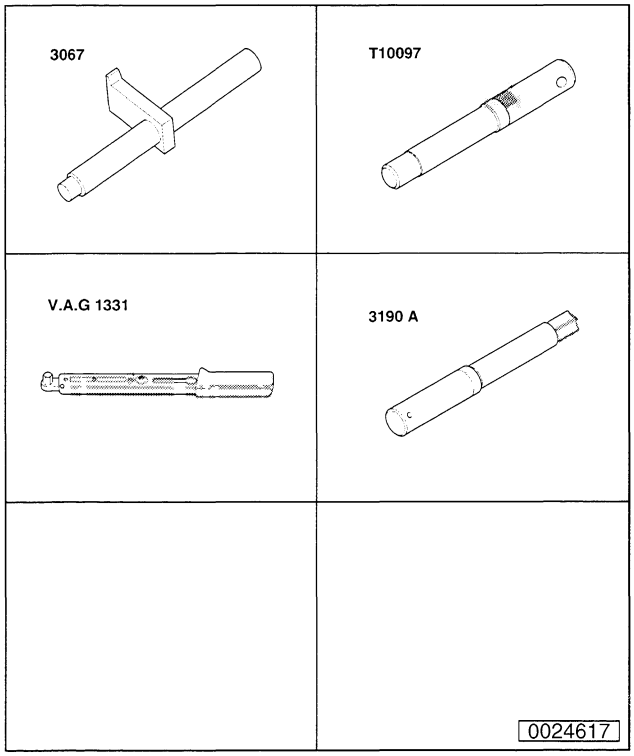
Clutch assembly



1. **Flywheel**
   - Two-piece (dual mass) shown
   - Two-piece and single-piece flywheels installed depending on engine and transmission
   - Ensure that locating pins fit tightly in flywheel holes
   - Contact surfaces for clutch disc must be free of grooves, oil, grease, and preservative coatings.
   - Removing/installing, see **13a** or **13b Crankshaft/Cylinder Block**
2. **Clutch disc (plate)**
   - Diameter varies according to engine type/code
   - Installation position on two-piece flywheel: shorter disc hub end (**arrow**) points toward pressure plate
   - Installation position on one-piece flywheel: spring cage faces pressure plate
   - Clean corrosion and lightly grease splines on transmission input shaft and clutch disc hub with special VW/Audi grease G 000 100
   - After light greasing, move clutch disc back and forth on input shaft until hub moves freely on shaft. Remove excess lubricant from clutch disc hub and input shaft.
   - Clutch disc must be centered on flywheel for transmission installation, see **Clutch disc, centering; Pressure plate, removing and installing**
3. **Pressure plate**
   - Pressure plates are protected against rust and corrosion. Only remove protection on disc contact and mounting surfaces. Complete removal of corrosion protection may shorten service life of clutch.
   - Clean surfaces with suitable cleaner that leaves no residue.
   - Removing and installing, see **Clutch disc, centering; Pressure plate, removing and installing**
   - Check ends of diaphragm spring, see **Pressure plate diaphragm spring, checking**
4. **Bolt, polygon socket or 12 point socket head**
   - Several different bolt types. Correct version dependant on flywheel and/or engine type
   - Loosen and tighten gradually and diagonally
   - Two-piece flywheel: Tighten to 13 Nm (10 ft-lb)
   - One-piece flywheel: Tighten to 20 Nm (15 ft-lb)

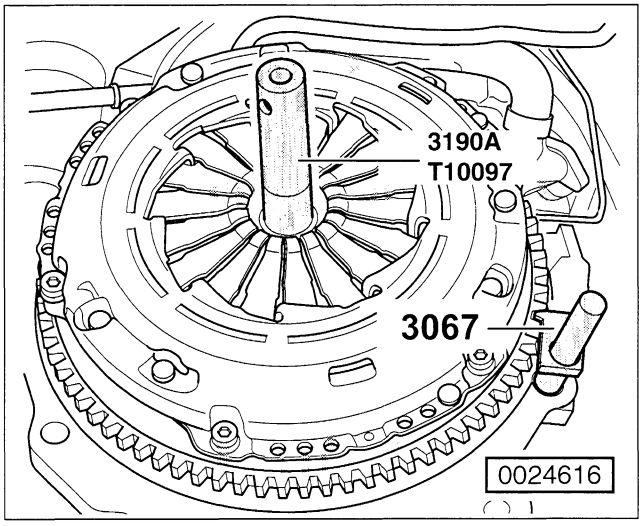
NOTE —

- *Replace clutch plates and pressure plates that have damaged or loose rivets.*
- *Select the correct clutch disc and pressure plate according to engine type and/or code.*
- *Two-piece and single-piece flywheels installed depending on engine and transmission type.*



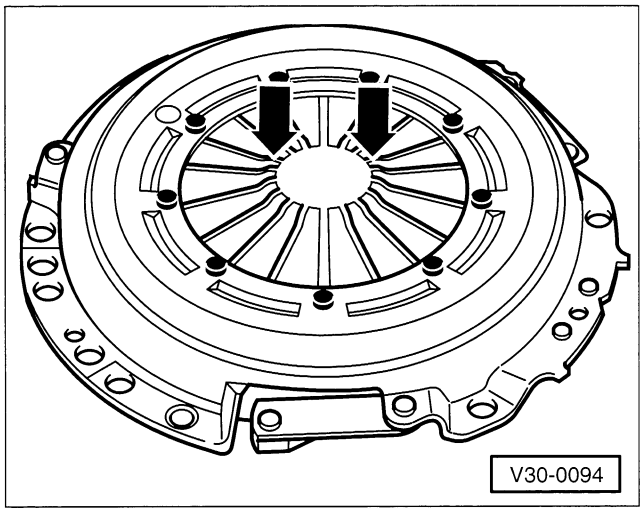
Special tools required for removing and installing clutch disc and pressure plate:

- Centering mandrels 3190A, T10097 or equivalent are used to center the clutch disc on the flywheel when the pressure plate is bolted down. Be sure that mandrel is fully seated into the centering hole in the center of the flywheel.
- Flywheel lock 3067 or equivalent is used to lock the flywheel during removal and installation. Proper use prevents damage to flywheel ring gear teeth.
- Torque wrench VAG 1331 or equivalent.



Clutch disc, centering; Pressure plate, removing and installing

- When removing pressure plate, loosen bolts diagonally to ensure that pressure plate is removed evenly. When installing, tighten bolts diagonally to ensure that pressure plate is seated squarely on flywheel without distortion.
- If not seated and torqued evenly, chattering and engagement problems can result.
- Center clutch disc with 3190A or T10097 as appropriate for clutch version
- Flywheel lock, special tool 3067, is shown in position during clutch installation. Reverse position for clutch removal.



Pressure plate diaphragm spring, checking

- Check pressure plate diaphragm spring ends (**arrows**) for wear.
- Maximum wear (wear limit): up to one half (½) of the original spring material thickness.

QUALITY REVIEW

When you have finished working under the hood, under the vehicle, and around other areas, it is advisable to take a moment to quality check or review your work. This helps to insure that the operation or repair has been completed properly with all affected systems functioning within normal parameters. These may include the following:

- Make sure that all components involved in the repair are positioned correctly and function properly.
- Make sure all tools and shop cloths are removed.
- Be sure to top off brake fluid.
- Be careful not to spill brake fluid as it can damage painted surfaces. Wipe up any spills immediately.
- Check for smooth operation of clutch pedal and shift linkage.
- Before road testing vehicle, confirm that clutch operates properly.
- Road test the vehicle to check operation of clutch and transmission.

32 Torque Converter

GENERAL 32-1

TORQUE CONVERTER 32-2
Torque converter identification (01M) 32-2
Torque converter identification (09A) 32-3
Torque converter oil seal replacement (01M) . . 32-4
Torque converter oil seal replacement (09A) . . . 32-5
Turbine shaft sleeve bearing removal (01M) . . . 32-6
Torque converter installing (09A) 32-7
Torque converter, draining 32-8
Automatic Transmission Fluid (ATF) 32-8

GENERAL

Servicing of the automatic transmission torque converter requires that the transmission be removed from the vehicle. Special tools and equipment are required to remove the transmission and service the torque converter. See **37 Automatic Transmission** for transmission removal procedures. Read the procedures through to fully understand the scope and nature of the job.

WARNING —

- *The cars covered by this manual use an airbag system that automatically deploys the airbags in the event of a frontal or side impact. The airbags are inflated by an explosive device. Handled improperly or without adequate safeguards, the system can be very dangerous. Special precautions must be observed prior to any work at or near the steering wheel or steering column, including the pedal assembly. See* **69 Seatbelts, Airbags**.
- *To guard against personal injury or airbag system failure, only trained Volkswagen service technicians should test, disassemble or service the airbag system.*
- *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using Volkswagen scan tools VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent scan tool or computer program.*
- *Before working on the pedal cluster, obtain anti-theft radio code and then disconnect battery ground (–) strap.*
- *Part numbers are listed for reference only. Consult an authorized Volkswagen Dealer or aftermarket parts Specialist for the latest parts information.*

TORQUE CONVERTER

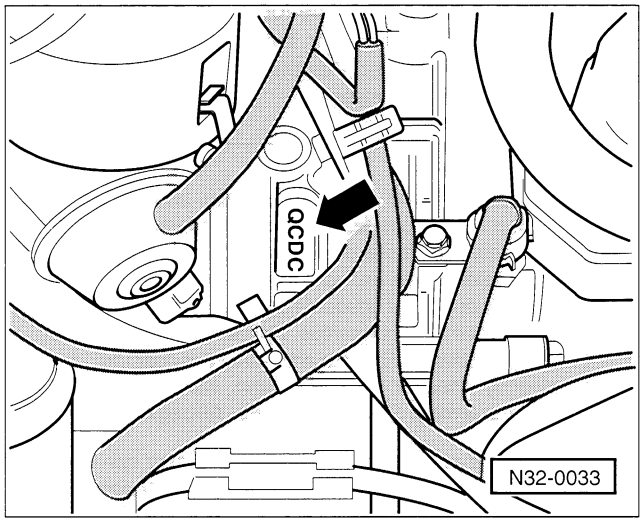
The torque converter is a type of fluid coupling connecting the engine and the transmission. It is driven by a steel drive plate which is attached to the engine crankshaft. In addition to connecting the engine and transmission, some versions drive the ATF pump inside the transmission which supplies hydraulic pressure for operation.

Transmission Types

- 01M . . . . . 4-speed automatic transmission
- 09A. . . . . 5-speed automatic transmission

Torque converter identification (01M)

Different versions of the torque converter are installed depending on engine type and these can be identified by a 4-digit code. For correct application, see **37 Automatic Transmission**.



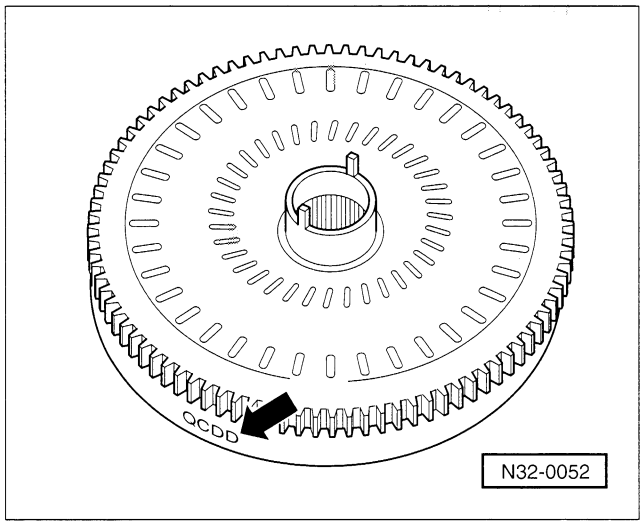
Torque converter identification can be made on 01M transmissions without removal. Turn engine over by hand until the 4-digit code (**QCDC** in example) shows through the slot (**arrow**) in the transmission housing.

Aside from different operating characteristics, two different torque converter types are used.

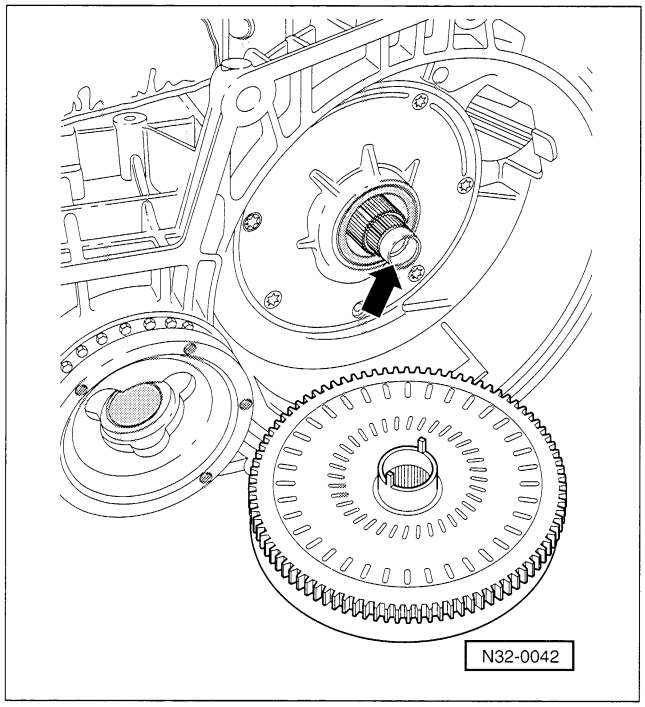
- If the transmission turbine shaft has an internal sleeve bearing, the torque converter will have a plain bearing surface.
- If the transmission turbine shaft does not have an internal sleeve bearing, the torque converter will have an external needle bearing.

NOTE —

If a new torque converter with integrated needle bearing is installed in a transmission with a sleeve bearing in the turbine shaft, the sleeve bearing must be removed.



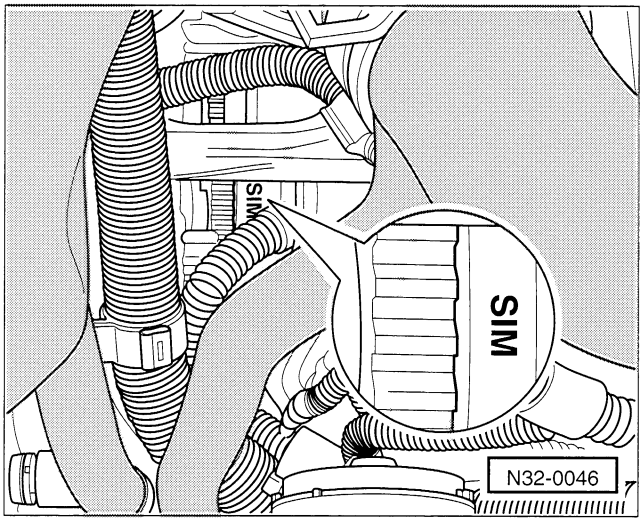
Torque converter identification is stamped into circumference as shown (**arrow**). The letters **B, C, R, T, V** in the last (4th) code letter position are to be used in transmissions with sleeve bearings. Torque converters with codes **D, H, J** will have integrated external needle bearings.



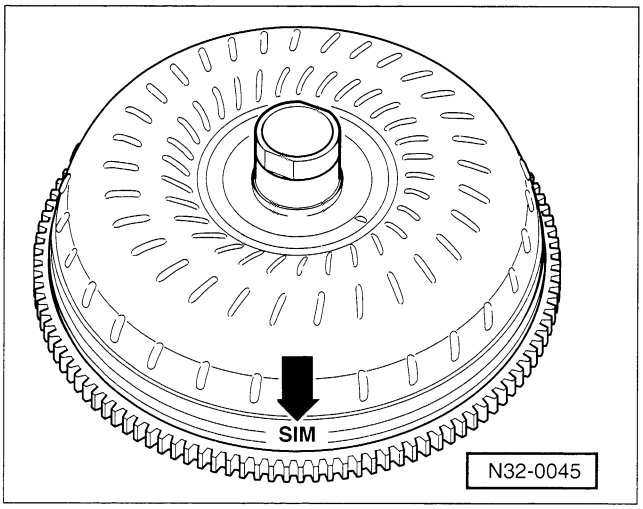
➤ Sleeve bearing (**arrow**) is pressed into turbine shaft. Ensure correct torque converter and turbine shaft match as noted above. See **37 Automatic Transmission**, for application data tables.

Torque converter identification (09A)

Different versions of the torque converter are also installed with 09A transmissions, depending on engine type. These can be identified by a 4-digit code. For correct application, see **37 Automatic Transmission**.

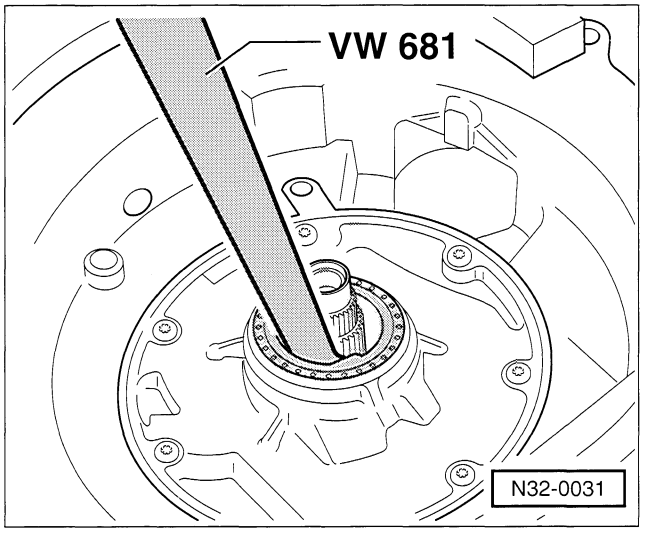


➤ Torque converter identification can be made on 09A transmissions without removal. Turn engine over by hand until the 3-digit code (**SIM** in example) shows through the slot in the transmission housing as shown.

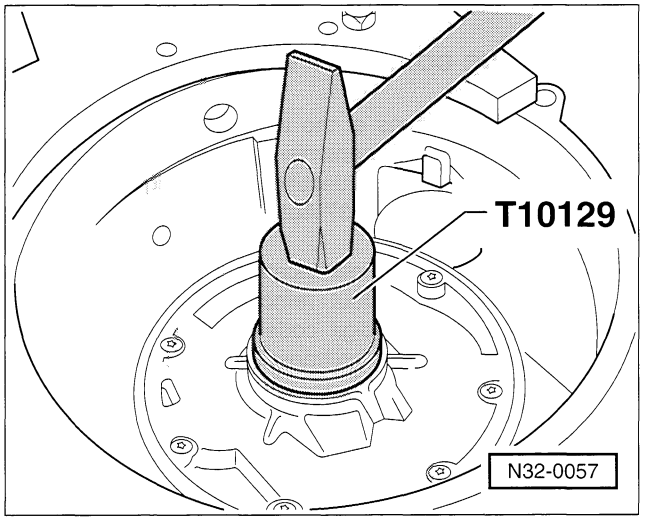


➤ Torque converter identification (**SIM** in example) is stamped into circumference as shown (**arrow**).

Torque converter oil seal replacement (01M)

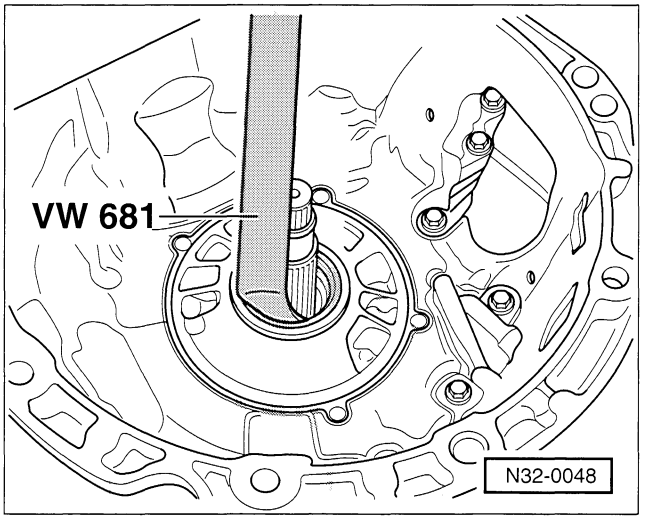


- Carefully pry out oil seal with special tool VW 681 or equivalent. Use care to avoid gouging the housing with the tip of the removal tool. Seal is usually destroyed during removal.

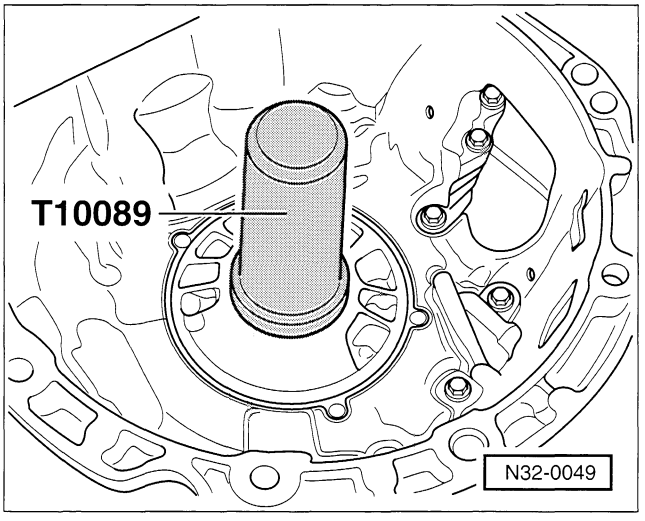


- Install new oil seal squarely into cover with seal installer 3158 or equivalent. Drive new oil seal into cover until it is flush with cover edge.

Torque converter oil seal replacement (09A)

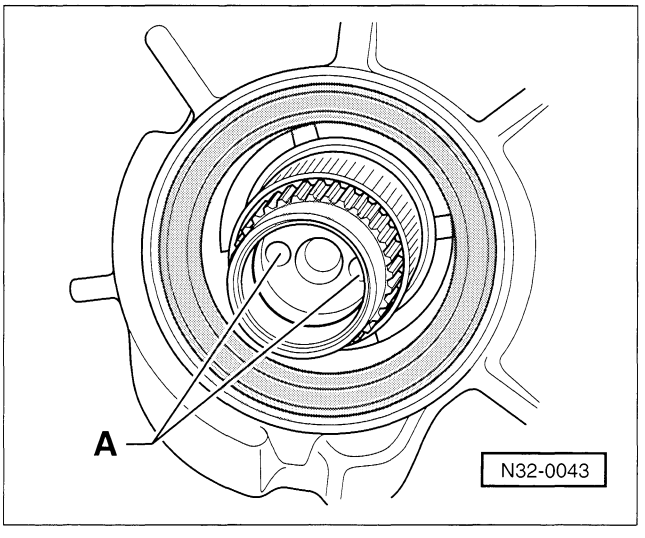


➤ Carefully pry out oil seal with special tool VW 681 or equivalent. Use care to avoid gouging the housing with the tip of the removal tool. Seal is usually destroyed during removal.



➤ Install new oil seal squarely into cover with seal installer T10089 or equivalent. Drive new oil seal into cover until it is flush with cover edge.

Turbine shaft sleeve bearing removal (01M)

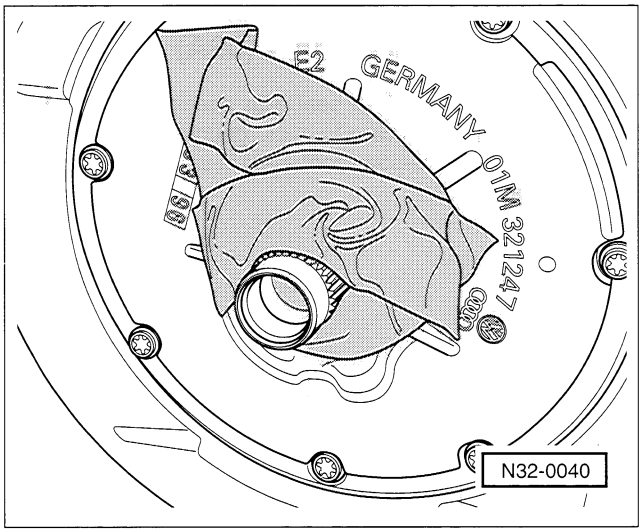


If a new torque converter with integrated needle bearing is installed in a 01M transmission with a sleeve bearing in the turbine shaft, the sleeve bearing must be removed to allow for proper operation.

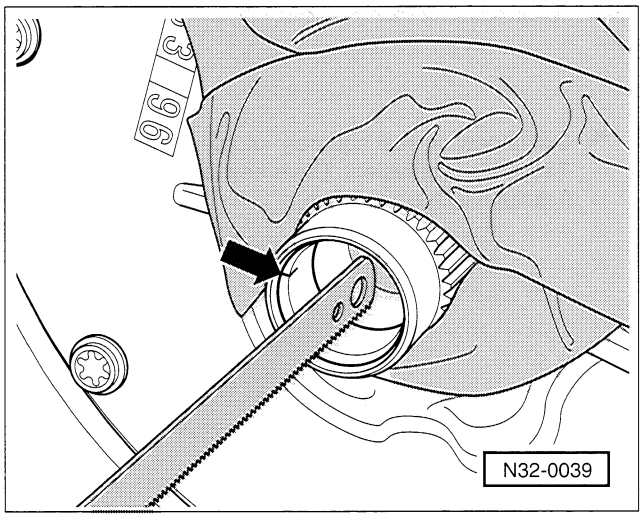
– Place transmission on a workbench or other suitable horizontal surface. Do not stand vertically.

– Slide torque converter out of transmission and store so that no filings from the sleeve bearing removal can enter.

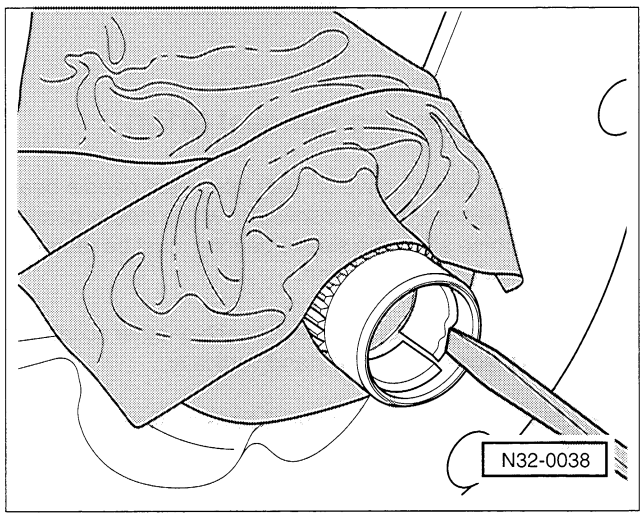
➤ Position hole (**A**) of turbine shaft in a horizontal position as shown.



Protect the input area of the transmission from filings that will be generated by the removal of the sleeve bearings. This can be accomplished by carefully wrapping adhesive tape (masking, duct, etc.) around the turbine shaft and over any holes.



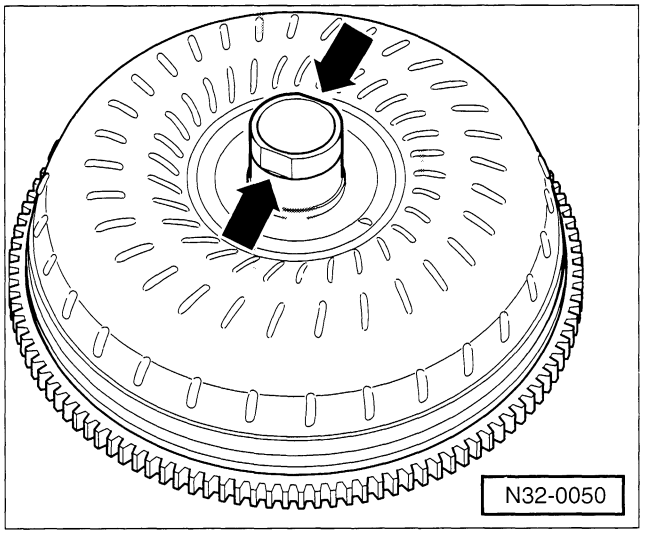
Using a hack saw blade, carefully saw through the sleeve bearing. Do not saw at thrust point of sleeve bearing (**arrow**). Saw carefully to keep filings out of transmission and to avoid marking the steel surface.



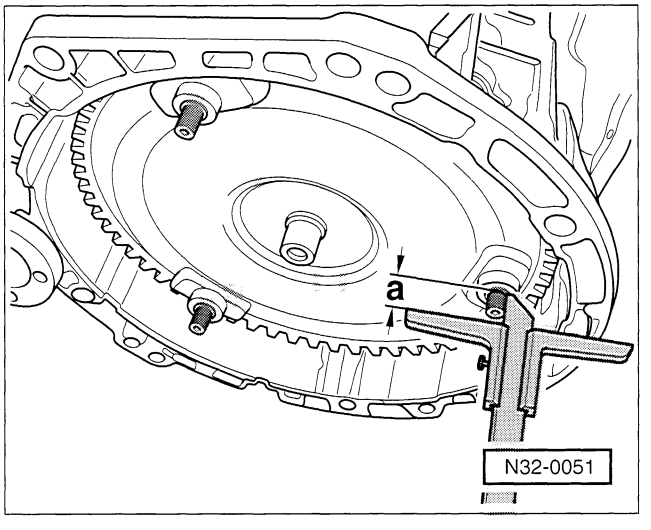
Carefully pry up split sleeve bearing with a screwdriver or similar tool. Use caution to avoid damaging turbine shaft.

- Remove protective tape and clean filings and adhesive residue.
- Replace torque converter seal as required.

Torque converter installing (09A)



➢ 09A transmissions drive the Automatic Transmission Fluid (ATF) pump via the torque converter at the locations indicated (**arrows**). When installing, ensure that the drive engages the recesses in the ATF pump inner wheel.



➢ The torque converter is installed correctly when the distance (**a**) between the transmission housing flange and the machined contact surface for the securing studs is as specified.

- 4-cylinder engines: 21 mm (0.827 in)
- 6-cylinder engines: 17 mm (0.669 in)

– If distance (**a**) is not correct, torque converter is not properly installed. Slide converter out and reposition until correct distance is obtained.

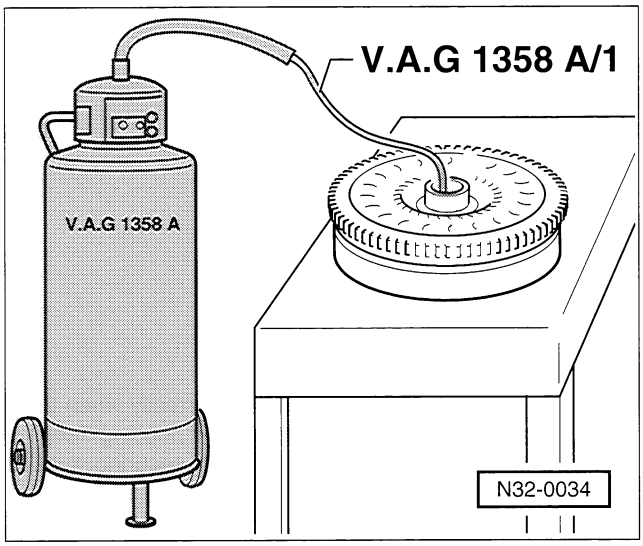
NOTE —

When installing transmission into vehicle, be sure that torque converter does not move. If torque converter slips out, installation distance may change and transmission can not be installed.

Torque converter, draining

If the torque converter has become contaminated by friction material wear particles or if required during major overhaul procedure, the torque converter must be completely drained.

This is best accomplished by use of the VAG 1358 or equivalent.



VAG 1358 shown with adapter VAG 1358 A/1. Always follow manufacturers instructions for operation.

NOTE —
Be sure to allow sufficient time for fluid to drain from all internal areas of torque converter.

Automatic Transmission Fluid (ATF)

Volkswagen requirements for ATF depend on the transmission type.

Automatic Transmission Fluid (VW ATF)
- 01M transmission (4-speed). . . . . G 052 162 A2
- 09A transmission (5-speed) . . . . . G 052 990 A2



Volkswagen supplies two different types of ATF for automatic transmissions. G 052 990 A2 (**left**) is specified for the 09A 5-speed and G 052 162 A2 (**right**) is specified for the 01M 4-speed transmission. See **0 Maintenance** for additional information.

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GENERAL

This repair group covers repair information for the cable-operated gear shift mechanism and the removal and installation of the 02J and 02M manual transmissions. This repair group does not cover transaxle or transmission teardown, disassembly, or internal repairs.

NOTE —

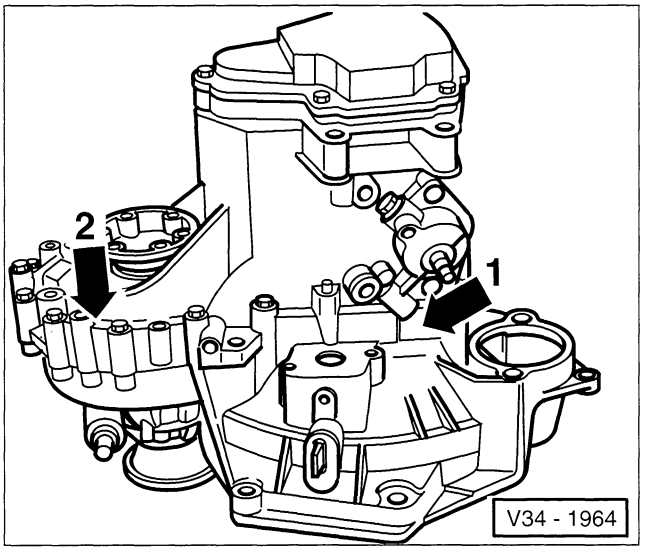
- *For information on the hydraulic and mechanical components of the clutch, see* **30 Clutch**.
- *For information on drive axles, including drive flange oil seals, see* **39 Differential and Final Drive**.
- *To check manual transmission oil, see* **0 Maintenance**.

WARNING —

- *Before working on the transmission or gear selector lever mechanism disconnect the negative (–) battery cable.*
- *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using a VAG 1551/1552 or equivalent scan tool.*
- *Be sure to have the anti-theft radio code on hand before disconnecting the battery.*

Transmission Types

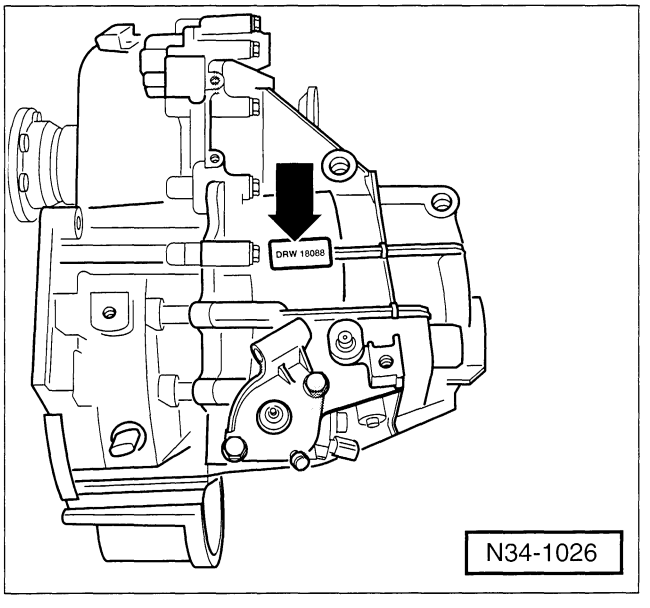
- 02J . . . . . 5-speed manual transmission
- 02M . . . . . 6-speed manual transmission



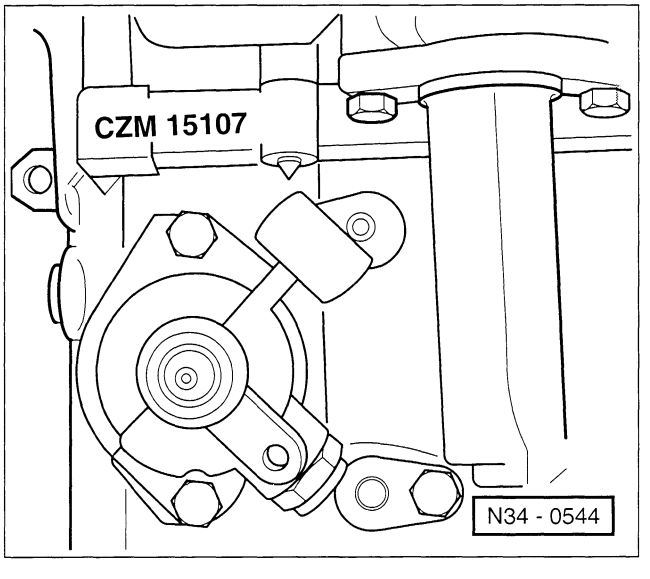
Transmission code location

The transmission code and production number can be found stamped on the transmission case near the shift linkage. See illustrations below. The transmission code letters can also be found on the vehicle data stickers located in the luggage compartment and attached to the Glovebox Owner's Manual.

Transmission code letters and date of manufacture for the 02J 5-speed manual transmission are stamped into machined area on transmission housing (**1**) near shifter linkage close to engine side. Transmission type designation (**2**) is cast into transmission housing at several locations.



Transmission code letters and date of manufacture for the 02M 5-and 6-speed manual transmission are stamped into machined area at upper center of transmission housing (**arrow**).



Transmission code letters and date of manufacture identification are the same for both 02J and 02M transmissions. Example is a code **CZM**, manufactured on the **15**th day of the **10**th month in 199**7**

Tables a lists the engine applications, gear ratios, and other data for the different versions of the 02J 5-speed manual transmission. **Table b** covers the same data for the 02M 6-speed.

Table a. 02J manual transmission specifications

Code letters	EBN	EBQ	EGX	EGY
Engine application, horsepower	1.8L, 150hp	1.8L, 150hp	1.8L, 150hp	1.8L, 150hp
Ratio: Z_2:Z_1				
Final drive	70:19 = 3.684	63:16 = 3.938	63:16 = 3.938	70:19 = 3.684
1st gear	33:10 = 3.300	33:10 = 3.300	33:10 = 3.300	33:10 = 3.300
2nd gear	35:18 = 1.944	35:18 = 1.944	35:18 = 1.944	35:18 = 1.944
3rd gear	34:26 = 1.308	34:26 = 1.308	34:26 = 1.308	34:26 = 1.308
4th gear	35:34 = 1.029	35:34 = 1.029	35:34 = 1.029	35:34 = 1.029
5th gear	36:43 = 0.837	36:43 = 0.837	36:43 = 0.837	36:43 = 0.837
Reverse gear	17:10 x 36:20 = 3.060	17:10 x 36:20 = 3.060	17:10 x 36:20 = 3.060	17:10 x 36:20 = 3.060
Speedometer drive	13:22 = 0.591	13:22 = 0.591	13:22 = 0.591	13:22 = 0.591
Lubricant (also see table c)				
Capacity	2.0 liters (2.1 qt.)			
Specification	G50 synthetic oil, SAE 75W90	G50 synthetic oil, SAE 75W90	G50 synthetic oil, SAE 75W90	G51 synthetic oil, SAE 75W90
Clutch control	hydraulic			
Clutch disc diameter	219 mm	219 mm	225 mm	225 mm
Driveshaft flange diameter	100 mm	100 mm	100	100 mm
Ratio, overall in top gear	3.084	3.296	3.296	3.084

Table a. (continued) 02J manual transmission specifications

Code letters	EHA	ENJ	FBW	FBX
Engine application, horsepower	1.8L, 180hp	1.8L, 150hp	1.8L, 150hp	1.8L, 150hp
Ratio: Z_2:Z_1				
Final drive	62:17 = 3.647	70:19 = 3.684	63:16 = 3.938	70:19 = 3.684
1st gear	33:10 = 3.300	33:10 = 3.300	33:10 = 3.300	33:10 = 3.300
2nd gear	35:18 = 1.944	35:18 = 1.944	35:18 = 1.944	35:18 = 1.944
3rd gear	34:26 = 1.308	34:26 = 1.308	34:26 = 1.308	34:26 = 1.308
4th gear	30:29 = 1.034	35:34 = 1.029	35:34 = 1.029	35:34 = 1.029
5th gear	31:37 = 0.838	36:43 = 0.837	36:43 = 0.837	36:43 = 0.837
Reverse gear	17:10 x 36:20 = 3.060	17:10 x 36:20 = 3.060	17:10 x 36:20 = 3.060	17:10 x 36:20 = 3.060
Speedometer drive	13:22 = 0.591	13:22 = 0.591	13:22 = 0.591	13:22 = 0.591
Lubricant (also see table c)				
Capacity	2.0 liters (2.1 qt.)			
Specification	G50 synthetic oil, SAE 75W90	G50 synthetic oil, SAE 75W90	G50 synthetic oil, SAE 75W90	G51 synthetic oil, SAE 75W90
Clutch control	hydraulic			
Clutch disc diameter	225 mm	219 mm (through 06-00) 225 mm (from 07-00)	219 mm (through 06-00) 225 mm (from 07-00)	219 mm (through 06-00) 225 mm (from 07-00)
Driveshaft flange diameter	108 mm	108 mm	108 mm	108 mm
Ratio, overall in top gear	3.056	3.084	3.296	3.084

Table a. (continued) 02J manual transmission specifications

Code letters	FDS			
Engine application, horsepower	1.8L, 150hp			
Ratio: Z_2:Z_1				
Final drive	63:16 = 3.938			
1st gear	33:10 = 3.300			
2nd gear	35:18 = 1.944			
3rd gear	34:26 = 1.308			
4th gear	35:34 = 1.029			
5th gear	36:43 = 0.837			
Reverse gear	18:9 x 36:20 = 3.600			
Speedometer drive	13:22 = 0.591			
Lubricant (also see table c)				
Capacity	2.0 liters (2.1 qt.)			
Specification	G50 synthetic oil, SAE 75W90			
Clutch control	hydraulic			
Clutch disc diameter	225 mm			
Driveshaft flange diameter	100 mm			
Ratio, overall in top gear	3.296			

Table a. (continued) 02J manual transmission specifications

Code letters	DQY	EBJ	EGR	EUH
Engine application, horsepower	1.9L, 90hp	1.9L, 90hp	1.9L, 90hp	1.9L, 100hp
Ratio: Z_2:Z_1				
Final drive	61:18 = 3.389	61:18 = 3.389	61:18 = 3.389	72:17 = 4.235
1st gear	34:9 = 3.788	34:9 = 3.788	34:9 = 3.788	34:9 = 3.788
2nd gear	36:17 = 2.118	36:17 = 2.118	36:17 = 2.118	33:16 = 2.063
3rd gear	34:25 = 1.360	34:25 = 1.360	34:25 = 1.360	31:23 = 1.360
4th gear	34:35 = 0.971	34:35 = 0.971	34:35 = 0.971	29:30 = 0.870
5th gear	34:45 = 0.756	34:45 = 0.756	34:45 = 0.756	29:39 = 0.744
Reverse gear	18:9 x 36:20 = 3.600	18:9 x 36:20 = 3.600	18:9 x 36:20 = 3.600	18:9 x 36:20 = 3.600
Speedometer drive	13:22 = 0.591	13:22 = 0.591	13:22 = 0.591	13:20 = 0.591
Lubricant (also see table c)				
Capacity	2.0 liters (2.1 qt.)			
Specification	G50 synthetic oil, SAE 75W90			G 052 726 A2
Clutch control	hydraulic			
Clutch disc diameter	219 mm (through 05-00) 228 mm (from 06-00)		228 mm	228 mm
Driveshaft flange diameter	100 mm	100 mm	100 mm	100 mm
Ratio, overall in top gear	2.562	2.562	2.562	2.500

Table a. (continued) 02J manual transmission specifications

Code letters	DZQ, EBP, EGT, EKG, EMS, EZH	EFG, ERS, EVR	EGC	EGU
Engine application, horsepower	2.0L, 115hp	2.0L, 115hp	2.0L, 115hp	2.0L, 115hp
Ratio: Z_2:Z_1				
Final drive	72:17 = 4.235	71:18 = 3.944	71:18 = 3.944	71:18 = 3.944
1st gear	34:9 = 3.778	33:10 = 3.300	33:10 = 3.300	33:10 = 3.300
2nd gear	36:17 = 2.118	35:18 = 1.944	35:18 = 1.944	35:18 = 1.944
3rd gear	34:25 = 1.360	34:26 = 1.308	34:26 = 1.308	34:26 = 1.308
4th gear	35:34 = 1.029	35:34 = 1.029	35:34 = 1.029	35:34 = 1.029
5th gear	36:43 = 0.837	36:43 = 0.837	36:43 = 0.837	36:43 = 0.837
Reverse gear	18:9 x 36:20 = 3.600	17:10 x 36:20 = 3.060	18:9 x 36:20 = 3.600	17:10 x 36:20 = 3.060
Speedometer drive	13:22 = 0.591	13:22 = 0.591	13:22 = 0.591	13:22 = 0.591
Lubricant (also see table c)				
Capacity	2.0 liters (2.1 qt.)			
Specification	G50 synthetic oil, SAE 75W90	G51 synthetic oil, SAE 75W90	G50 synthetic oil, SAE 75W90	G50 synthetic oil, SAE 75W90
Clutch control	hydraulic			
Clutch disc diameter	215 mm	215 mm	215 mm	215 mm
Driveshaft flange diameter	100 mm	100 mm	100 mm	100 mm
Ratio, overall in top gear	3.545	3.301	3.301	3.301

Table a. (continued) 02J manual transmission specifications

Code letters	EMR	FBV		
Engine application, horsepower	2.0L, 115hp	2.0L, 115hp		
Ratio: Z_2:Z_1 Final drive	71:18 = 3.944	72:17 = 4.235		
1st gear	33:10 = 3.300	34:9 = 3.778		
2nd gear	35:18 = 1.944	36:17 = 2.118		
3rd gear	34:26 = 1.308	34:25 = 1.360		
4th gear	35:34 = 1.029	35:34 = 1.029		
5th gear	36:43 = 0.837	36:43 = 0.837		
Reverse gear	17:10 x 36:20 = 3.060	18:9 x 36:20 = 3.600		
Speedometer drive	13:22 = 0.591	13:22 = 0.591		
Lubricant (also see table c) Capacity	2.0 liters (2.1 qt.)			
Specification	G50 synthetic oil, SAE 75W90	G51 synthetic oil, SAE 75W90		
Clutch control	hydraulic			
Clutch disc diameter	215 mm	215 mm		
Driveshaft flange diameter	100 mm	100 mm		
Ratio, overall in top gear	3.301	3.545		

Table a. (continued) 02J manual transmission specifications

Code letters	DZC, EHC	EGF	EZK	FBY
Engine application, horsepower	2.8L, 174hp	2.8L, 174hp	2.8L, 174hp	2.8L, 174hp
Ratio: Z_2:Z_1				
Final drive	61:18: 3.389	61:18: 3.389	72:17 = 4.235	61:18: 3.389
1st gear	29:8 = 3.625	29:8 = 3.625	34:9 = 3.778	29:8 = 3.625
2nd gear	29:14 = 2.071	29:14 = 2.071	36:17 = 2.118	29:14 = 2.071
3rd gear	28:19 = 1.474	28:19 = 1.474	34:25 = 1.360	28:19 = 1.474
4th gear	27:26 = 1.038	27:26 = 1.038	35:34 = 1.029	27:26 = 1.038
5th gear	27:32 = 0.844	27:32 = 0.844	36:43 = 0.837	27:32 = 0.844
Reverse gear	15:8 x 36:20 = 3.375	17:10 x 36:20 = 3.060	18:9 x 36:20 = 3.600	15:8 x 36:20 = 3.375
Speedometer drive	13:22 = 0.591	13:22 = 0.591	13:22 = 0.591	13:22 = 0.591
Lubricant (also see table c)				
Capacity	2.0 liters (2.1 qt.)			
Specification	G50 synthetic oil, SAE 75W90	G50 synthetic oil, SAE 75W90	G51 synthetic oil, SAE 75W90	G51 synthetic oil, SAE 75W90
Clutch control	hydraulic			
Clutch disc diameter	228 mm	228 mm	228 mm	228 mm
Driveshaft flange diameter	100 mm	100 mm	100 mm	108 mm
Ratio, overall in top gear	2.860	2.860	3.545	2.860

Table a. (continued) 02J manual transmission specifications

Code letters	EWW	FCF		
Engine application, horsepower	2.8L, 200hp	2.8L, 200hp		
Ratio: Z_2:Z_1 Final drive	61:18: 3.389	61:18: 3.389		
1st gear	29:8 = 3.625	29:8 = 3.625		
2nd gear	29:14 = 2.071	29:14 = 2.071		
3rd gear	28:19 = 1.474	28:19 = 1.474		
4th gear	27:26 = 1.038	27:26 = 1.038		
5th gear	27:32 = 0.844	27:32 = 0.844		
Reverse gear	15:8 x 36:20 = 3.375	15:8 x 36:20 = 3.375		
Speedometer drive	13:22 = 0.591	13:22 = 0.591		
Lubricant (also see table c) Capacity	2.0 liters (2.1 qt.)			
Specification	G50 synthetic oil, SAE 75W90	G51 synthetic oil, SAE 75W90		
Clutch control	hydraulic			
Clutch disc diameter	228 mm	228 mm		
Driveshaft flange diameter	108 mm	100 mm		
Ratio, overall in top gear	2.860	2.860		

Table b. 02M manual transmission specifications

Code letters	ERR	FML, FZQ		
Engine application, horsepower	1.8L, 180hp	1.8L, 180hp		
Gear Ratio: Z_2:Z_1				
Final drive (with dual-mass flywheel)	62:16 = 3.875	71:18 = 3.944		
Final drive (w/o dual-mass flywheel)	62:20 = 3.100	71:23 = 3.087		
1st gear	41:12 = 3.417	47:14 = 3.357		
2nd gear	40:19 = 2.105	48:23 = 2.087		
3rd gear	40:27 = 1.481	47:32 = 1.469		
4th gear	38:33 = 1.152	46:40 = 1.150		
5th gear	35:30 = 1.167	43:36 = 1.194		
6th gear	32:33 = 0.970	39:40 = 0.975		
Reverse gear	30:12 x 23:14 = 4.107	34:14 x 23:14 = 3.990		
Lubricant (also see table c)				
Capacity	2.3 liters (2.45 qt.)			
Specification	G51 synthetic oil, SAE 75W90	G51 synthetic oil, SAE 75W90		
Clutch control	hydraulic			
Clutch disc diameter (with dual-mass flywheel)	240 mm	240 mm		
Driveshaft flange diameter	108 mm	108 mm		
Ratio, overall in top gear	3.007	3.010		

Table b. (continued) 02M manual transmission specifications

Code letters	EDJ	FSR, FZR		
Engine application, horsepower	2.8L, 200hp	2.8L, 200hp		
Gear Ratio: Z_2:Z_1				
Final drive (with dual-mass flywheel)	60:18 = 3.333	71:18 = 3.944		
Final drive (w/o dual-mass flywheel)	60:22 = 2.727	71:23 = 3.087		
1st gear	42:11 = 3.818	47:14 = 3.357		
2nd gear	40:19 = 2.105	48:23 = 2.087		
3rd gear	40:28 = 1.429	47:32 = 1.469		
4th gear	37:34 = 1.088	46:40 = 1.150		
5th gear	34:31 = 1.097	43:36 = 1.194		
6th gear	31:34 = 0.912	39:40 = 0.975		
Reverse gear	31:11 x 23:14 = 4.630	34:14 x 23:14 = 3.990		
Lubricant (also see table c)				
Capacity	2.3 liters (2.45 qt.)			
Specification	G51 synthetic oil, SAE 75W90	G51 synthetic oil, SAE 75W90		
Clutch control	hydraulic			
Clutch disc diameter (with dual-mass flywheel)	240 mm	240 mm		
Driveshaft flange diameter	108 mm	108 mm		
Ratio, overall in top gear	2.487	3.010		

Manual transmission gear oil

Different types of manual transmission gear oils are specified for different transmission versions as shown in the table. If in doubt, always consult an Authorized Volkswagen Dealer for the most current information.

Table c. Manual transmission gear oil specifications

Engine type	Transmission type	Transmission code(s)	Factory information (Service/Repair manual)	Factory information (Fluid capacity chart)	Factory information (Parts ETKA 581)
1.8T	**02J**	EBN	G50	G50	*
		EBQ	G50	G50	*
		EGX	G50	G50	*
		EGY	G51	G50	*
		EHA	G50	G50	G052726A2
		ENJ	G50	G50	*
		FBW	G50	G50	*
		FBX	G51	G50	*
		FDS	G50	G50	*
1.9	**02J**	DQY	G50	G50	*
		EBJ	G50	G50	*
		EGR	G50	Through my 2003 = G50 From my 2004 = G052726A2	G052726A2
2.0	**02J**	DZQ,EBP, EGT, EKG, EMS	G50	Through my 2003 = G50 From my 2004 = G052726A2	G052726A2
		EFG, ERS, EVR	G51	Through my 2003 = G50 From my 2004 = G052726A2	G052726A2
		EGC	G50	G50	*
		EGU	G50	Through my 2003 = G50 From my 2004 = G052726A2	*
		EMR	G50	G50	*
		FBV	G51	G50	*
2.8	**02J**	DZC, EHC	G50	G50	G052726A2
		EGF	G50	G50	*
		EZK	G51	G50	G052726A2
		FBY	G51	G50	*
		FCF	G51	G50	G052726A2
1.8T	**02M**	ERR	G51	Through my 2003 = G50 From my 2004 = G052171A2	G052171A2
		FML, FZQ	G51	Through my 2003 = G50 From my 2004 = G052171A2	G052171A2
2.8	**02M**	EDJ	G51	Through my 2003 = G50 From my 2004 = G052171A2	G052171A2
		FSR, FZR	G51	Through my 2003 = G50 From my 2004 = G052171A2	G052171A2

* No manual transmission oil listed in Parts Information for these transmissions.
G50 = G 005 000 (1 liter container)
G51 = G 005 100 A1 (½ liter container)
G 052 726 A2 (1 liter container)
G 052 171 A2 (1 liter container)



Gear oil G50 (**left**) and G51 (**right**). Volkswagen lists these as synthetic 75W90 gear oils. Both are available in 1 liter and ½ liter containers and carry the following part numbers:

- G50 = G 005 000 (1 liter)
- G51 = G 005 100 A1 (½ liter)



Gear oil G 052 171 A2 (**left**) and G 052 726 A2 (**right**). Volkswagen lists G 052 171 A2 as synthetic and G 052 726 A2 as mineral. Viscosity is not specified for either gear oil.

NOTE —

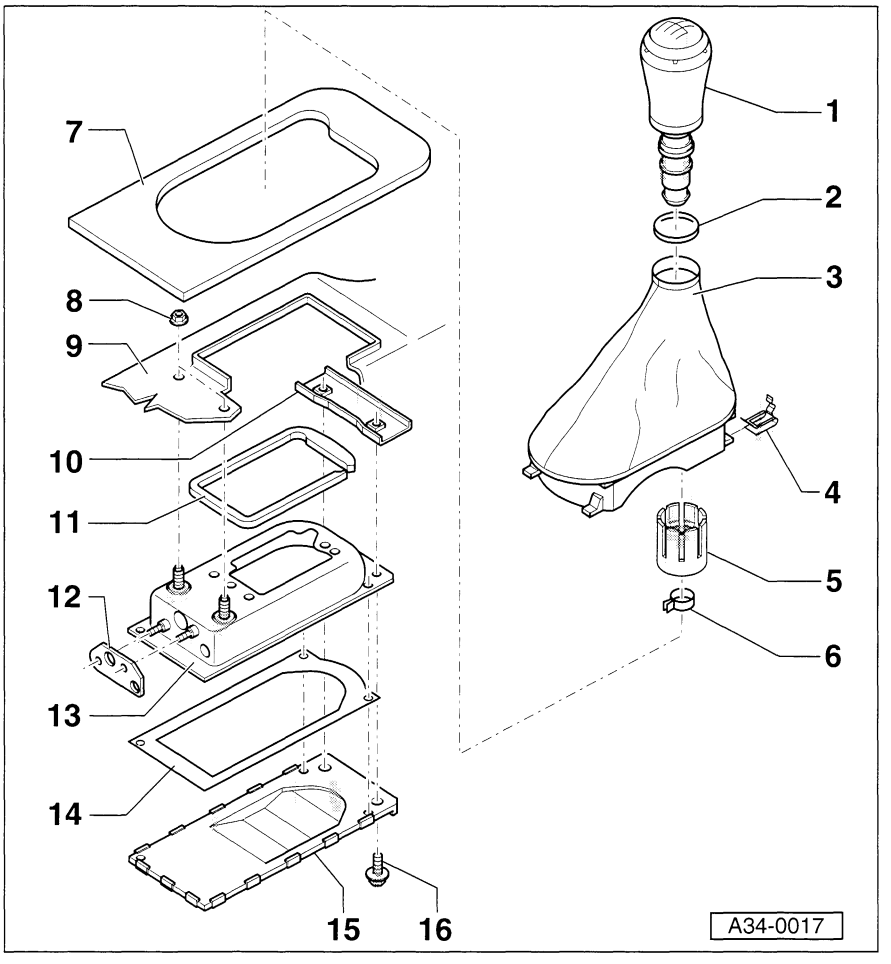
Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.

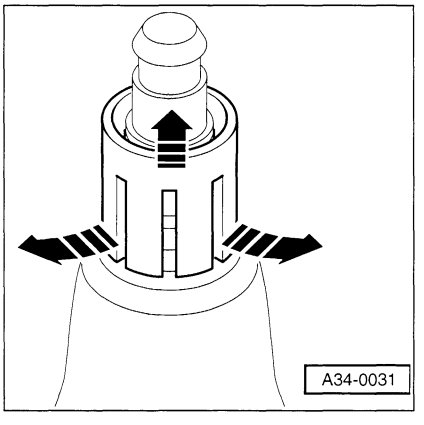
GEAR SELECTOR MECHANISM, 02J (through 05/99)

Two different manual transmission gear selector mechanisms are used with the 02J transmission depending on production date and transmission type. This section covers the 02J transmissions through May 1999 production.

Shift lever housing and boot assembly, 02J (through 05/99)

1. **Gear shift knob**
   - Screw on/off together with boot
   - See **Separating boot from gear shift knob**
2. **Boot collar**
3. **Boot with frame**
   - Remove and install together with gear shift knob
   - Separating
4. **Clip**
5. **Bushing, segmented**
6. **Clamp**
   - Secures gear shift knob on gear lever
7. **Cover**
8. **Nut, hex head**
   - Tighten to 25 Nm (18 ft-lb)
9. **Vehicle floor plate**
10. **Retainer**
    - For gear lever housing
11. **Gasket**
    - Between selector housing and floor
    - Self-adhesive, attach to gear lever housing
12. **Gasket**
    - Between selector cables and gear lever housing
13. **Selector housing**
14. **Gasket**
    - Self-adhesive, attach underneath gear lever housing
15. **Cover plate**
16. **Bolt, hex combi**
    - Tighten to 25 Nm (18 ft-lb)



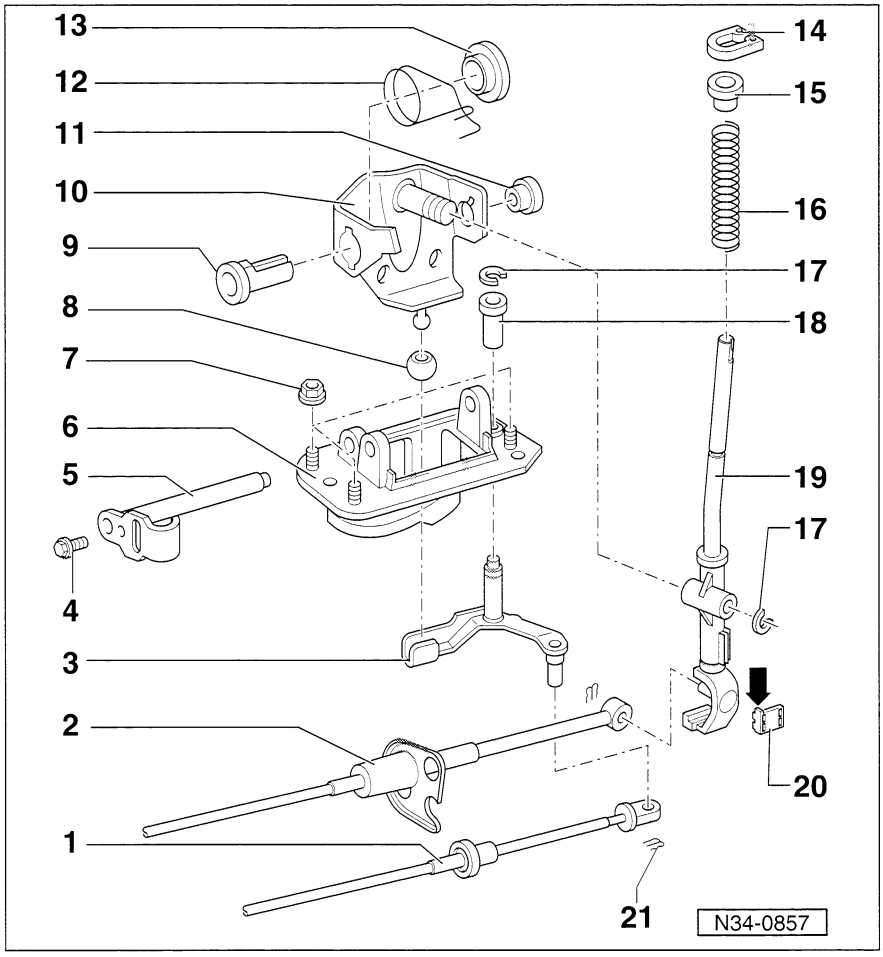


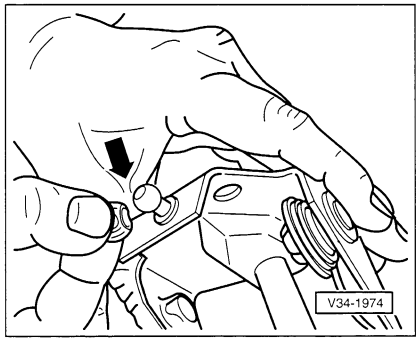
Separating boot from gear shift knob

- Turn boot inside out
- Carefully pry a bushing segment with a small screwdriver in direction of arrow while simultaneously pulling gear shift knob out
- To install, insert knob into inside out boot and install segmented bushing until fully engaged

Shift lever, servicing, 02J (through 05/99)

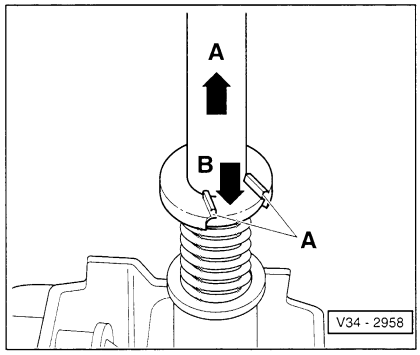
1. **Gate selector cable**
   - On gate selector bracket
2. **Gear selector cable**
   - On gear shift lever
3. **Gate selector bracket**
4. **Bolt, hex**
   - Fulcrum pin to mounting plate
   - Tighten to 15 Nm (11 ft-lb)
5. **Fulcrum pin**
6. **Mounting plate**
7. **Nut, self-locking hex**
   - Mounting plate to gear lever housing
   - Always replace
   - Tighten to 20 Nm (15 ft-lb)
8. **Cap**
   - See **Fitting cap to gate selector housing**
9. **Bushing**
   - Fits properly in one position only
10. **Gate selector housing**
    - Install into mounting plate after assembly with complete gear lever
11. **Bushing**
12. **Spring**
13. **Guide bushing**
    - Position on bushing 9
14. **Circlip**
    - See **Removing and installing circlip**
15. **Spacer sleeve**
16. **Spring**
17. **Lock plate**
    - See **Removing lock plate...,** on following page
18. **Bushing**
    - Fits properly in one position only
19. **Gear Selector lever**
    - With gear lever guide and dampening ring
20. **Damper**
    - Fits properly in one position only
    - Lug (**arrow**) faces gear lever guide
21. **Spring clip**





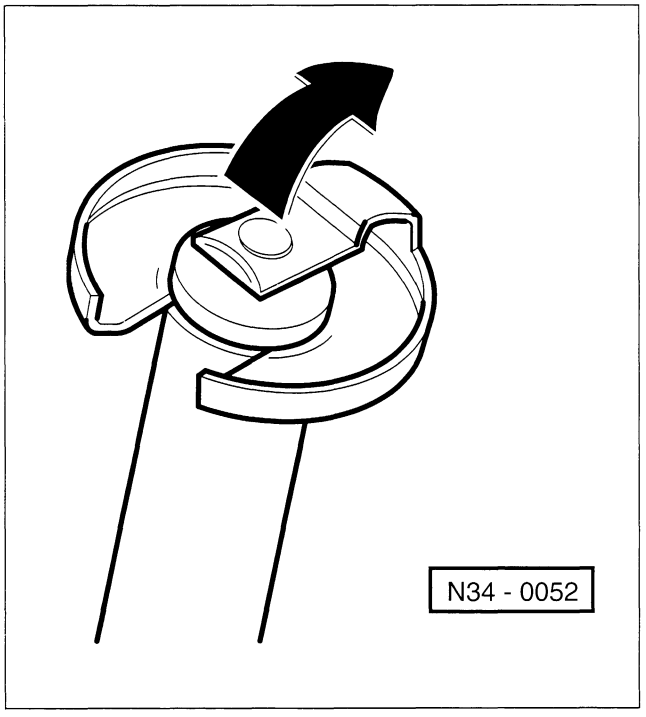
Fitting cap to gate selector housing

- Warm cap by placing in hot water to facilitate installation as needed
- Squeeze opening to form a slot
- Press cap on from side (**arrow 1**)



Removing and installing circlip

- Pull gear selector lever in direction of arrow **A** while at the same time pushing spacer sleeve in direction of arrow **B** with a screwdriver
- Do not tilt or cock spacer sleeve when pushing.
- Carefully release spacer sleeve due to spring tension



Removing lock plate for gate selector bracket and gear lever guide/gate selector housing

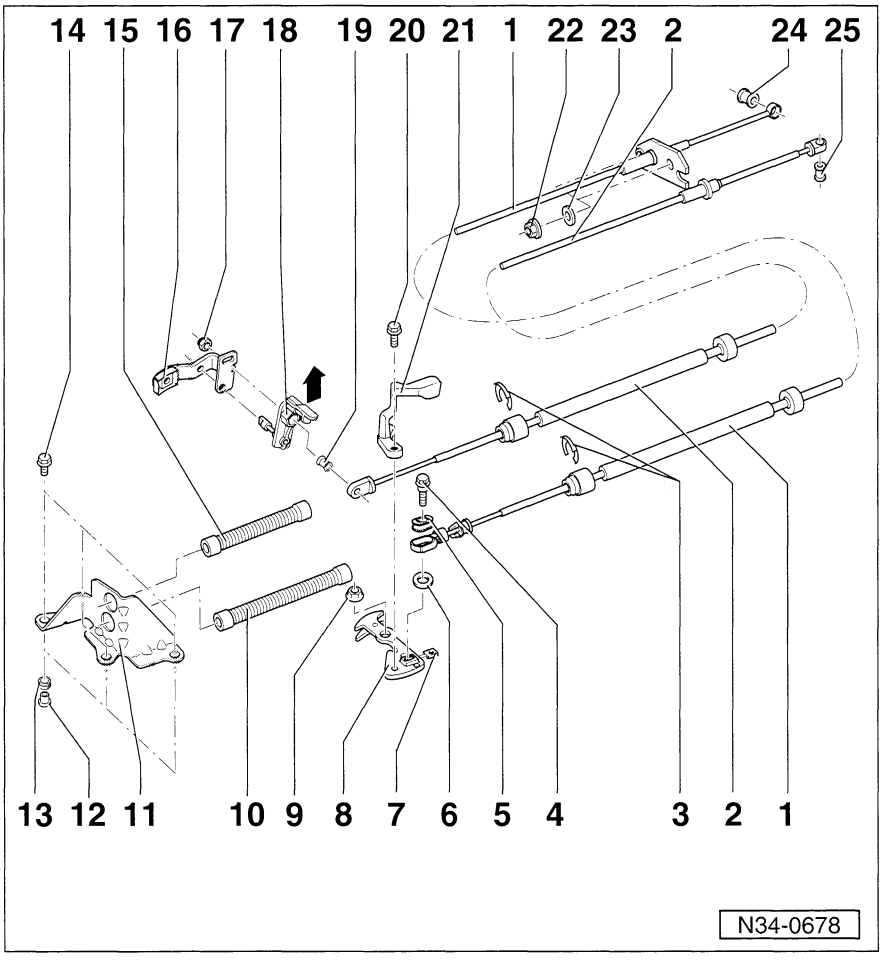
- Lift tab in direction of **arrow** and slide off
- Install by sliding onto shaft

NOTE —

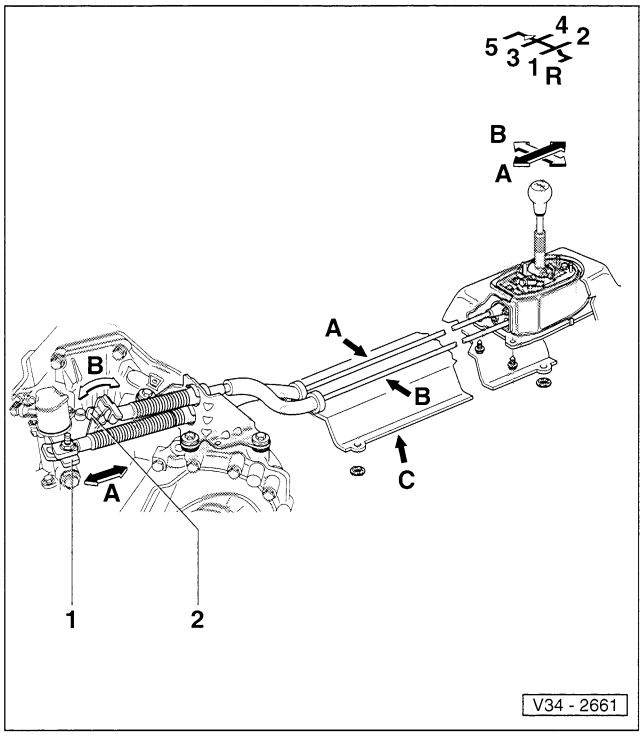
- *It may be necessary to lift tab over shift during installation.*
- *Lubricate all mountings and sliding surfaces with Polyuric grease (VW part no. G 052 142 A2, or equivalent).*

Selector cables, removing and installing, 02J (through 05/99)

1. **Gear selector cable**
   - See **Installation position of gear selector mechanism, A**
2. **Gate selector cable**
   - See **Installation position of gear selector mechanism, B**
   - Pull off actuating arm 18 by pulling in direction of arrow
   - Install before installing gear selector cable
3. **Circlip**
   - When removing, take care to avoid damage to boot
4. **Bolt, shouldered hex combi**
   - Tighten to 25 Nm (18 ft-lb)
   - Gear selector cable to gear change lever
5. **Rubber bushing**
   - For gear change cable to gear selector lever
   - Replace boot by pressing out of end piece
6. **Washer**
   - Install between gear selector cable and gear selector lever
7. **Nut, square self-locking**
   - Always replace
   - Insert into gear selector lever
8. **Gear selector lever**
   - Fits properly in one position only
   - See **Installation position, gear selector lever/relay lever actuating arm/balance weight**
   - Adjust after installation, See **Adjusting gear selecting mechanism**
9. **Nut, hex self-locking**
   - Always replace
   - Tighten to 20 Nm (15 ft-lb)
10. **Boot**
    - Carefully pull over gear selector cable end piece
    - Use MoS_2 (moly) grease
11. **Support bracket**
12. **Distance piece**
13. **Grommet**
    - Support bracket mounting to transmission



14. **Bolt, hex**
    - For support bracket
    - Tighten to 25 Nm (18 ft-lb)
15. **Boot**
    - Carefully pull over gate selector cable end piece
    - Use MoS_2 (moly) grease
16. **Relay lever**
    - Remove before removing clutch control
    - With sliding shoe
    - See **Installation position, gear selector lever/relay lever actuating arm/balance weight**
17. **Nut, hex self-locking**
    - For relay lever to actuating arm
    - Only loosen to adjust selector mechanism
    - Tighten to 15 Nm (11 ft-lb)
18. **Actuating arm**
    - With pivot pin to mount relay lever
    - See **Installation position, gear selector lever/relay lever actuating arm/balance weight**
19. **Rubber bushing**
    - For gate selector cable to actuating arm
    - Press in and out with a drift
20. **Bolt, hex**
    - For balance weight
    - Tighten to 25 Nm (18 ft-lb)
21. **Balance weight**
    - Remove to adjust selector mechanism
22. **Nut, hex self-locking**
    - For selector cable to selector housing
    - Tighten to 15 Nm (11 ft-lb)
23. **Rubber washer**
24. **Rubber bushing**
    - For gear selector cable/gear change lever
    - Press in and out with drift
25. **Rubber bushing**
    - For gate selector cable/selector bracket
    - Press in and out with drift



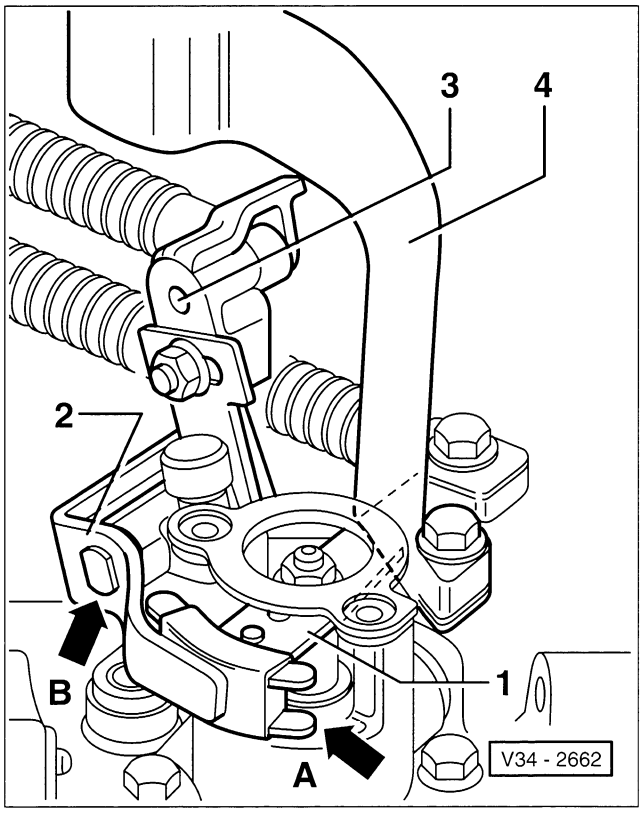
Installation position of gear selector mechanism

A. Gear change cable
- **A arrows** (⇔) indicates fore and aft movement of shift lever and selector movement

B. Gate selector cable
- **B arrows** (⇔) indicate side to side movement of shift lever and up/down movement of selector movement

C. Heat shield
- Remove before removing the gear selector mechanism

1. **Gear selector lever**
2. **Relay lever with actuating arm/gate selector cable**

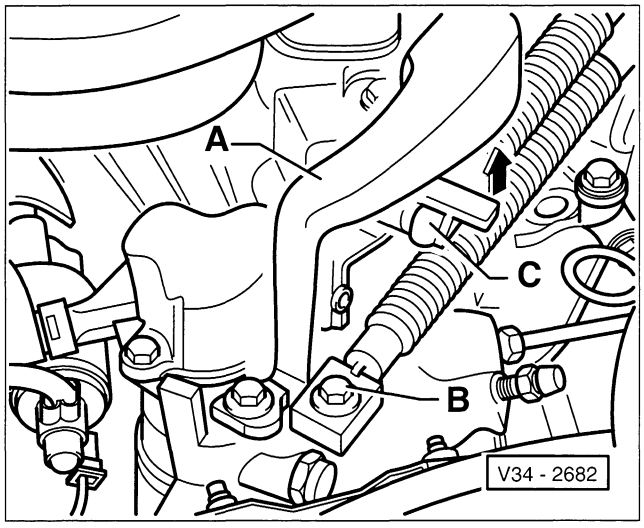


Installation position, gear selector lever/relay lever actuating arm/balance weight

1. **Gear selector lever**
2. **Relay lever**
   - Locates in guide rail of gear shift lever (arrow **A**)
   - Use MoS_2 (molybdenum disulfide, "moly") grease for lubrication
3. **Actuating arm**
   - Flats (arrow **B**) of axis face mounting, relay lever fits properly in one position only
4. **Balance weight**
   - Bolt onto gear selector lever

NOTE —

For illustration clarification, the back-up light switch and operating linkage have been removed.



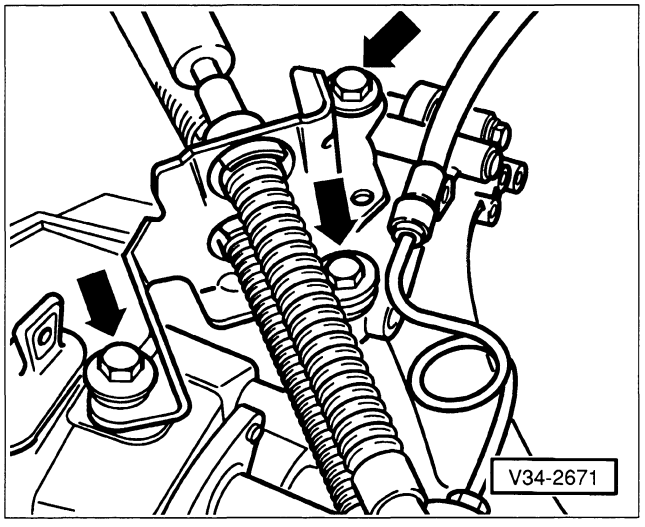
Selector mechanism, removing and installing, 02J (through 05/99)

Removing

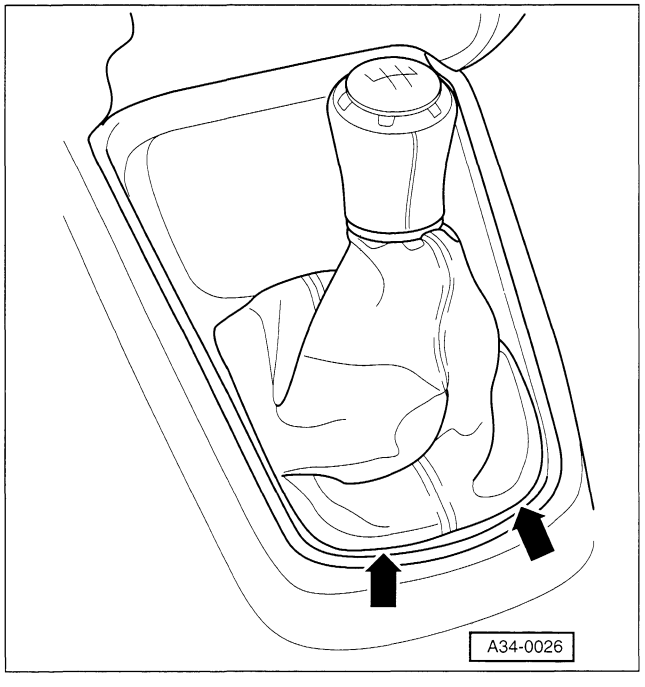
➢ Remove balance weight (**A**) and gear selector cable bolt (**B**) from gear selector lever.

– Remove gear selector cable, bushing, washer and square nut.

– Lift lug in direction of **arrow** and pull gate selector cable off of actuating arm/relay lever (**C**).

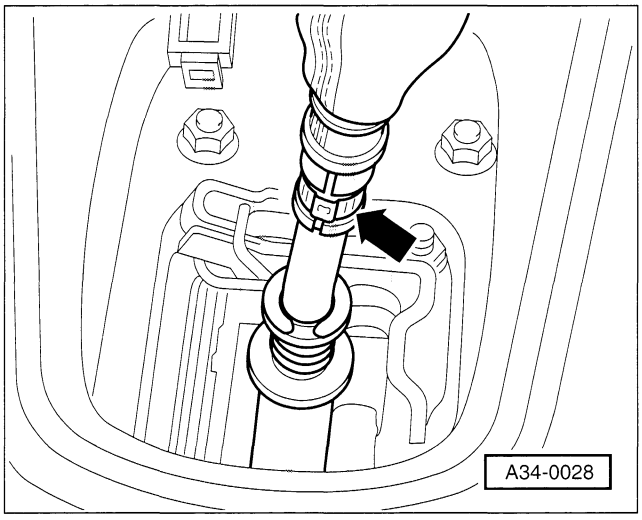


➢ Unbolt cable support bracket from transmission (**arrows**). As required, unclip hydraulic hose at cable support bracket before unbolting.



➢ Carefully pry shift boot off of center console.

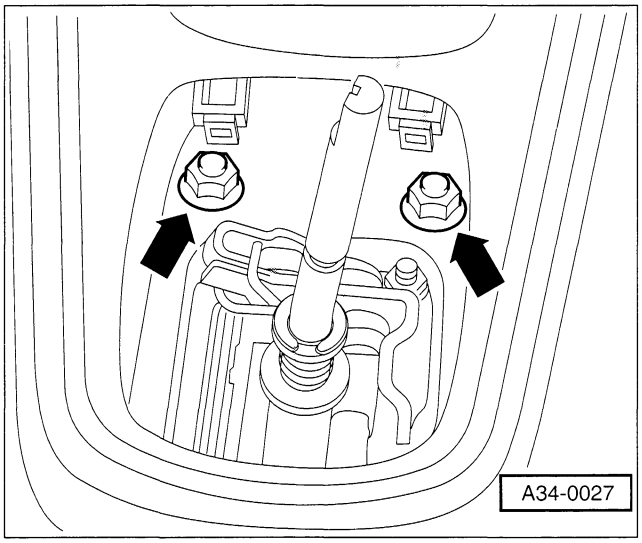
– Pull cover to rear of center console.



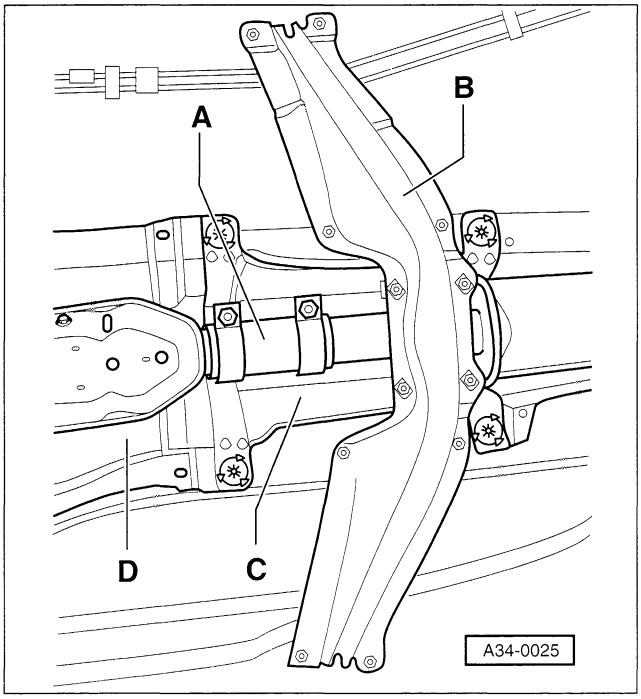
➤ Cut and remove clip (**arrow**) and pull gear shift knob off with boot.

• Cutting clip will destroy it.

– Remove rubber sound insulation boot if equipped.



➤ Remove gear lever housing securing nut (**arrows**).



➤ Disconnect front exhaust pipe (**A**), see **26 Exhaust System and Emission Controls.**

– Remove lower cross support (**B**) below exhaust system.

– Loosen heat shield (**C**) in forward area.

– Remove heat shield (**D**).

– Unbolt selector housing from body.

– Swing gear lever housing down and remove assembly complete with cables attached.

GEAR SELECTOR MECHANISM, 02J (THROUGH 05/99)

Selector mechanism, installing

Installation is the reverse of the above steps noting the following additional points:

- Align gear lever housing parallel to the body.
- Adjust the distance to the body so that it is the same on each side.
- Adjust selector mechanism upon completion of installation.

Tightening torques

- Selector housing to body . . . . . 25 Nm (18 ft-lb)
- Cross support to body . . . . . 25 Nm (18 ft-lb)
- Selector cable support bracket to body. . . . . 25 Nm (18 ft-lb)
- Selector cable bolt to transmission selector lever. . . . . 25 Nm (18 ft-lb)
- Balance weight to transmission selector lever. . . . . 25 Nm (18 ft-lb)

Selector mechanism, adjusting, 02J (through 05/99)

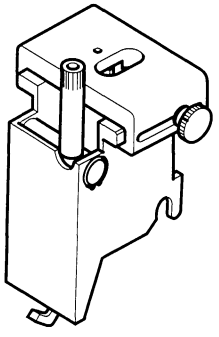
Prior to adjusting the gear selector mechanism, observe the following points:

- All moving parts of the selector mechanism and transmission shift mechanism must be in proper working order and lubricated.
- Selector mechanism must move freely.
- Transmission, clutch and clutch mechanism must also be in proper working order.

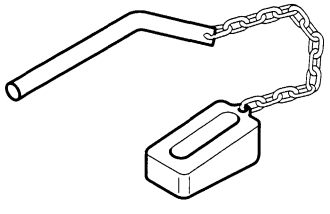
On some engine types, it will also be necessary to remove sections of the engine sound absorber panels for access to the transmission linkage.

Special tool 3422 Gear Lever Gauge is required to properly position, align, and hold the gear shift lever during adjustments. Special tool 3192/1 Pin & Wedge locks the selector mechanism at the transmission.

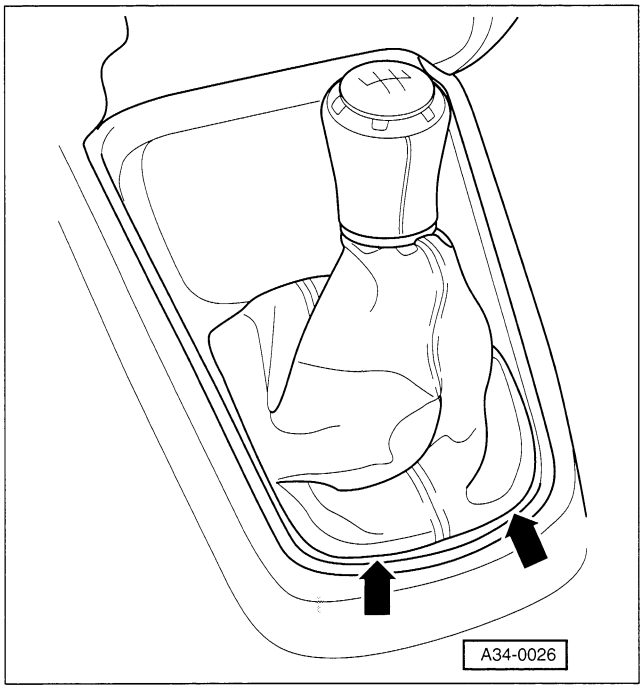
3422



3192/1



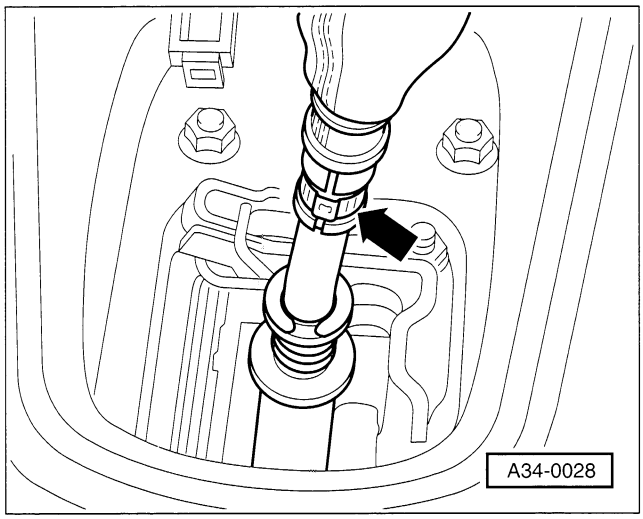
W00-0087



– Place transmission in neutral.

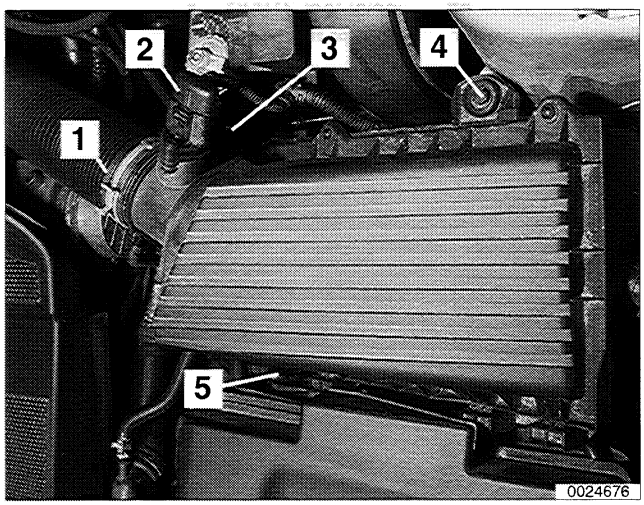
➢ Carefully pry shift boot off of center console.

– Pull cover to rear of center console.



➢ Cut and remove clip (**arrow**) and pull gear shift knob off with boot.

- Cutting clip will destroy it.
- Remove rubber sound insulation boot if equipped.

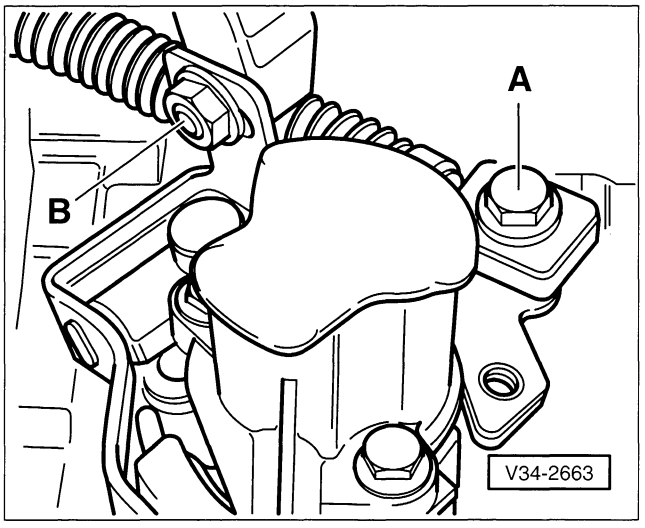


➢ Remove intake air hose (**1**), and harness connector (**2**), from Mass Air Flow (MAF) Sensor.

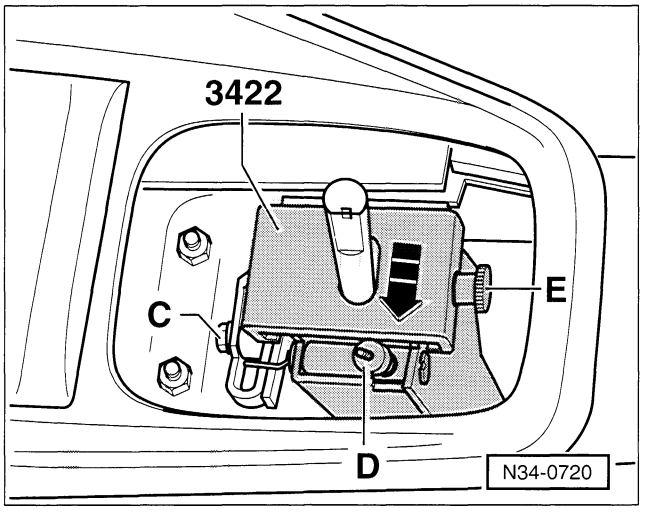
– Remove vacuum hose (**3**) to air cleaner near MAF, where equipped.

– Remove complete air cleaner housing assembly by unscrewing bolts (**4**) and (**5**).

– Remove balance weight.



➤ Loosen bolt (**A**) and nut (**B**) just enough so that gear selector cable and actuating arm/gate selector are free to move in their elongated hole.



➤ Loosen bolt (**C**).

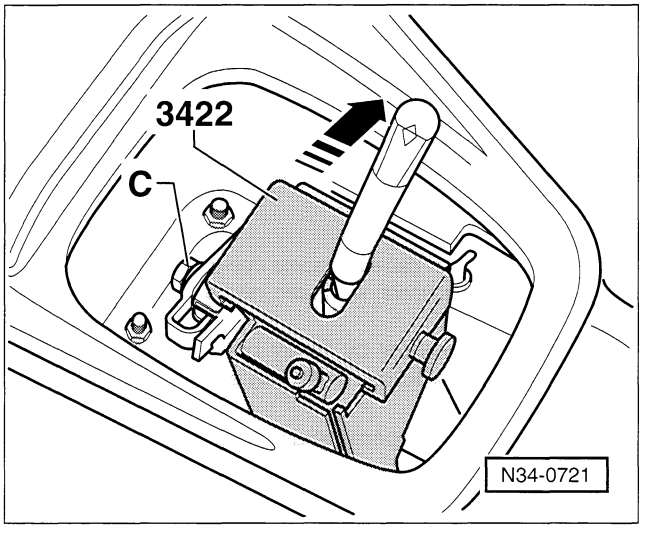
• Pull off foam seal in area of bolt if necessary.

– Insert 3422 Gear Lever Gauge.

– Swing gauge securing hook under mounting plate and tighten nut (**D**).

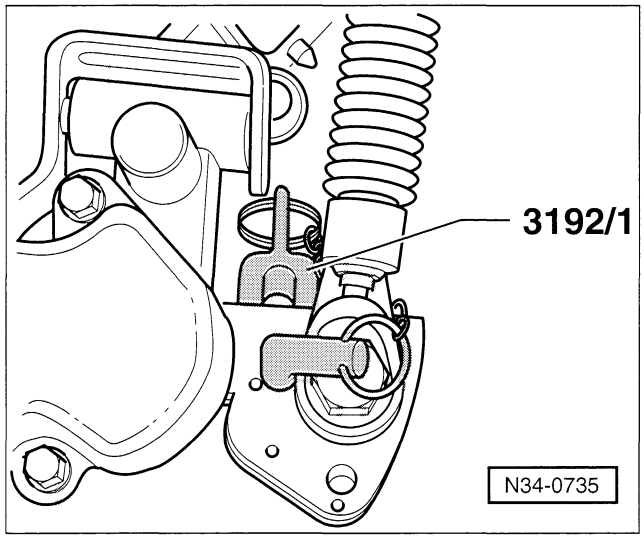
– Press gear lever into left side detent of sliding piece of tool.

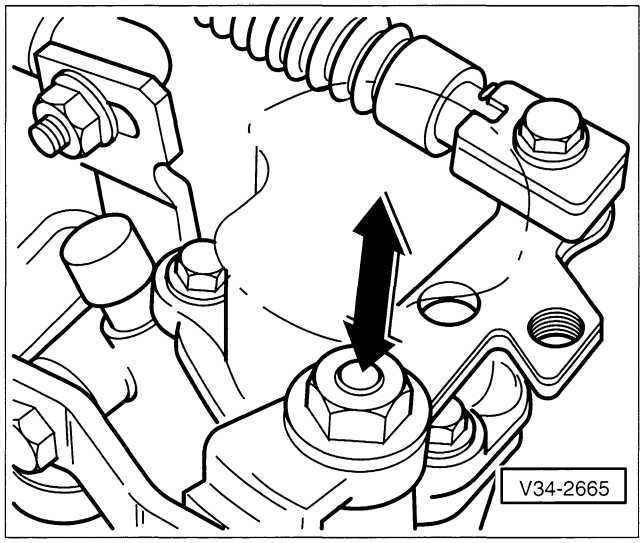
– Press gear lever together with sliding piece fully to the left to the stop (**direction of dashed arrow**) and tighten sliding piece with bolt (**E**).

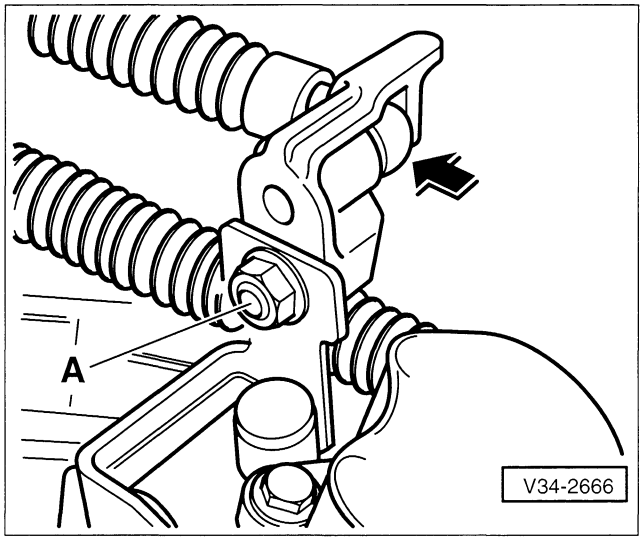


➤ Press gear lever into right side detent (**direction of dashed arrow**).

– Tighten bolt (**C**).







GEAR SELECTOR MECHANISM, 02J (THROUGH 05/99)

- At transmission, using tool 3192/1, slide wedge between gear selector lever and selector cover plate. Ensure that there is no play, and that wedge does not lift gear lever.
- Place pin of tool 3192/1 into aligned holes, locking them in position.
- With linkage secured in position by the tools, tighten gear selector cable and actuating arm/gate selector cable bolts. Ensure that wedge does not move while during tightening.
- Remove tool 3192/1 from transmission linkage and re-install balance weight.
- Remove tool 3422 from gear lever and re-install rubber sound insulation boot (if equipped), shift knob and shifter boot.

Selector Mechanism, functional check, 02J (through 05/99)

The correct at-rest position of the gear shift lever is in neutral between 3rd and 4th gears.

- Depress clutch.
- Shift through the shift pattern several times. Pay particular attention to the operation of the reverse gear lock-out and 5th gear operation.

NOTE —
If a gear fails to engage smoothly after repeated selection, the selector shaft play (lift, at the transmission), should be checked.

- Engage first gear.
- Press gear shift lever to the stop and release. At the same time, a second technician must observe the selector shaft on the transmission.

When moving gear lever, selector shaft must move approximately 1 mm in direction of **arrow** (up/down).

If there is no movement, disengage first gear and again loosen nut (**A**) for actuating arm/gate selector cable mount.

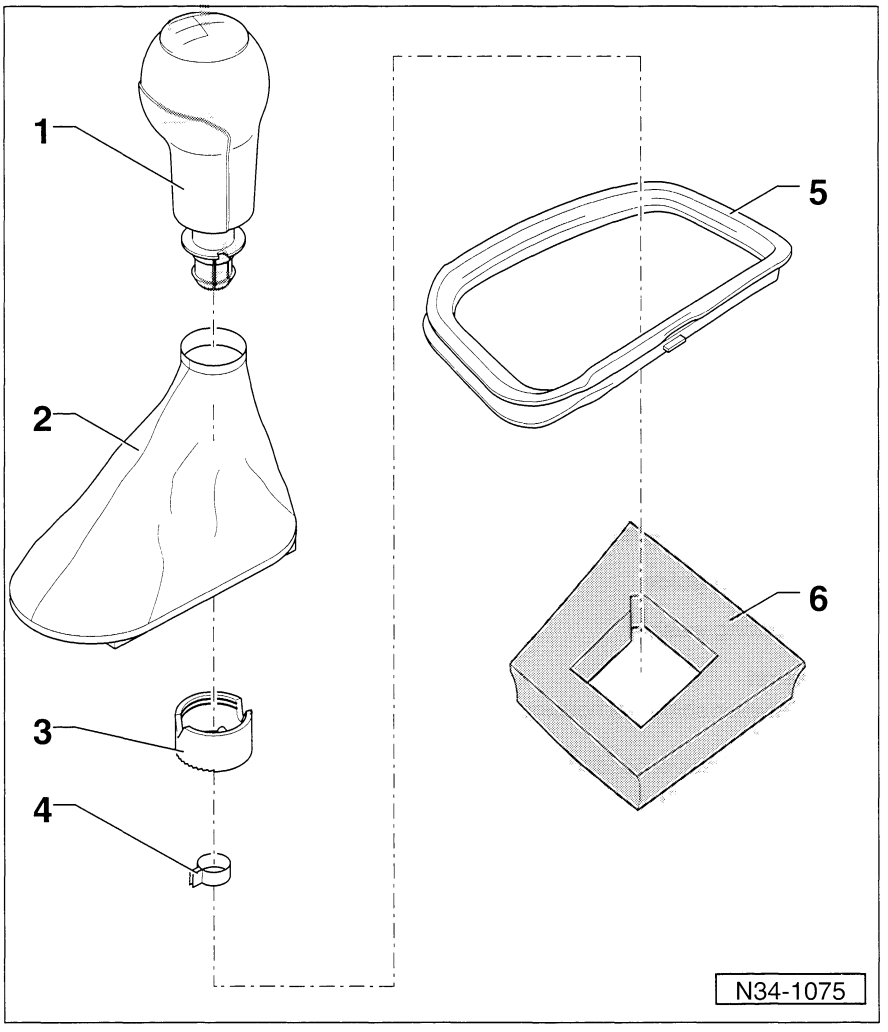
NOTE —
Gate selector cable has some free-play present due to insulating element, which can influence adjustments.

- Take up free-play by lightly pressing mounting toward bulkhead (**direction of arrow**) and tighten nut (**A**).
- Re-check shift operation as needed.

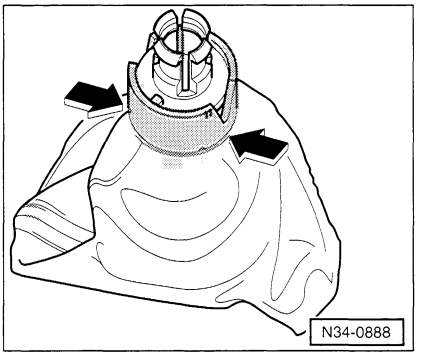
GEAR SELECTOR MECHANISM, 02J (FROM 05/99)

This section covers the 02J gear selector mechanisms from May, 1999 production.

Shift lever boot assembly, 02J (from 05/99)



1. **Gear shift knob**
   - Screw on and off together with boot
2. **Boot**
   - Remove and install together with gear shift knob
   - Assemble to gear shift knob before installing
   - See **Separating boot from gear shift knob and re-assembling**
3. **Sleeve**
4. **Clamp**
   - Secures gear shift knob on gear shift lever using VAG 1275 or equivalent
5. **Frame**
6. **Sound insulation**
   - Foam construction

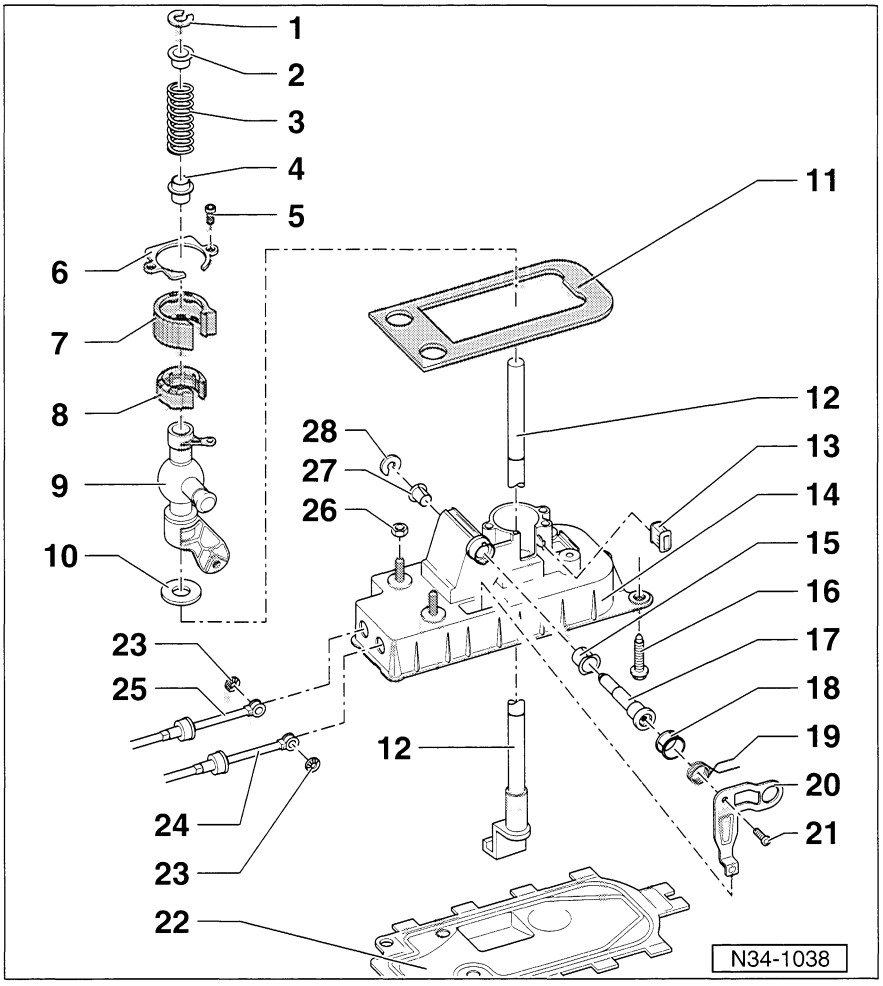


Separating boot from gear shift knob and re-assembling

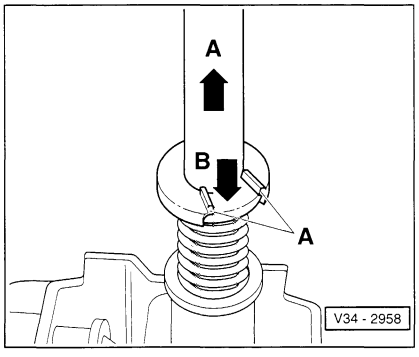
- Turn boot inside out
- Carefully pry clamping sleeve (**arrow**) off with a screwdriver and pull gear shift knob out
- Installation is the reverse of the above steps. Also note the following additional points
- Insert gear shift knob in cover
- Push clamping sleeve onto gear shift knob and engage lock
- Install gear shift knob and boot together at the same time

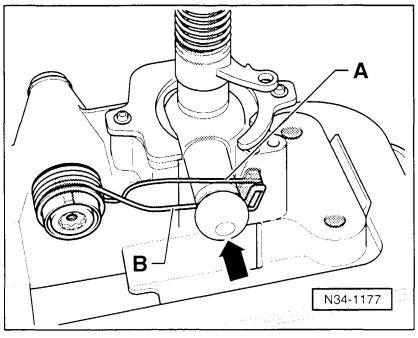
Shift lever and housing, servicing, 02J (from 05/99)

1. **Circlip**
   - See **Removing and installing circlip**
2. **Bushing**
3. **Spring**
4. **Bushing**
5. **Screw, Torx**
   - Tighten to 5 Nm (44 in-lb)
6. **Cover plate**
7. **Dampener**
8. **Bearing housing/shell**
9. **Shift lever guide**
10. **Insulating washer**
11. **Gasket**
    - Between shift lever housing and floor
    - Self-adhesive, bonded to shift lever housing
12. **Gear selector lever**
13. **Damper**
14. **Selector housing**
15. **Bushing**
16. **Bolt, hex head**
    - Tighten to 25 Nm (18 ft-lb)
17. **Pivot pin**
18. **Guide bushing**
19. **Spring**
    - See **Installing spring**
20. **Gate selector bracket**
21. **Screw, Torx**
    - Tighten to 5 Nm (44 in-lb)
22. **Floor (base) plate**
    - Bend up tabs to remove
    - Always replace
23. **Washer, locking**
24. **Gate selector cable**
    - On gate selector bracket
25. **Gear selector cable**
    - On gear selector lever
    - Press onto shift lever guide
26. **Nut, hex head**
    - Tighten to 25 Nm (18 ft-lb)



27. **Bushing**
    - Fits properly in one position only
28. **Washer, locking**





NOTE —

Lubricate all mountings and sliding surfaces with Polyurea grease (VW part no. G 052 142 A2 or G 000 450 A2 equivalent).

Removing and installing circlip

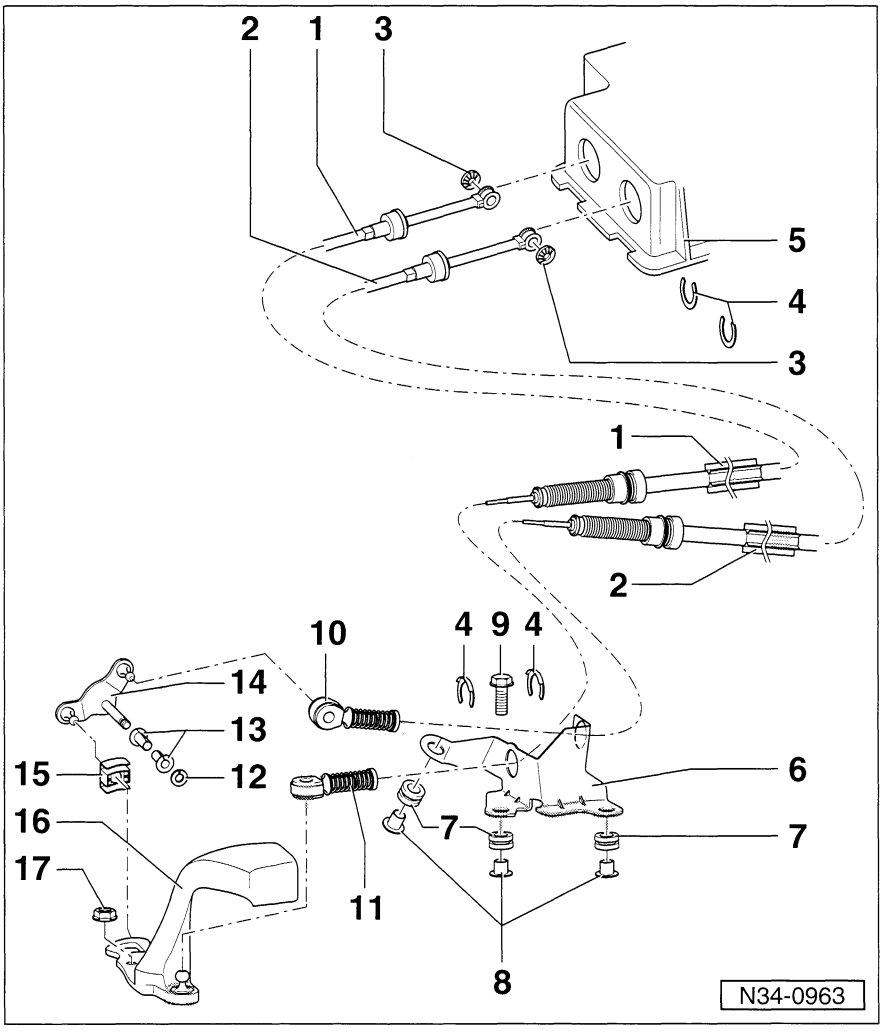
- Pull gear selector lever in direction of arrow **A** while at the same time pushing spacer sleeve in direction of arrow **B** with a screwdriver
- Do not tilt or cock spacer sleeve when pushing.
- Carefully release spacer sleeve due to spring tension

Installing spring

- Insert spring so that one long end of spring (**A**) is positioned above pin (**arrow**)
- Position other long end below pin (**arrow**)
- Spring must be positioned as shown for proper operation

Selector cables, removing and installing, 02J (from 05/99)

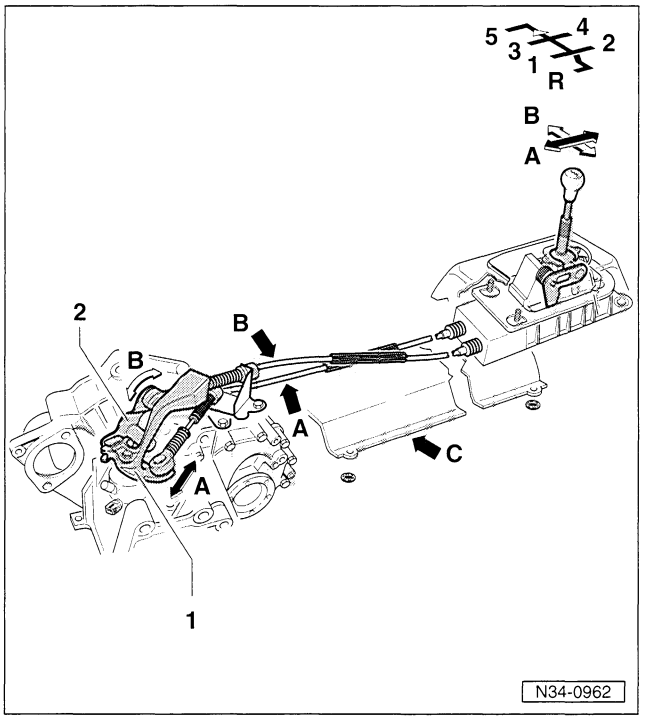
1. **Gear selector cable**
   - Press onto gear shift guide
   - See **Installation position of gear selector mechanism**
2. **Gate selector cable**
   - On gate selector bracket
   - See **Installation position of gear selector mechanism**
3. **Circlip**
4. **Circlip**
   - When removing use caution to avoid damage to cables
5. **Selector housing**
6. **Support bracket**
7. **Grommet**
   - Support bracket mounting to transmission
8. **Spacer**
9. **Bolt, hex**
   - Tighten to 25 Nm (18 ft-lb)
   - For support bracket
10. **Cable end attachment/locking piece**
    - For gate selector cable to relay lever, 2 versions
    - From production 05/99 through 12/00, snapped in place Always replace after removing from relay lever (item 14)
    - From production 01/01 with through hole, secured with clip. Replacement not required
    - Both versions, see **Selector mechanism, removing and installing**
11. **Cable end attachment/locking piece**
    - For gear selector cable to gear selector lever, 2 versions
    - From production 05/99 through 12/00, snapped in place Always replace after removing from relay lever (item 16)
    - From production 01/01 with through hole, secured with clip Replacement not required
    - Both versions, see **Selector mechanism, removing and installing**



12. **Circlip**
13. **Bushing**
14. **Relay lever**
    - See **Installation position of transmission selector lever/relay lever**
15. **Sliding shoe**
16. **Transmission selector lever**
    - With balance weight
    - Install so that master spline aligns with matching position on selector shaft
    - Adjust selector mechanism after installing, see **Adjusting gear selector mechanism**
    - See **Installation position of transmission selector lever/relay lever**
17. **Nut, hex self-locking**
    - Always replace
    - Tighten to 20 Nm (15 ft lb)

NOTE —

During reassembly, lubricate all mounting and contact surfaces with polycarbomide grease (VW part no. G 052 142 A2).



Installation position of gear selector mechanism

A. Gear change cable

- **A arrows** (⇔) indicates fore and aft movement of shift lever and selector movement

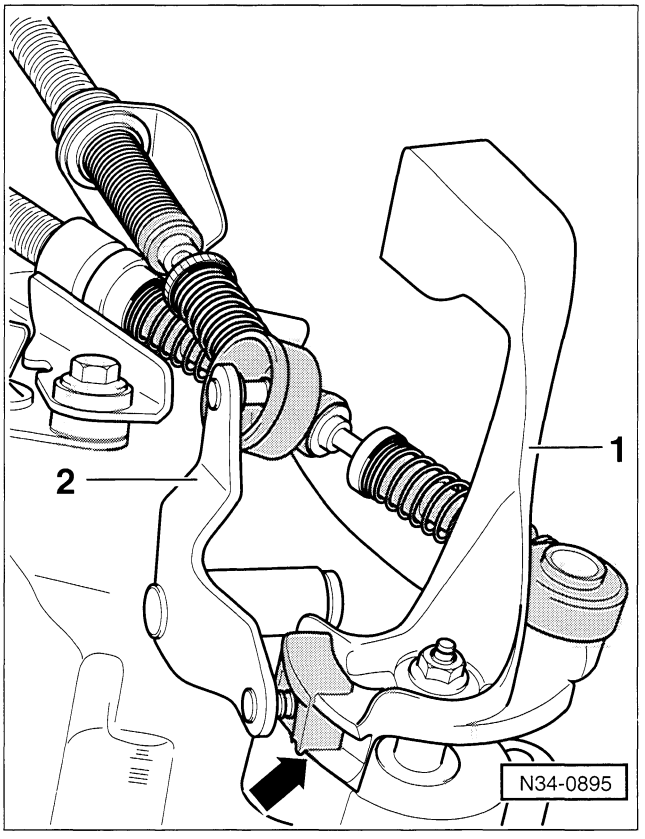
B. Gate selector cable

- **B arrows** (⇔) indicate side to side movement of shift lever and up/down movement of selector movement

C. Heat shield

- Remove before removing the gear selector mechanism

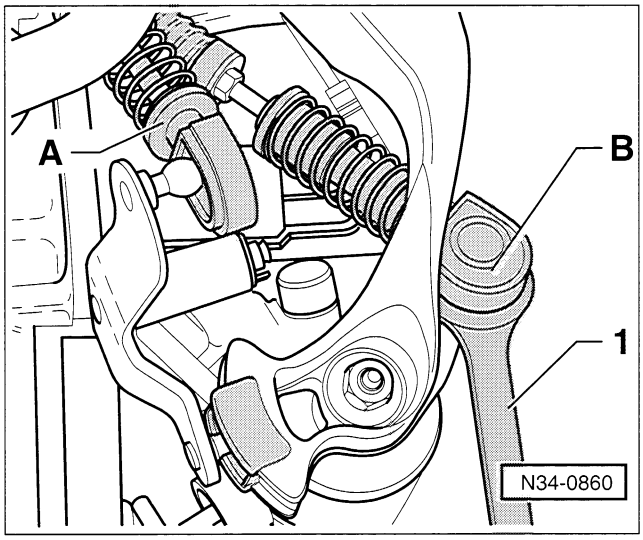
1. **Gear selector lever**
2. **Relay lever**



Installation position of transmission selector lever/relay lever

1. **Gear selector lever with balance weight**
2. **Relay lever**
   - Locates in guide rail of gear selector via sliding shoe (**arrow**)

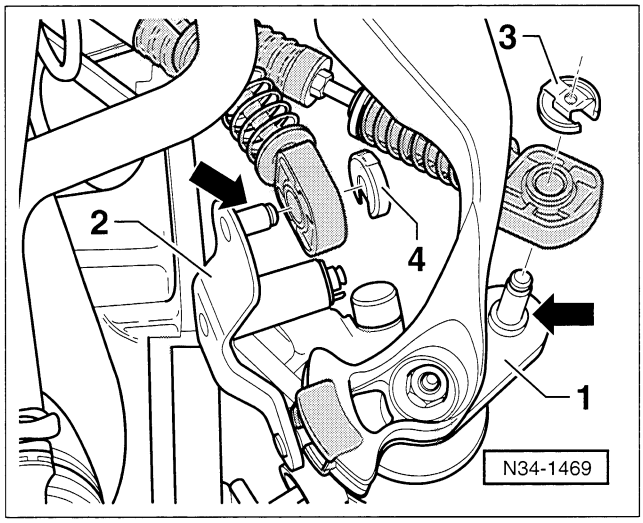
Selector mechanism, removing and installing (from 05/99)



Removing (from 05/99 through 12/00)

➢ Pry off gate selector cable (**A**) and gear selector cable (**B**) using a 13 mm open end wrench (**1**).

– Remove gear selector cable, bushing, washer and square nut.

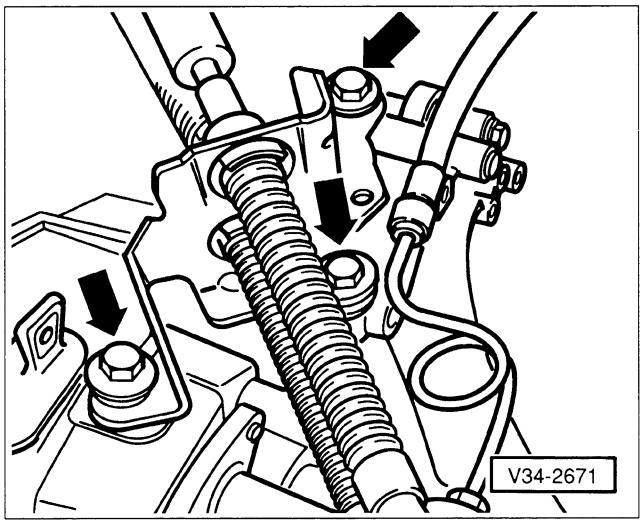


Removing (from 01/01)

➢ Remove securing clip (**3**) for gear selector cable from gear selector lever (**1**).

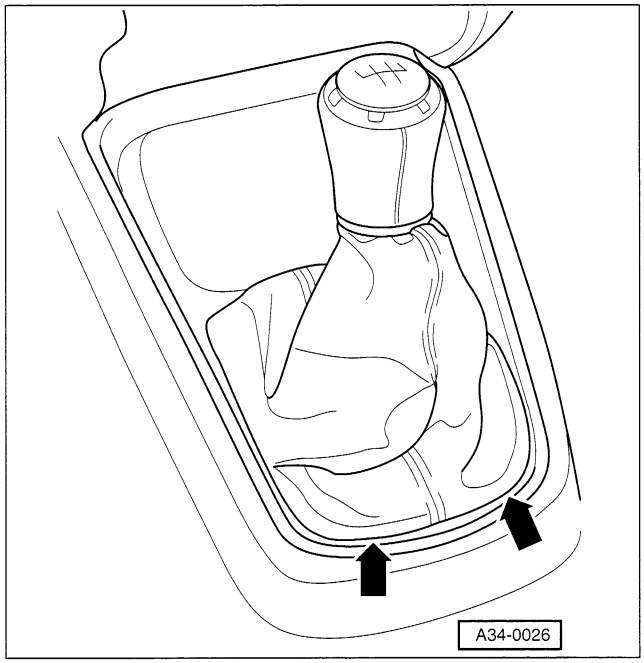
– Remove securing clip (**4**) for gate selector cable from gate selector lever (**2**).

– Carefully pry gate selector cable and gear selector cable off of attaching pins (**arrow**).



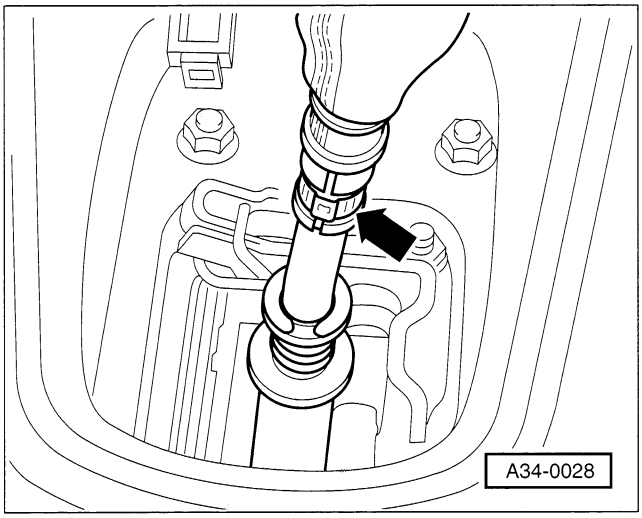
Continued, for both versions

➢ Unbolt cable support bracket from transmission (**arrows**). As required, unclip hydraulic hose at cable support bracket before unbolting.



➤ Carefully pry shift boot off of center console.

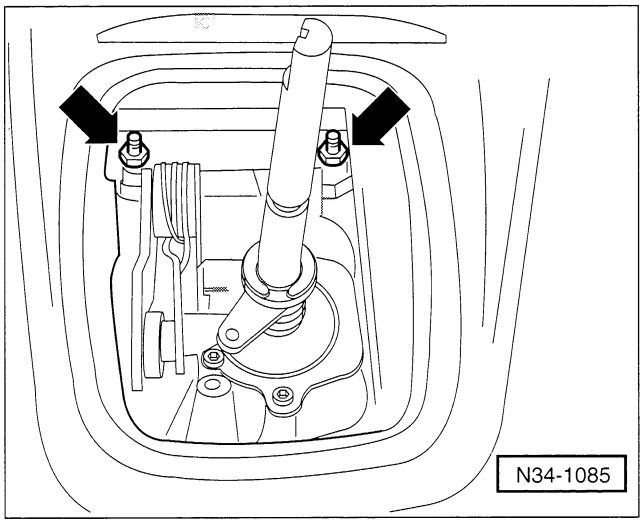
– Pull cover to rear of center console.



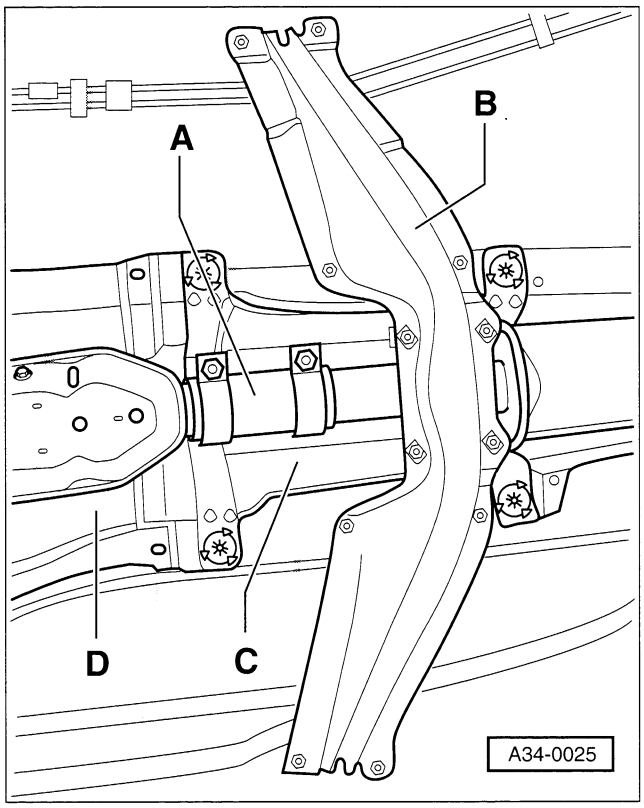
➤ Cut and remove clip (**arrow**) and pull gear shift knob off with boot.

• Cutting clip will destroy it.

– Remove rubber sound insulation boot if equipped.



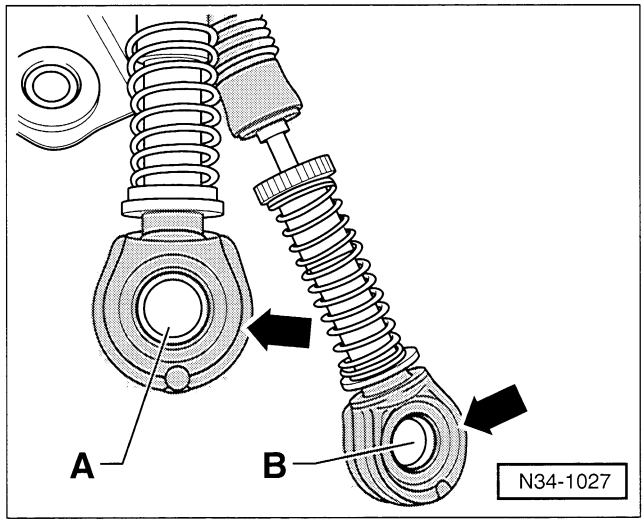
➤ Remove gear lever housing securing nut (**arrows**).



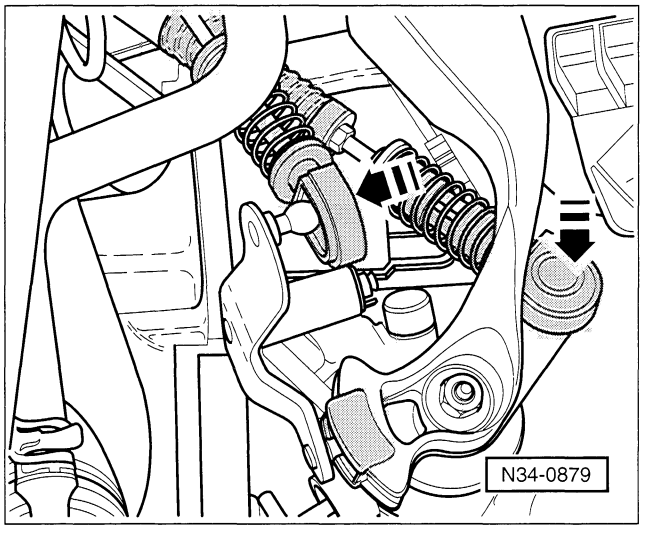
- Disconnect front exhaust pipe (**A**), see **26 Exhaust System and Emission Controls.**
- Remove lower cross support (**B**) below exhaust system.
- Loosen heat shield (**C**) in forward area.
- Remove heat shield (**D**).
- Unbolt selector housing from body.
- Swing gear lever housing down and remove assembly complete with cables attached.

Selector mechanism, installing (from 05/99 through 12/00)

This version of the cable locking mechanism at transmission ends of cables uses a recess in the end and must be replaced after each use.



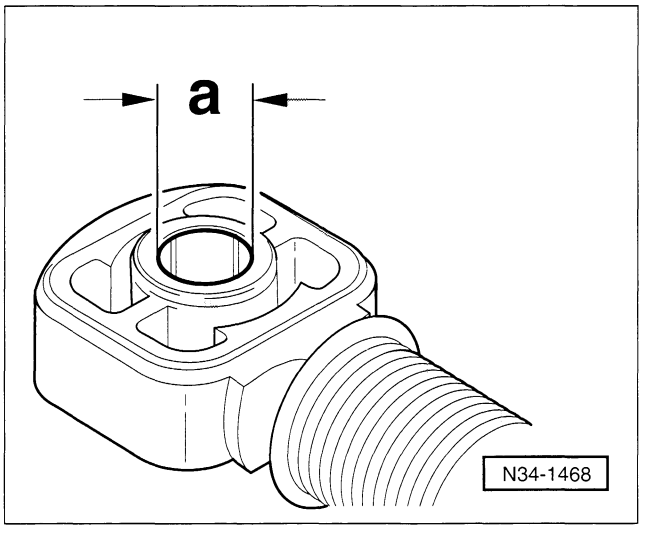
- Put a small amount of polyurea grease (VW/Audi part number G 052 142 A2 or G000 450 A2) into hole of gear cable locking mechanism (**A**) and gate cable locking mechanism (**B**). Avoid getting grease on outside seals (**arrows**).



➢ Press (snap) gear selector cable onto transmission selector lever and gate selector cable onto relay lever (**arrows**).

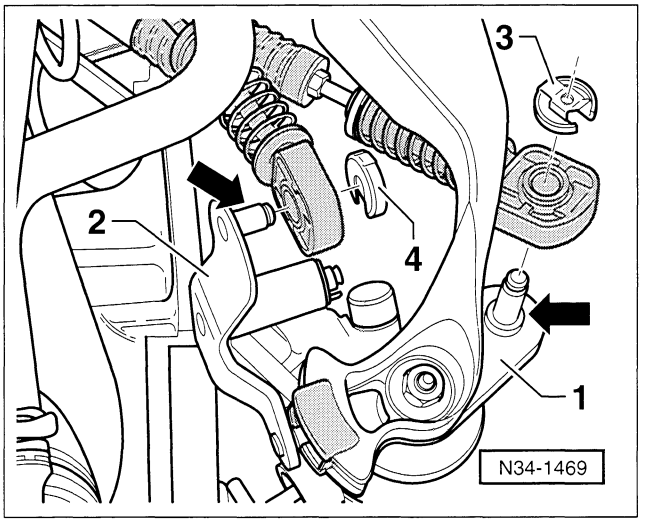
Selector mechanism, installing (from 01/01)

This version of the cable locking mechanism uses through-holes and locking clips and does not need to be replaced after each use unless damaged or worn.



➢ Gear selector and gate selector cables have different pin attachment hole diameters (**a**) to prevent incorrect attachment to transmission linkage.

- Gear selector cable to gear change lever diameter **a** = 10 mm
- Gate selector cable to relay lever diameter **a** = 8 mm



➢ Put a small amount of polyurea grease (VW/Audi part number G 052 142 A2 or G 000 450 A2) on the pins (**arrows**) of gear change lever (**1**) and relay lever (**2**).

– Secure gear selector cable and gate selector cable to linkage with new securing clips (**3**) and (**4**).

NOTE —

- *Cable securing clips must always be replaced.*
- *Part numbers are listed for reference only. Consult an authorized Volkswagen dealer or aftermarket parts specialist for the latest parts information.*

Selector mechanism, installing (continued) for both versions

Remaining installation is the reverse of the above steps noting the following additional points:

- Align gear lever housing parallel to the body.
- Adjust the distance to the body so that it is the same on each side.
- Adjust selector mechanism upon completion of installation.

Tightening torques

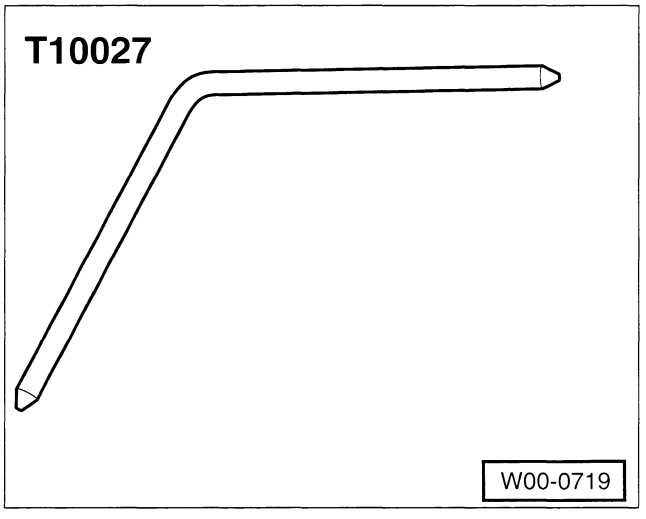
- Selector housing to body . . . . . 25 Nm (18 ft-lb)
- Cross support to body . . . . . 25 Nm (18 ft-lb)
- Selector cable support bracket to body. . . . . 25 Nm (18 ft-lb)

Selector mechanism, adjusting, 02J (from 05/99)

Prior to adjusting the gear selector mechanism, observe the following points:

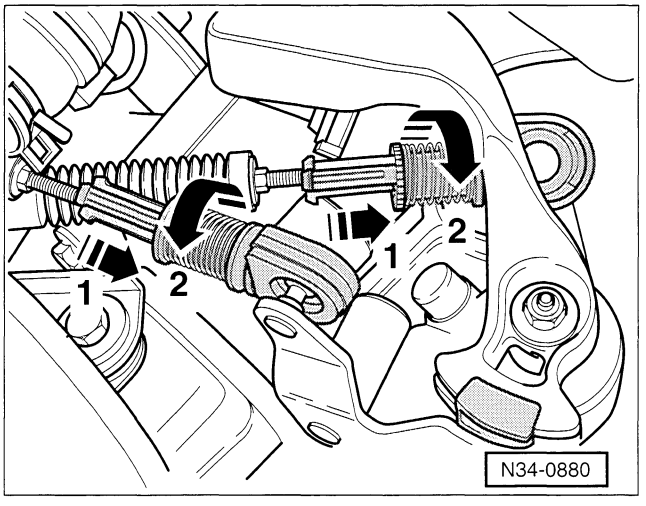
- All moving parts of the selector mechanism and transmission shift mechanism must be in proper working order and lubricated.
- Selector mechanism must move freely.
- Transmission, clutch and clutch mechanism must also be in proper working order.

On some engine types, it will also be necessary to remove sections of the engine sound absorber panels for access to the transmission linkage.

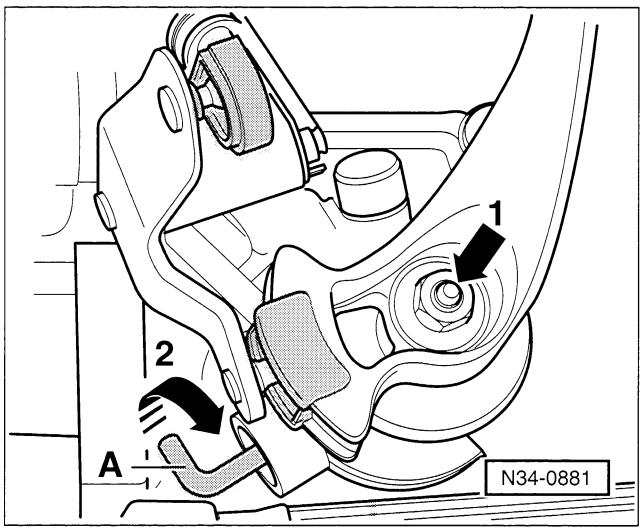


➤ Special tool T10027 is required to properly align shift linkage in passenger compartment. Each leg is approximately 65 mm (2.5 in.) long and the diameter is approximately 5.0 mm (0.197 in.).

– Place transmission in neutral.

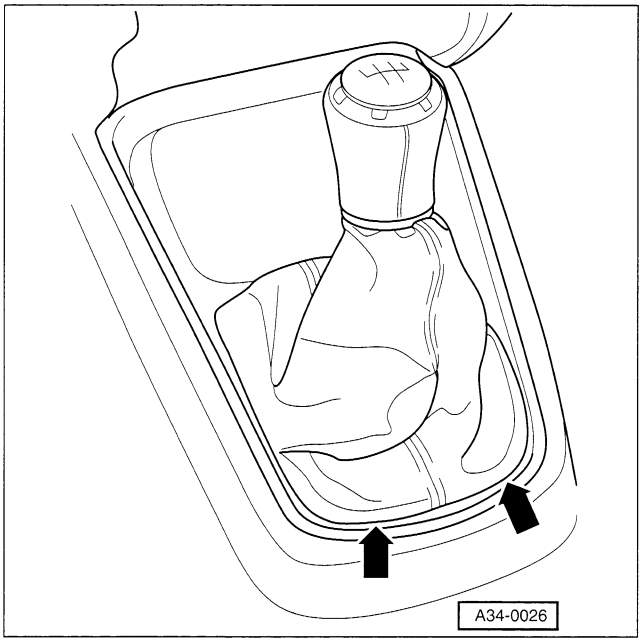


➤ Secure locking mechanism on gear selector cable and gate selector cable ends by pulling forward until stop (**arrow 1**) and then turning to the left to lock (**arrow 2**).

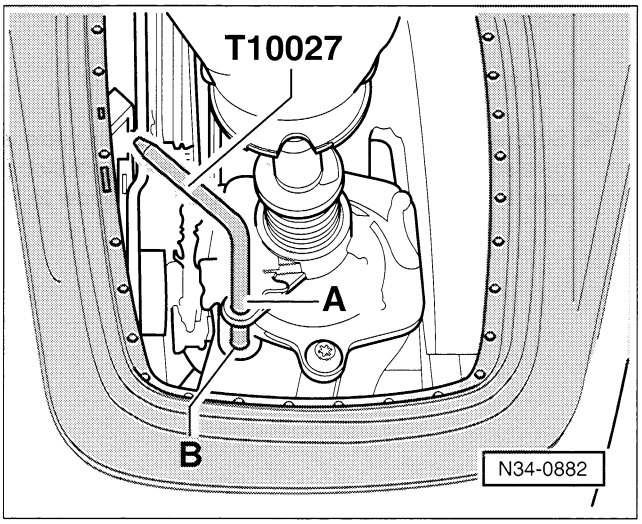


- Lock selector shaft by pressing shaft down (**arrow 1**) while at the same time turning shaft lock (**A**) approximately 90° (**dashed arrow 2**) so that it is in the up position.

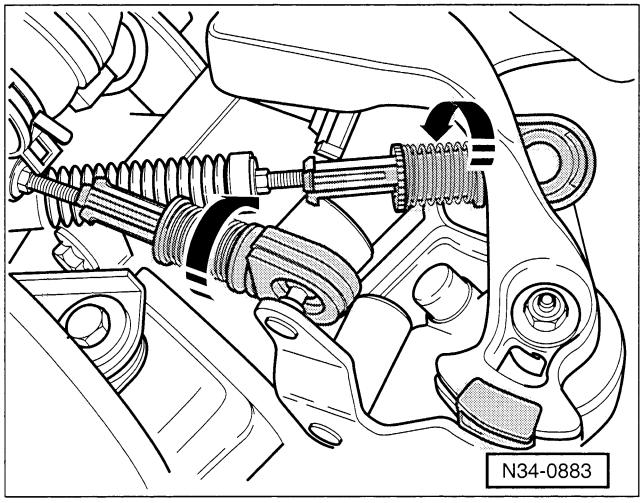
NOTE —
*Shaft lock (**A**) is part of, and built into selector housing.*



- Carefully pry shift boot off of center console.
- Pull cover to rear of center console. Remove rubber sound insulation boot if equipped.



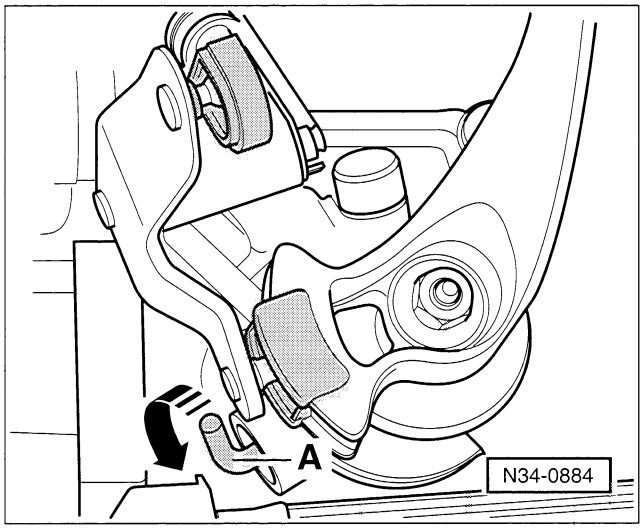
- Lock gear lever in passenger compartment by selecting neutral position and sliding T10027 Locking Pin through holes (**A**) and (**B**).



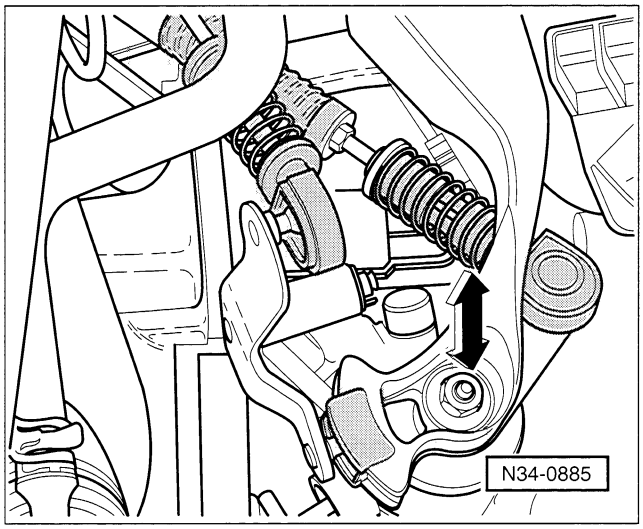
- With linkage in passenger compartment locked and secured with T10027 Locking Pin, and selector shaft locked with built-in shaft lock, turn locking mechanism on gear selector cable and gate selector cable to the right (**dashed arrows**) onto the stops.

NOTE —

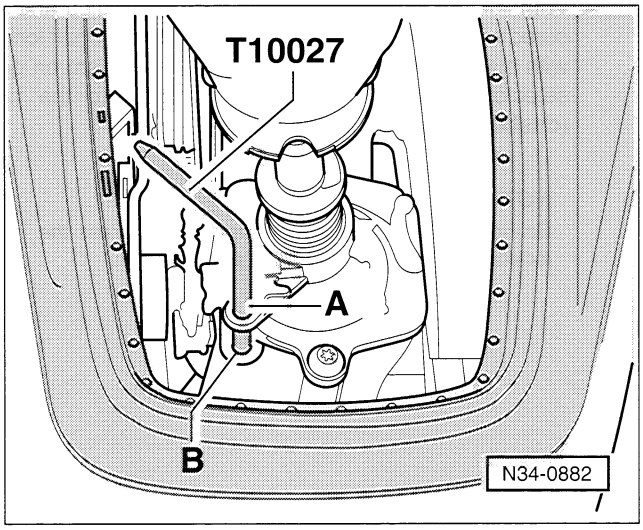
Spring tension on locking mechanism will press the locking mechanisms into correct position.

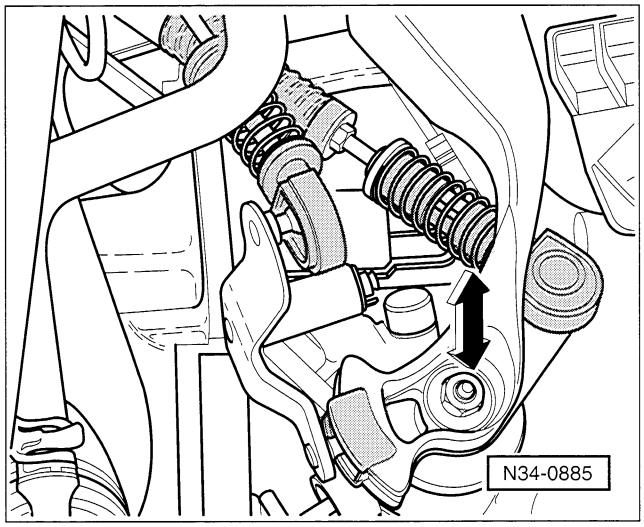


- Turn selector shaft lock (**A**) back to original unlocked position (**dashed arrow**).



- Ensure that selector shaft is free to move up and down in housing (**arrow**).





- Remove T10027 Locking Pin from passenger compartment linkage holes (**A**) and (**B**).
- Reinstall rubber sound insulation boot (if equipped), shifter boot and knob,

Selector Mechanism, functional check, 02J (from 05/99)

The correct at-rest position of the gear shift lever is in neutral between 3rd and 4th gears.

- Depress clutch.
- Shift through the shift pattern several times. Pay particular attention to the operation of the reverse gear lock-out and 5th gear operation.

  If a gear fails to engage smoothly after repeated selection, the selector shaft play (lift, at the transmission), should be checked as described below.
- Engage first gear.
- Press gear shift lever to the stop and release. At the same time, a second technician must observe the selector shaft on the transmission.
- When moving gear lever, selector shaft must move approximately 1 mm in direction of **arrow** (up/down).
- If movement is not present, re-adjust selector mechanism. Re-check shift operation as needed.

GEAR SELECTOR MECHANISM, 02M

The manual transmission gear selector mechanism used with the 02M 6-speed transmission uses the same shift lever boot assembly and shift lever and housing as the 02J transmission from 05/99. The selector cables are different and are covered in this section.

Shift lever boot assembly, 02M

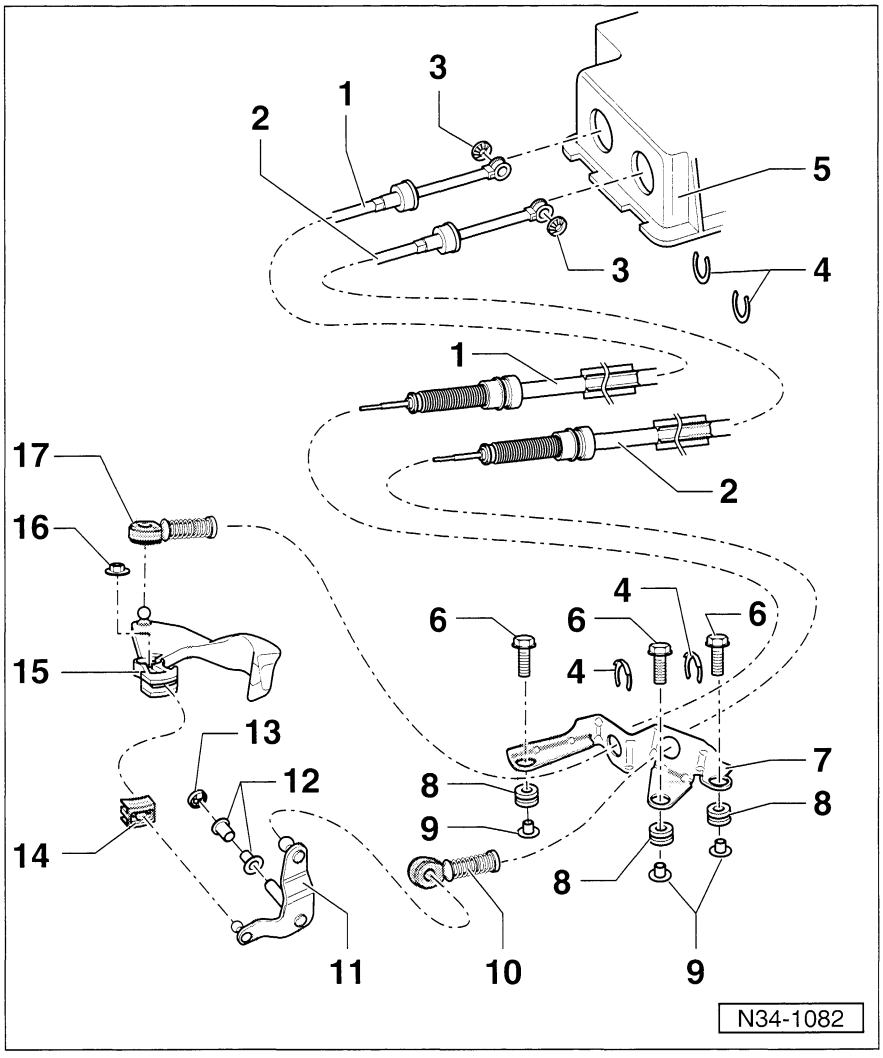
See **Shift lever boot assembly, 02J (from 05/99)**.

Shift lever and housing, servicing, 02M

See **Shift lever and housing, servicing, 02J (from 05/99)**.

Selector cables, removing and installing, 02M

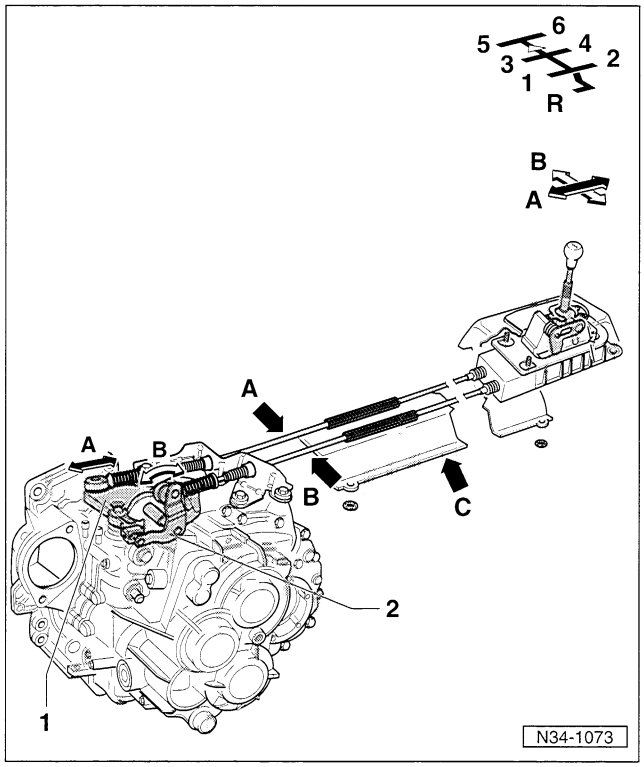
1. **Gear selector cable**
   - Press onto gear shift guide
   - See **Installation position of gear selector mechanism**
2. **Gate selector cable**
   - On relay lever
   - See **Installation position of gear selector mechanism**
3. **Circlip**
4. **Circlip**
   - When removing use caution to avoid damage to cables
5. **Selector housing**
6. **Bolt, hex head**
   - For support bracket
   - Tighten to 25 Nm (18 ft-lb)
7. **Support bracket**
8. **Grommet**
   - Support bracket mounting to transmission
9. **Spacer**
10. **Cable end attachment/locking piece**
    - For gate selector cable to relay lever, 2 versions
    - From production 05/99 through 12/00, snapped in place Always replace after removing from relay lever (item 11)
    - From production 01/01 with through hole, secured with clip Replacement not required
    - Both versions, see **Selector mechanism, removing and installing**
11. **Relay lever**
    - See **Installation position of transmission selector lever/relay lever**
12. **Bushing**
13. **Circlip**
14. **Sliding shoe**



15. **Transmission selector lever**
    - With balance weight
    - Install so that master spline aligns with matching position on selector shaft
    - Adjust selector mechanism after installing, see **Adjusting gear selector mechanism**
    - See **Installation position of transmission selector lever/relay lever**
16. **Nut, hex self-locking**
    - Always replace
    - Tighten to 20 Nm (15 ft lb)
17. **Cable end attachment/locking piece**
    - For gear selector cable to gear selector lever, 2 versions
    - From production 05/99 through 12/00, snapped in place Always replace after removing from transmission selector lever (item 15)
    - From production 01/01 with through hole, secured with clip. Replacement not required
    - Both versions, see **Selector mechanism, removing and installing**

NOTE —

During reassembly, lubricate all mounting and contact surfaces with polycarbomide grease (VW part no. G 052 142 A2).



Installation position of gear selector mechanism

A. Gear change cable

- **A arrows** (⇔) indicate fore and aft movement of shift lever and selector movement

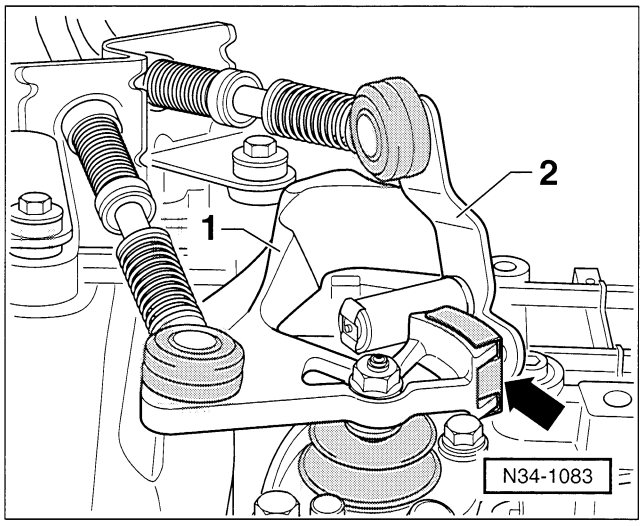
B. Gate selector cable

- **B arrows** (⇔) indicate side to side movement of shift lever and up/down movement of selector movement

C. Heat shield

- Remove before removing the gear selector mechanism

1. **Gear selector lever**
2. **Relay lever**

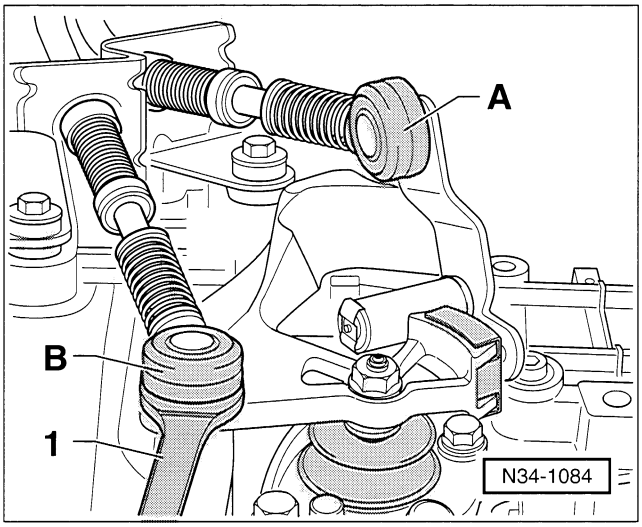


Installation position of transmission selector lever/relay lever

1. **Gear selector lever with balance weight.**
2. **Relay lever**
   - Locates in guide rail of gear selector via sliding shoe (**arrow**)

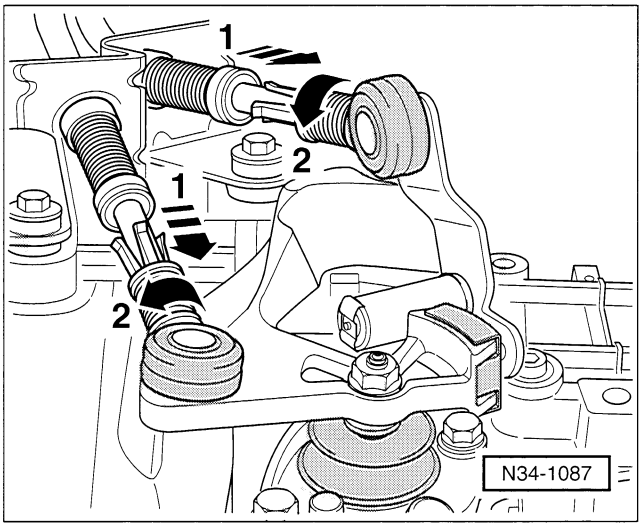
Selector mechanism, removing and installing, 02M

Selector mechanism, removing (from 05/99 through 12/00)

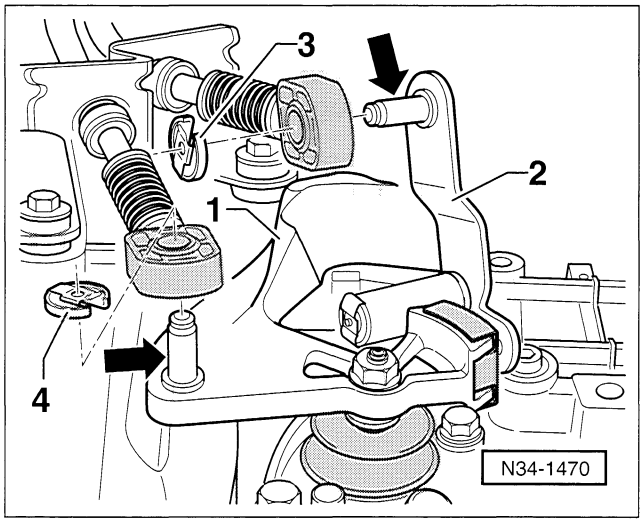


➢ Pry off gate selector cable (**A**) and gear selector cable (**B**) using a 13 mm open end wrench (**1**).

– Remove gear selector cable, bushing, washer and square nut.

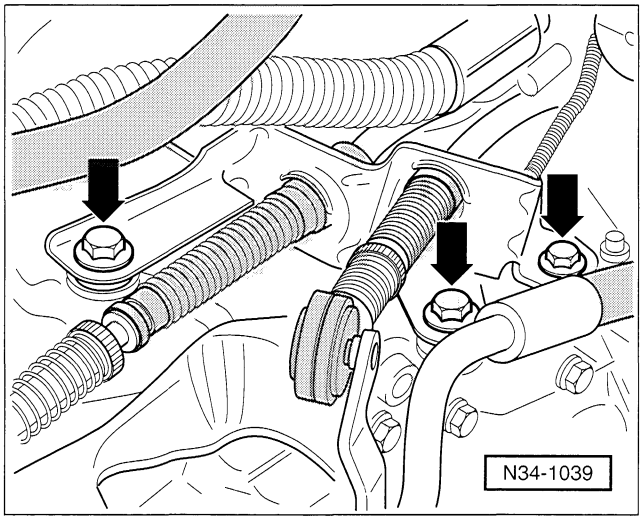


➢ If cable end attachment/locking pieces will not be replaced, secure locking mechanism on gear selector cable and gate selector cable by pulling forward in direction of arrow (**1**) onto stop and then turn to the left in direction of arrow (**2**) to lock.



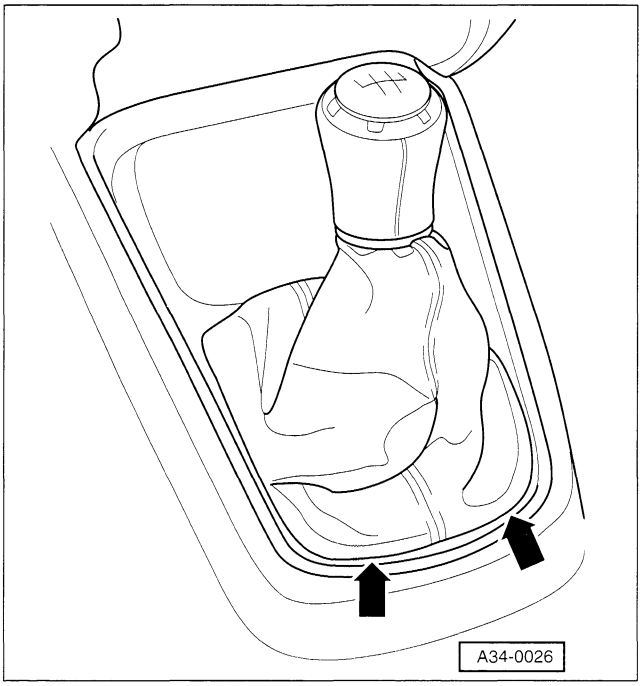
Selector mechanism, removing (from 01/01)

- Remove securing clip (**4**) for gear selector cable from gear selector lever (**1**).
- Remove securing clip (**3**) for gate selector cable from relay lever (**2**).
- Carefully pry gate selector cable and gear selector cable off of attaching pins (**arrows**).



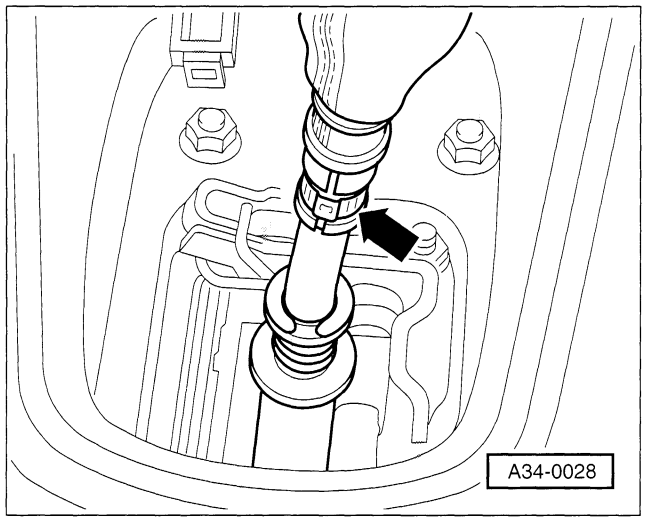
Continued, for both versions

- Unbolt cable support bracket from transmission (**arrows**). As required, unclip hydraulic hose at cable support bracket before unbolting.



- Carefully pry shift boot off of center console.
- Pull cover to rear of center console.

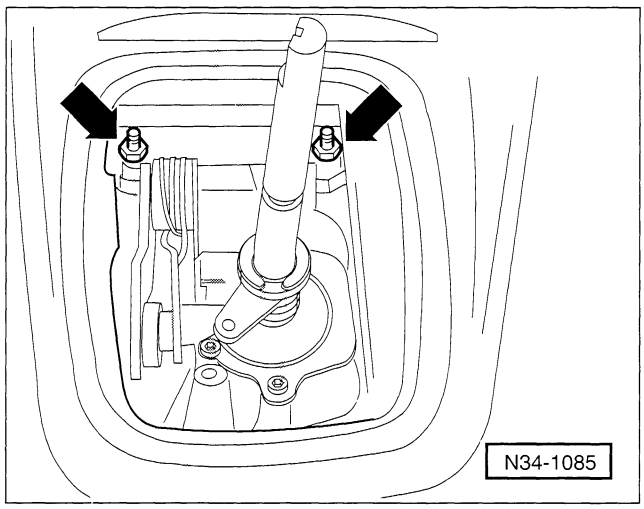
GEAR SELECTOR MECHANISM, 02M



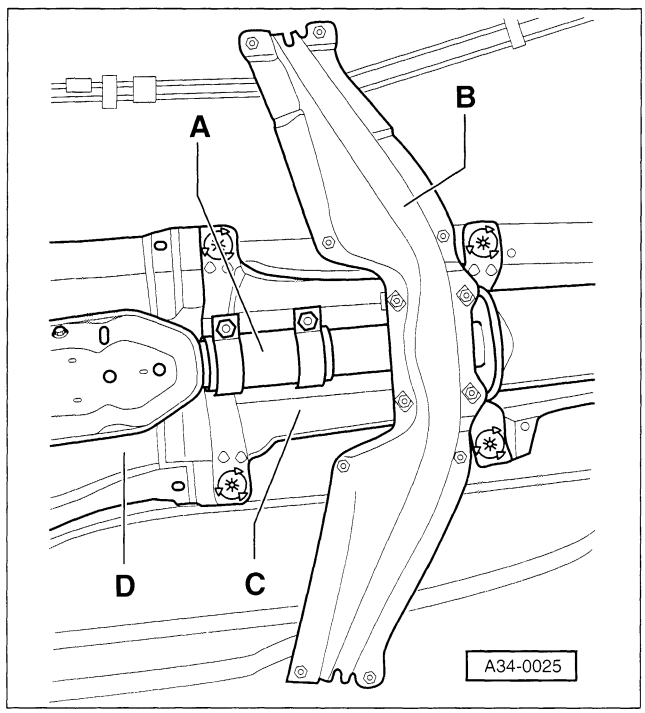
➤ Cut and remove clip (**arrow**) and pull gear shift knob off with boot.

• Cutting clip will destroy it.

– Remove rubber sound insulation boot if equipped.



➤ Remove gear lever housing securing nut (**arrows**).



➤ Disconnect front exhaust pipe (**A**), see **26 Exhaust System and Emission Controls.**

– Remove lower cross support (**B**) below exhaust system.

– Loosen heat shield (**C**) in forward area.

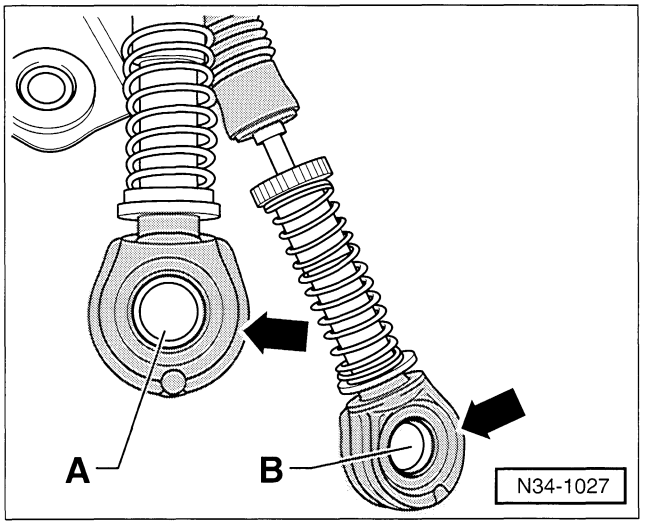
– Remove heat shield (**D**).

– Unbolt selector housing from body.

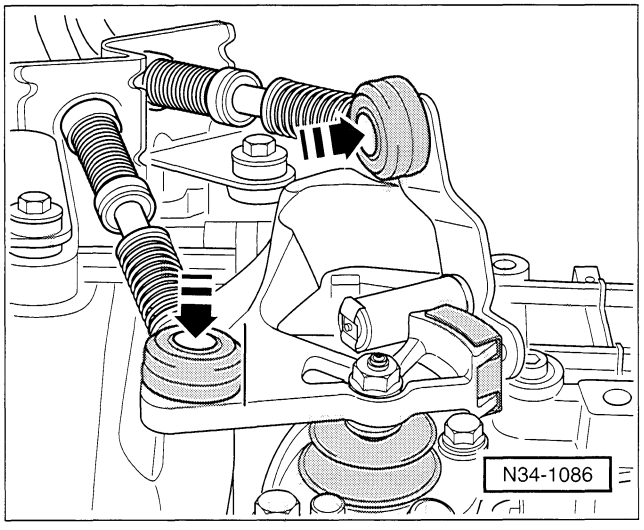
– Swing gear lever housing down and remove assembly complete with cables attached.

Selector mechanism, installing (from 05/99 through 12/00)

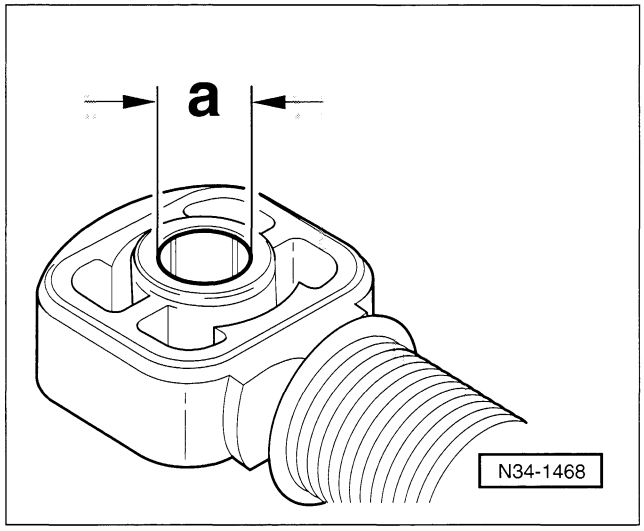
Gear selector and gate selector cables can be reused, however, cable end attachment/locking pieces must be replaced. This version of the cable end attachment/locking pieces at the transmission ends of cables uses a recess in the end and must be replaced after each use.



- Put a small amount of polyurea grease (VW/Audi part number G 052 142 A2 or G000 450 A2) into the hole of the gear cable locking mechanism (**A**) and gate cable locking mechanism (**B**). Avoid getting grease on the outside seals (**arrows**).



- Press (snap) gear selector cable onto transmission selector lever and gate selector cable onto relay lever (**arrows**).

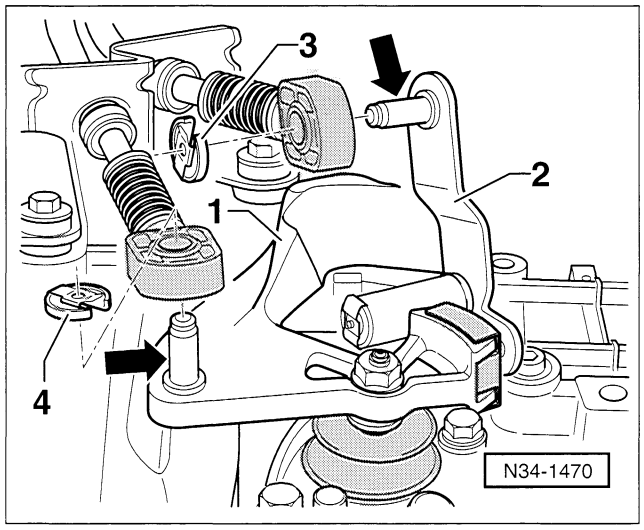


Selector mechanism, installing (from 01/01)

This version of the cable locking mechanism uses through-holes and locking clips and does not need to be replaced after each use unless damaged or worn.

➢ Gear selector and gate selector cables have different pin attachment hole diameters (**a**) to prevent incorrect attachment to transmission linkage.

- Gear selector cable to gear change lever diameter **a** = 10 mm
- Gate selector cable to relay lever diameter **a** = 8 mm



➢ Put a small amount of polyurea grease (VW/Audi part number G 052 142 A2 or G 000 450 A2) on the pins (**arrows**) of gear shift lever (**1**) and relay lever (**2**).

– Install gear selector cable to gear shift lever with a new clip (**3**) and gate selector cable to relay lever linkage with new clip (**4**).

NOTE —

- *Cable securing clips must always be replaced.*
- *Part numbers are listed for reference only. Consult an authorized Volkswagen Dealer or aftermarket parts Specialist for the latest parts information.*

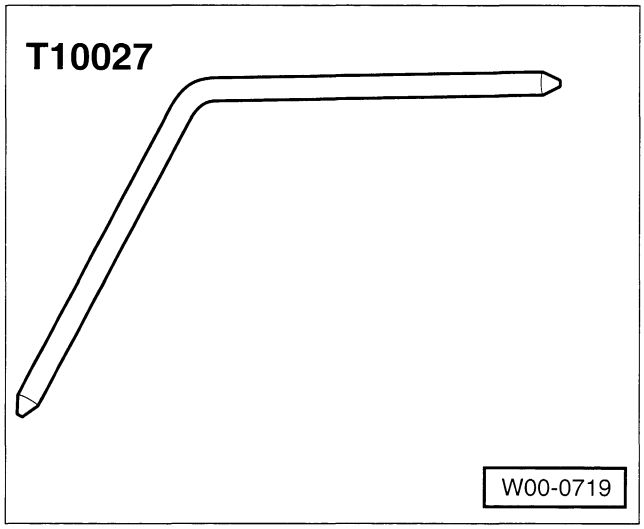
Continued, for both versions

Remaining installation is the reverse of removal noting the following additional points:

- Align gear lever housing parallel to the body.
- Adjust the gear lever housing distance to the body so that it is the same on each side.
- Adjust selector mechanism upon completion of installation.

Tightening torques

- Selector housing to body . . . . . 25 Nm (18 ft-lb)
- Cross support to body . . . . . 25 Nm (18 ft-lb)
- Selector cable support bracket to body. . . . . 25 Nm (18 ft-lb)



Selector mechanism, adjusting, 02M

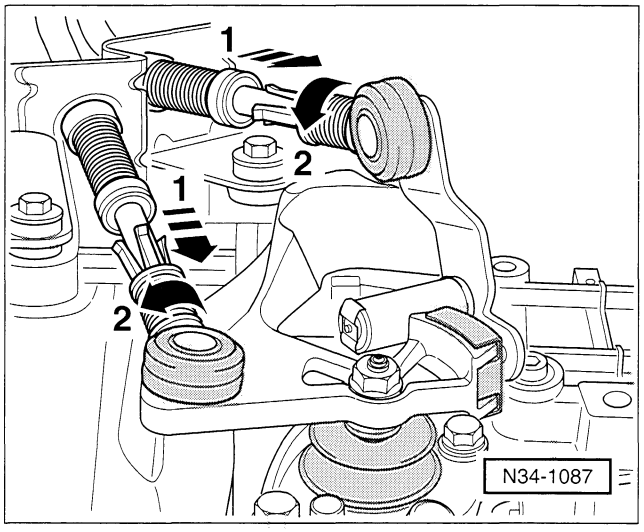
Prior to adjusting the gear selector mechanism, observe the following points:

- All moving parts of the selector mechanism and transmission shift mechanism must be in proper working order and lubricated.
- Selector mechanism must move freely.
- Transmission, clutch and clutch mechanism must also be in proper working order.

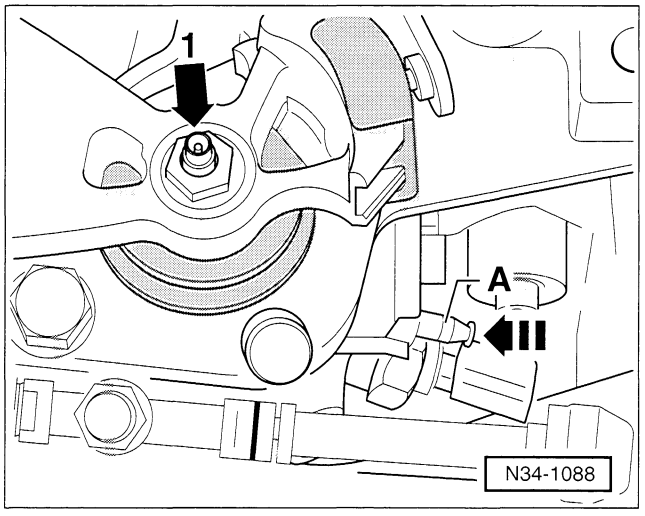
On some engine types, it will also be necessary to remove sections of the engine sound absorber panels for access to the transmission linkage.

➢ Special tool T10027 is required to properly align shift linkage in passenger compartment. Each leg is approximately 65 mm (2.5 in.) long and the diameter is approximately 5.0 mm (0.197 in.).

– Place transmission in neutral.

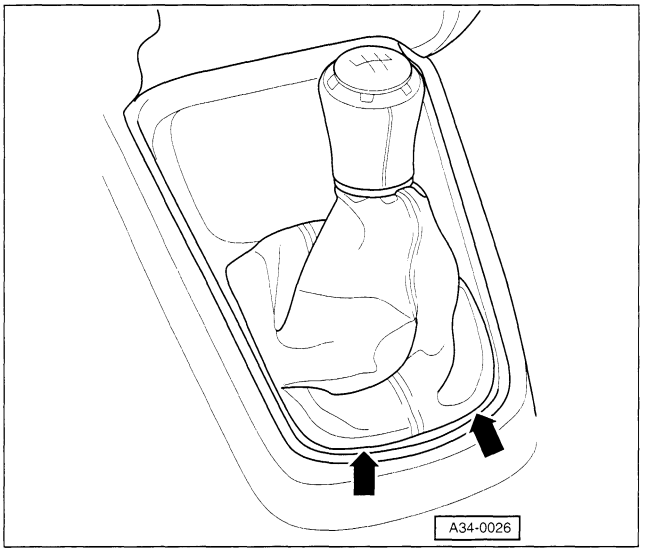


➢ Secure locking mechanism on gear selector cable and gate selector cable ends by pulling forward until stop (**arrow 1**) and then turning to the left to lock (**arrow 2**).



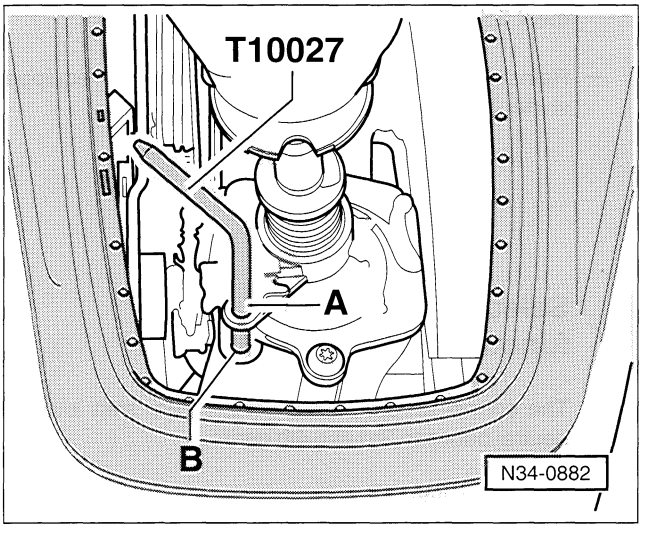
➢ Lock selector shaft by carefully pressing shaft down (**arrow 1**) while at the same time pushing shaft lock pin (**A**) into transmission (**dashed arrow**) until it engages and holds selector shaft in position. Shaft should now be locked.

NOTE —
*Selector shaft lock (**A**) is built into selector housing.*

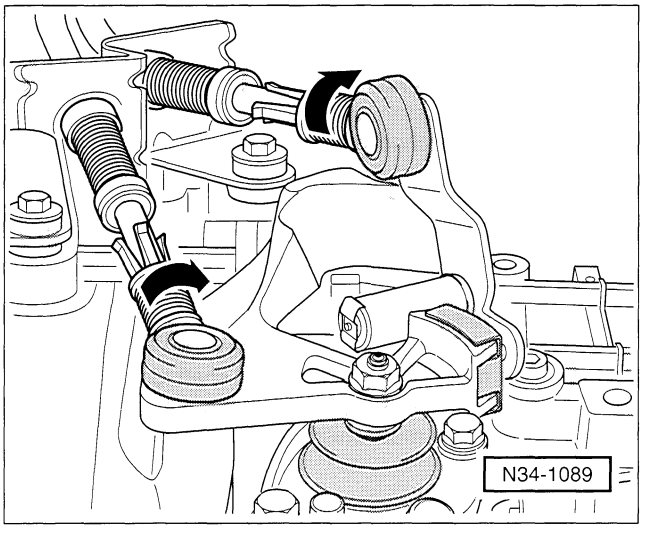


➤ Carefully pry shift boot off of center console at **arrows**.

– Pull cover to rear of center console. Remove rubber sound insulation boot if equipped.



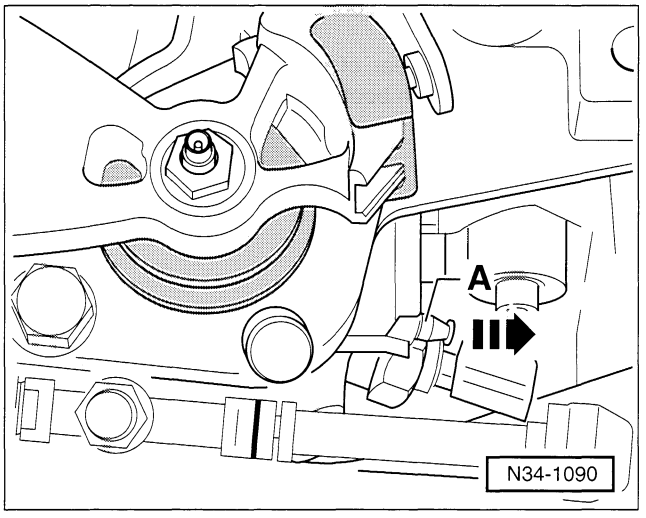
➤ Lock gear lever in passenger compartment by selecting neutral position gate between first and second gear and sliding T10027 Locking Pin through holes (**A**) and (**B**).



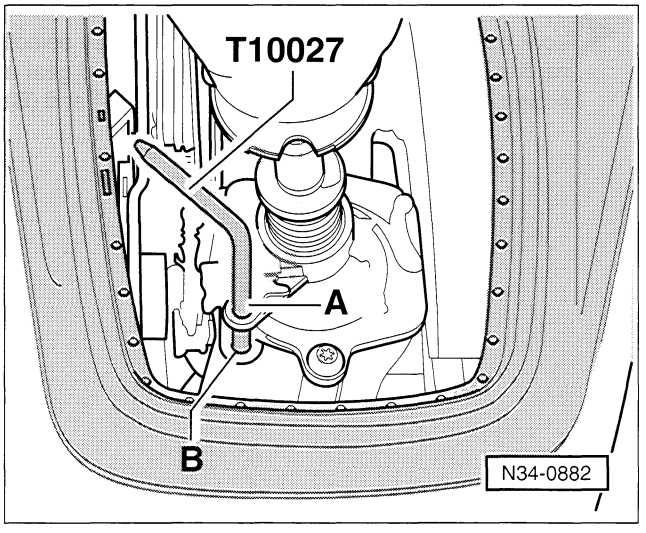
➤ With linkage in passenger compartment locked and secured in neutral between first and second gears with T10027 Locking Pin, and selector shaft locked with built-in shaft lock, turn locking mechanism on gear selector cable and gate selector cable to the right (**arrows**) onto the stops.

NOTE —

Spring tension on locking mechanism will press the locking mechanisms into correct position.



➢ Pull selector shaft locking pin (**A**) back to original unlocked position (**dashed arrow**).



➢ Remove T10027 Locking Pin from passenger compartment linkage holes (**A**) and (**B**).

– Reinstall rubber sound insulation boot (if equipped), shifter boot and knob,

Selector mechanism, functional check, 02M

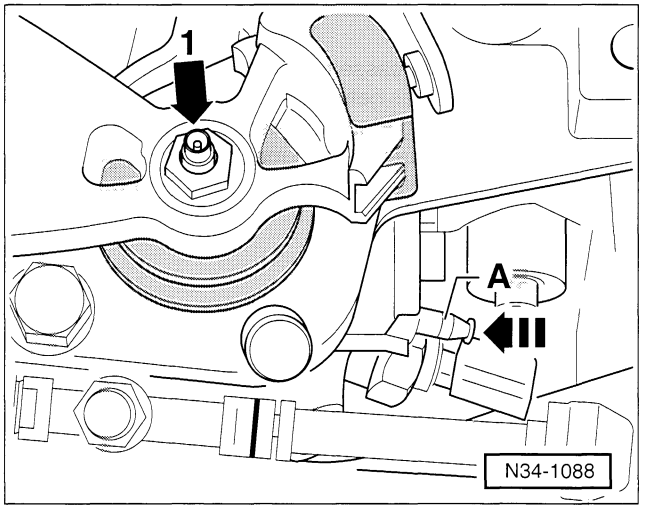
The correct at-rest position of the gear shift lever is in neutral between 3rd and 4th gears.

– Depress clutch.

– Shift through the shift pattern several times. Pay particular attention to the operation of the reverse gear lock-out, 1st/2nd gear shift, and 5th/6th gear.

– If a gear fails to engage smoothly after repeated selection, the selector shaft movement at the transmission should be re-checked as follows.

– Have a second Technician carefully press gear shift lever in passenger compartment against the stop for neutral between first and second gears.



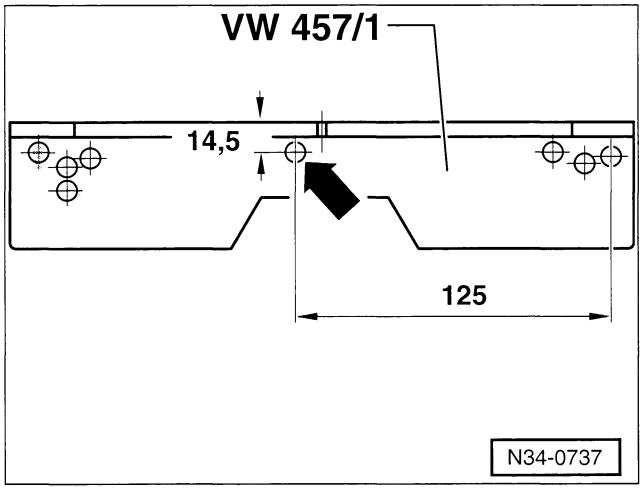
➢ While the second technician holds the gear shift lever in position, observe the selector shaft on the transmission. It must move down (**arrow 1**). If shaft lock pin cannot be easily pushed (**dashed arrow**) into selector shaft, re-adjust selector mechanism. Re-check shift operation as needed.

TRANSMISSION, 02J REMOVING AND INSTALLING

This procedure describes the removal and installation of the 02J 5-speed manual transmission. In addition to several special tools, the factory specifies special engine lifting and jacking equipment to support and reposition the engine as the transmission is removed from below.

Volkswagen recommended special tools

- VW 457/1 support rails (modified)
- 10-222A engine support
- 10-222A/1 adapter
- 10-222A/3 adapter (VR6)
- 3282 transmission support fixture with 3282/59 support
- 3282/8 adjustment plate with 3282/40 pins (3X)
- 3300A engine support
- 3336 adjustable transmission lifting beam
- VAG 1383A transmission jack



Special tool, modifying

Volkswagen special tool 457/1 will need to be modified to allow attachment to the subframe.

➢ Modify VW 457/1 by drilling an additional hole as indicated (**arrow**).

- Drill an 8.5 mm (0.335 in.) diameter hole (**arrow**) at location shown. Dimensions shown are in mm.

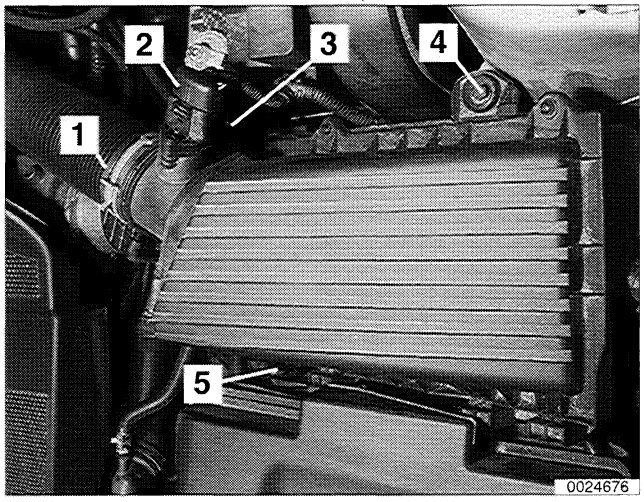
NOTE —
VW 457/1 may have been previously modified with more holes than shown.

02J transmission, removing

– Remove engine sound absorber cover.

– Disconnect battery ground (GND) strap from battery negative (–) terminal. See the **Caution** at the beginning of this repair group regarding battery disconnection.

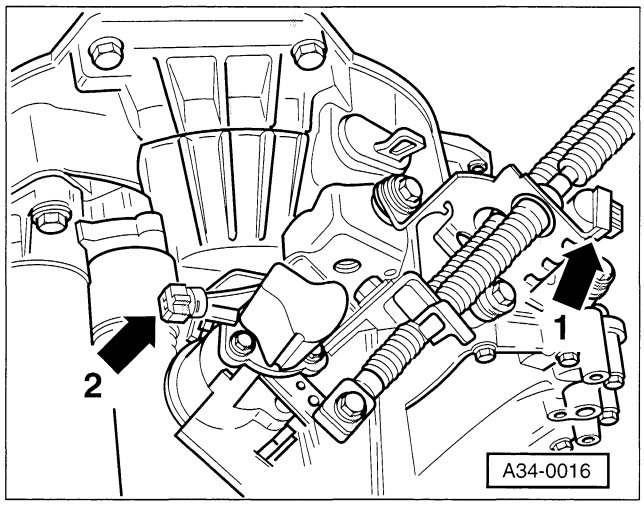
NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.



➢ Remove intake air hose (**1**), and harness connector (**2**), from Mass Air Flow (MAF) Sensor.

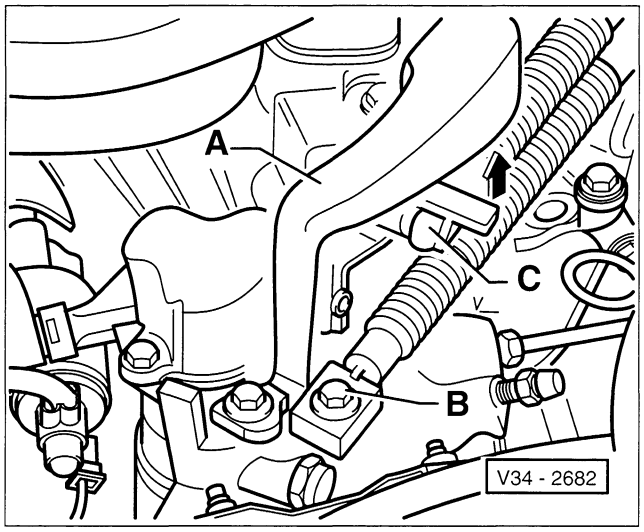
– Remove vacuum hose (**3**) to air cleaner near MAF, where equipped.

– Remove air cleaner mounting bolts (**4**) and (**5**), remove complete air cleaner assembly.

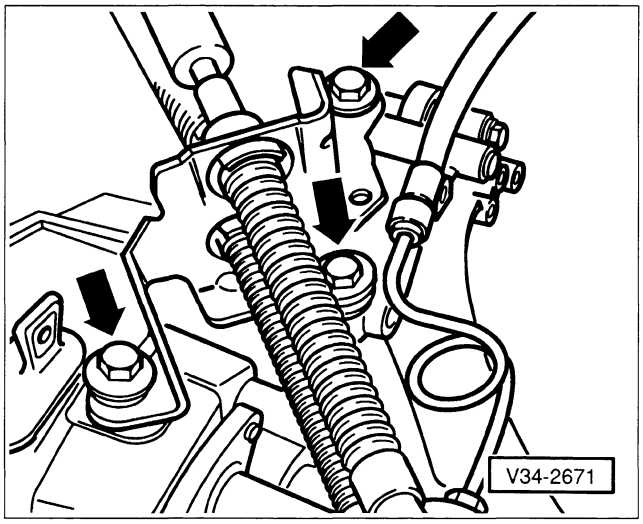


02J transmissions (through 05/99)

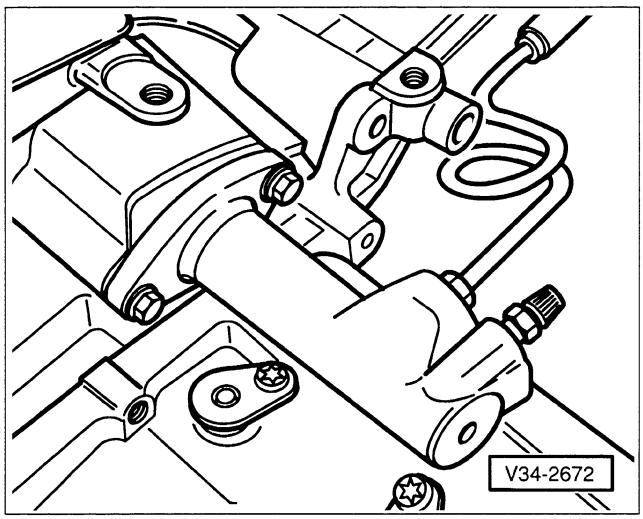
- Disconnect harness connector from vehicle speed sensor (**1**) and back-up light switch (**2**).



- Remove balance weight (**A**) and gear selector cable (**B**) from gear selector lever. Remove gear selector cable securing bolt and square nut. Lift tab and pull (**arrow**) gate selector cable off actuating arm/relay lever (**C**).

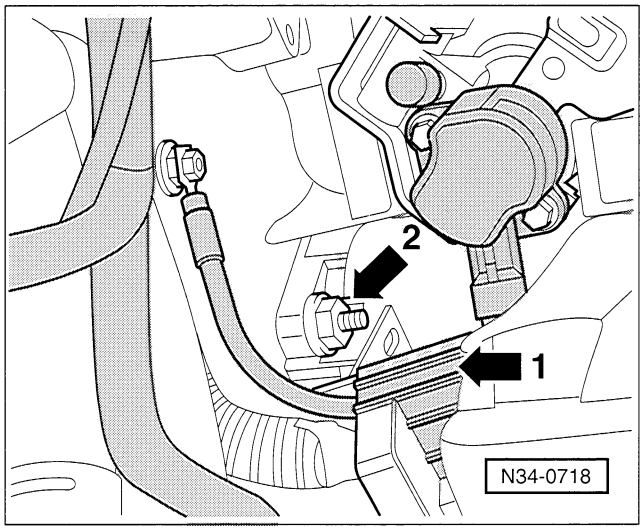


- Unbolt cable support bracket from transmission (**arrows**). As required, unclip hydraulic hose at cable support bracket before unbolting.



➤ Unbolt clutch slave cylinder from transmission and carefully move aside and secure with wire. Do not disconnect hydraulic lines.

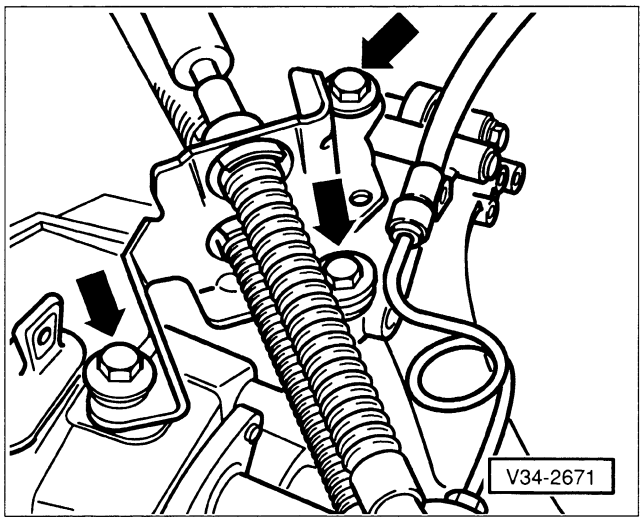
> ***CAUTION —***
> *Do not depress clutch pedal while slave cylinder is unbolted from transmission.*



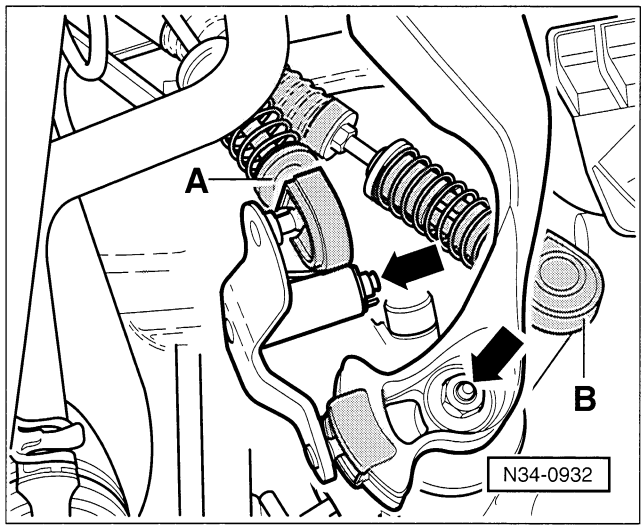
➤ Remove cable retaining bracket from starter motor (**1**) and remove upper starter securing bolt (**2**).

– Remove ground strap at upper engine/transmission securing bolt and remove bolts.

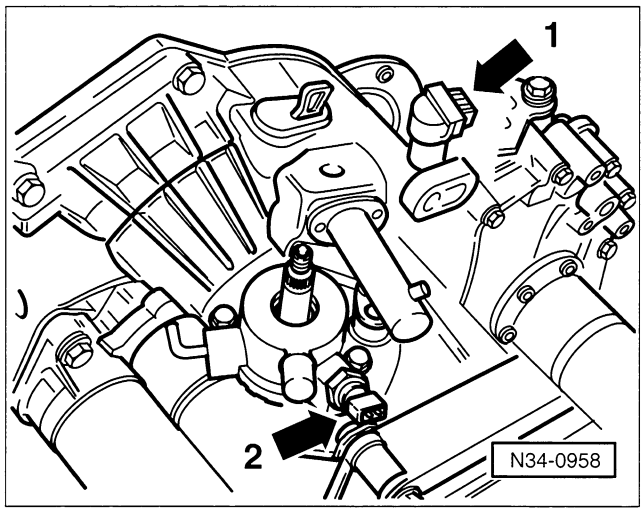
02J transmission (from 05/99)



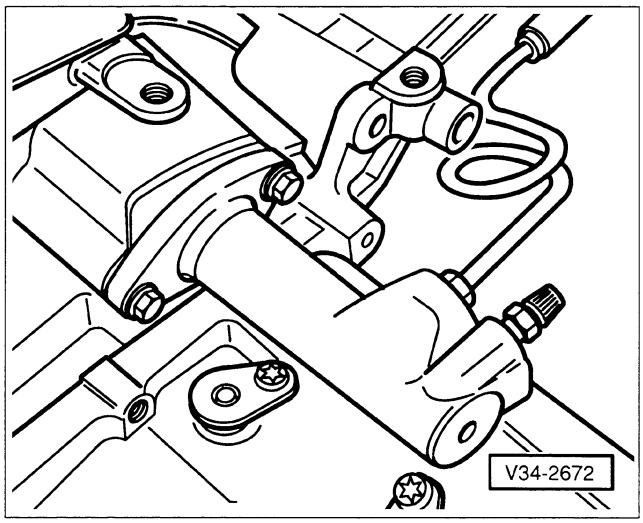
➤ Unbolt cable support bracket from transmission (**arrows**). As required, unclip hydraulic hose at cable support bracket before unbolting.



- Remove circlip (**upper arrow**) and pull gate selector cable (**A**) and relay lever off of transmission.
- Remove nut (**lower arrow**) and remove gear selector cable (**B**) with selector lever.
- Carefully secure gate selector and gear selector cables aside with wire.

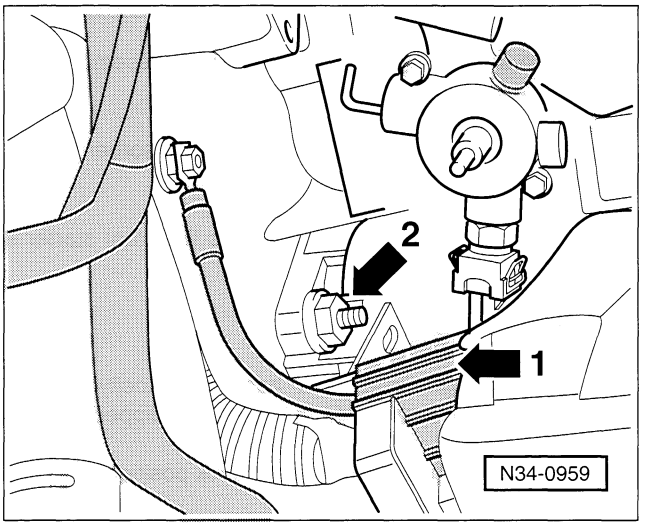


- Disconnect harness connector from vehicle speed sensor (**arrow 1**) and back-up light switch (**arrow 2**).



- Unbolt clutch slave cylinder from transmission and carefully move aside and secure with wire. It is not necessary to disconnect hydraulic lines.

> ***CAUTION —***
> *Do not depress clutch pedal while slave cylinder is unbolted from transmission.*



➤ Remove cable retaining bracket from starter motor (**arrow 1**) and remove wiring and cables from starter motor.

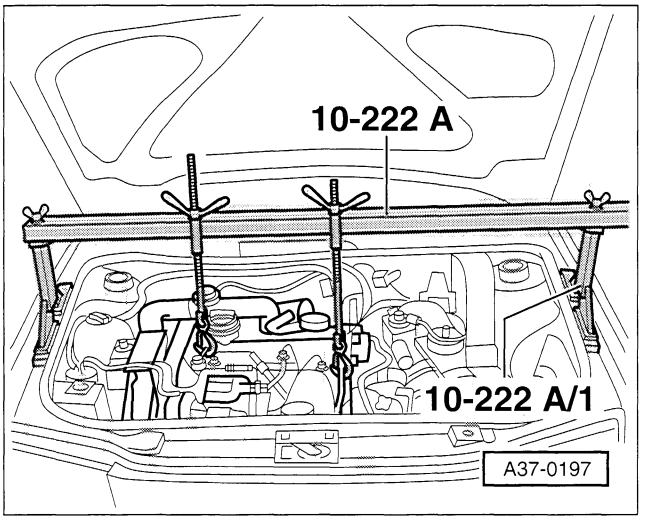
– Remove ground strap at upper engine/transmission securing bolt.

– Remove upper starter securing bolt (**arrow 2**).

– Remove remaining upper securing bolts.

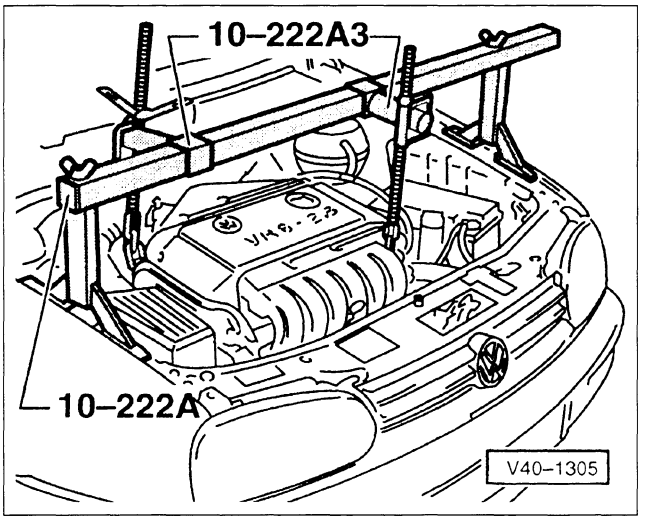
– If there are hoses or wiring harnesses in the areas of the mounting eyes for special tool 10-222A with 10-222A/1, carefully move them aside or disconnect them.

Vehicles with 4-cylinder engines

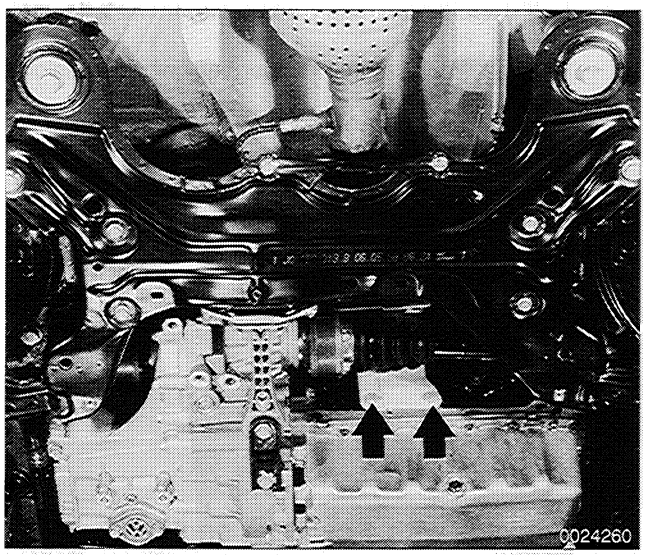


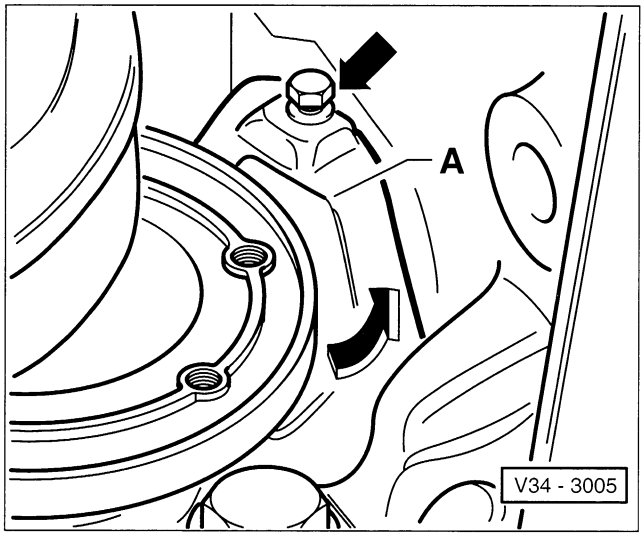
➤ Fit support bar 10-222A with legs 10-222A1 as shown.

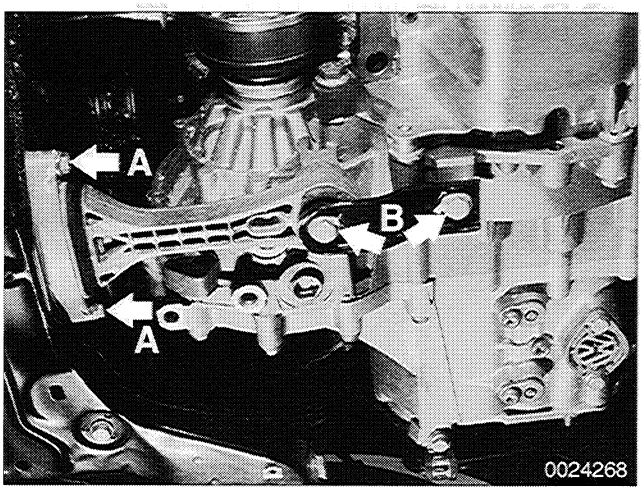
Vehicles with 6-cylinder engines



➤ Fit support bar 10-222A with legs 10-222A1 and adapters 10-222A/3 as shown.







All vehicles

– Take weight off of engine/transmission assembly by turning large wing nuts on support bar.

– Remove center and left lower sound absorber panels as required.

– Remove power steering hydraulic line from starter and transmission.

– Remove starter.

➢ Remove right side inner constant velocity (CV) joint shield bolts (**arrows**) from engine if equipped.

– Turn front wheels to the full left lock position.

– Disconnect both inner drive shafts from transmission drive flanges, see **40 Front Suspension and Drive Axles**. Carefully secure drive shafts as high up and out of the way as is possible with wire.

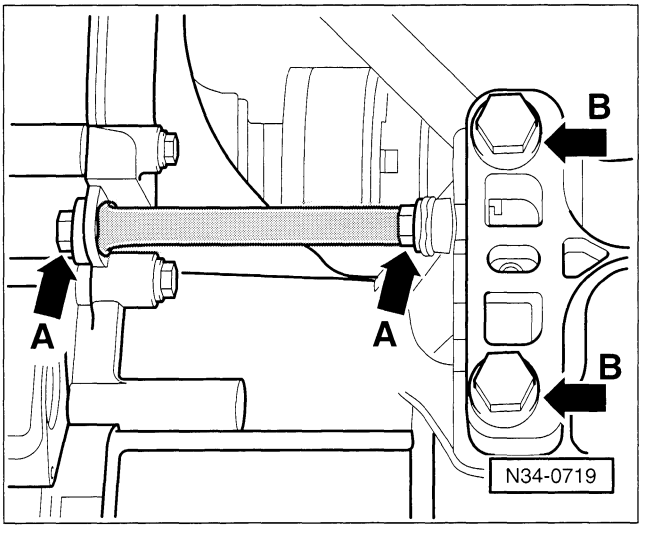
NOTE —
Take care to avoid damage to painted and coated surfaces of axles, boots, and vehicle.

➢ Remove small flywheel access/cover plate (**A**) behind right side drive shaft flange (**arrows**) if equipped.

– Remove lower flywheel cover plate if equipped.

– Separate exhaust system and remove from subframe as needed, see **26 Exhaust System and Emission Controls**.

➢ Remove pendulum support (**arrows A** and **arrows B**)



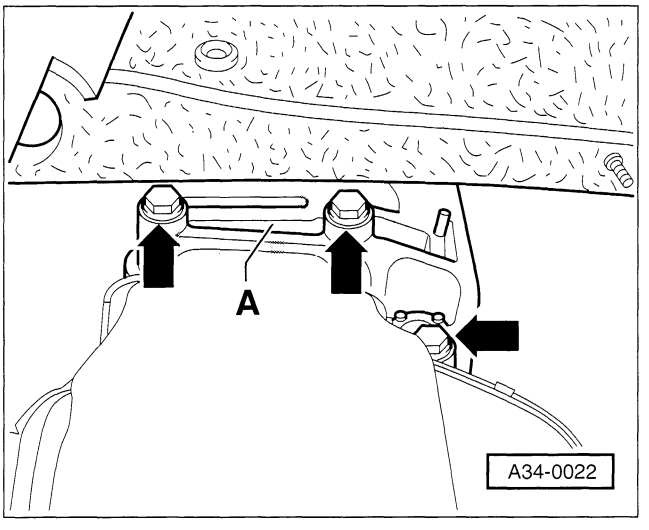
➤ Remove transmission support (**arrows A**) from transmission.

– Remove hex bolts (**arrows B**) from left side transmission mount.

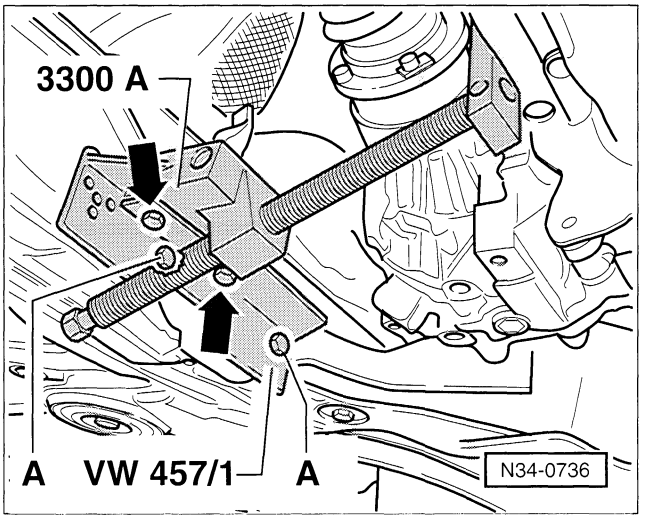
– Tilt engine/transmission assembly down on the left side by turning large wing nuts on support bar.

NOTE —

*Transmission mount securing bolts (**arrows A** in the following illustration) must remain accessible.*

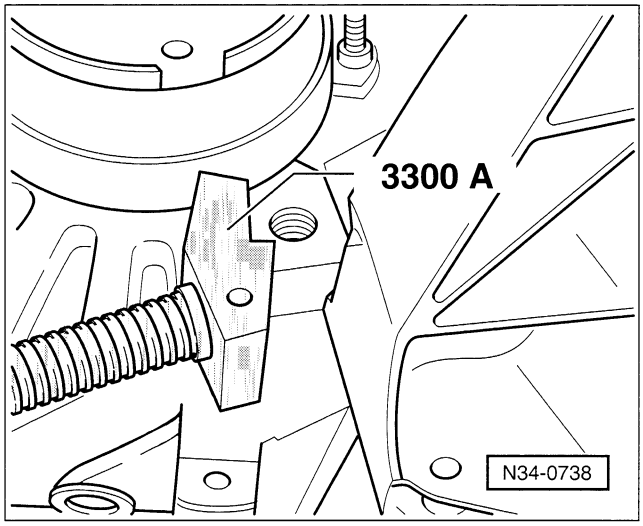


➤ Remove transmission mount (**arrows A**).



➤ Working from underneath vehicle, bolt modified support rail VW457/1 to both pendulum support securing holes on subframe with spacers totalling 6 mm between subframe and support rail (**arrows**). Bolts (**A**) must be M8x25.

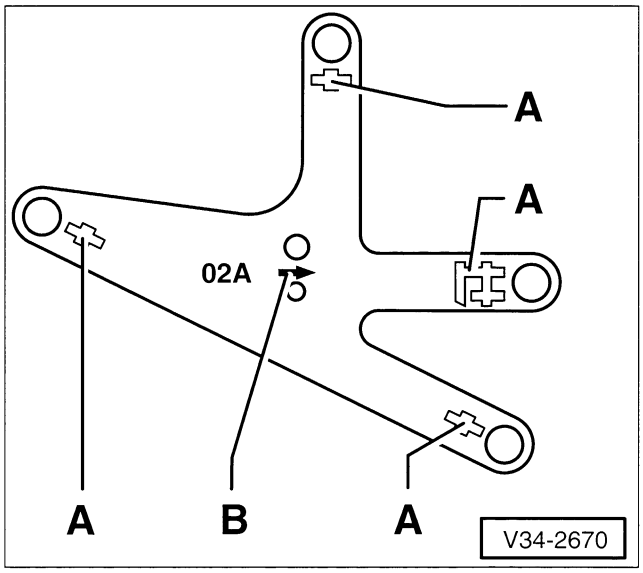
– Fit support 3300A to support rail VW457/1 and engine as shown and secure.



Vehicles with 5-valve engines

➤ Remove a lower engine/transmission securing bolt so that support 3300A can be installed.

NOTE —
Support 3300A must be installed on the engine directly next to the transmission.



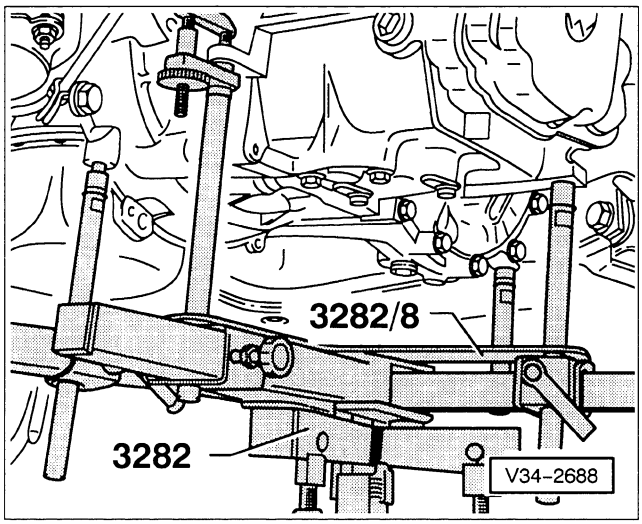
All vehicles

– Carefully move the engine forward slightly by turning threaded shaft of 3300A.

NOTE —
Take care to avoid damage to power steering hydraulic lines when moving engine/transmission assembly.

➤ Assemble transmission jack with transmission support fixture 3282, 3282/8 adjustment plate (marked 02A), and 3282/40 pins.

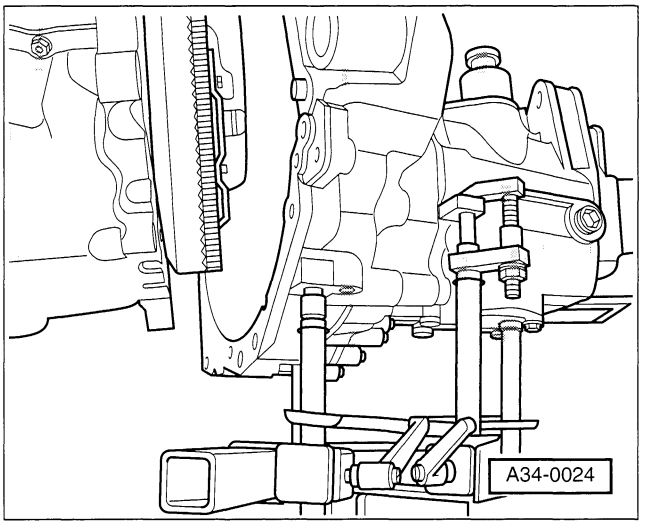
- Place adjustment plate 3282/8 on support fixture 3282 noting that plate fits properly in one direction only and that arrow (**B**) points to the front of the vehicle.
- Align arms of support fixture with holes in adjustment plate and attach pins to arms as indicated (**A**).



➤ Position transmission jack under vehicle so that arrow on adjustment plate points to the front of vehicle.

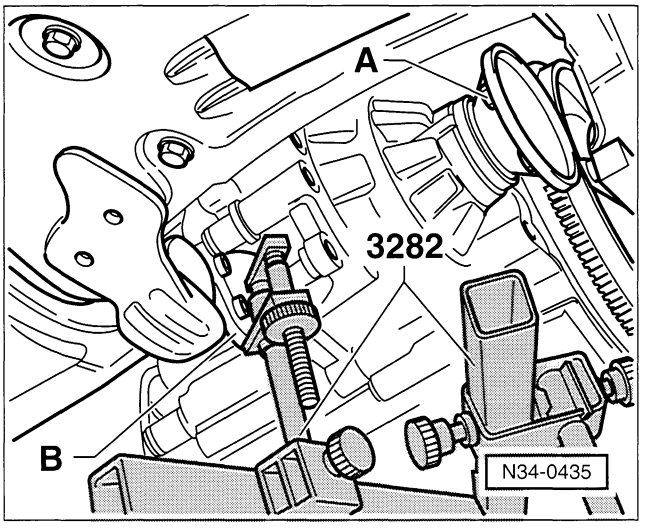
– Align adjustment plate parallel to transmission, attach and lock pins to transmission at locations indicated.

– Remove remaining engine/transmission securing bolts.



➢ Press transmission off of dowel pins on engine block and carefully swing towards subframe.

– Lower transmission slightly and tilt to the left by turning adjusters on transmission support fixture 3282.



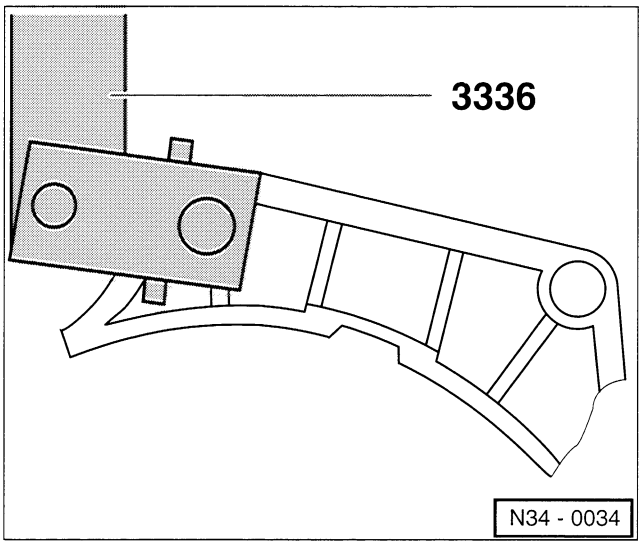
➢ Lower transmission carefully guiding the right side drive flange past the area of the flywheel as shown. Guide left side drive flange when in the area of the subframe.

NOTE —

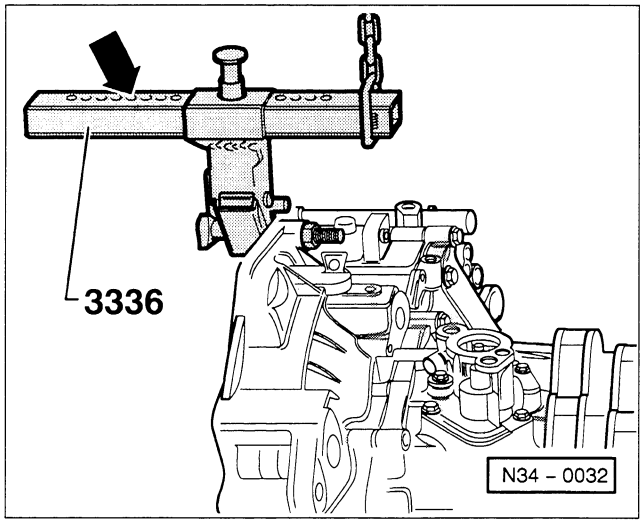
- *When lowering, change position of transmission by turning adjusters on transmission support fixture 3282.*
- *Take care to avoid damage to power steering hydraulic lines when lowering transmission assembly.*

02J transmission, transporting

Due to weight, size and bulk, the transmission is best moved by fitting the adjustable transmission lifting beam, 3336. Use of this support in conjunction with a suitable shop crane will minimize the chance of damage to the transmission.



➤ Bolt transmission lifting device 3336 to upper mounting holes as shown.



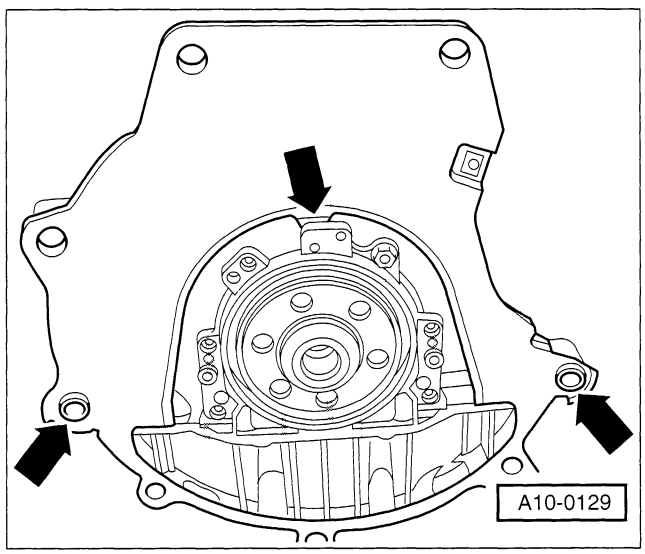
➤ Position support arm on sliding piece with locking pin (**arrow**) so that 5 holes are visible.

– Lift transmission with 3336 with a suitable shop crane and transport to work area or shipping container to avoid personal injury and/or damage to transmission.

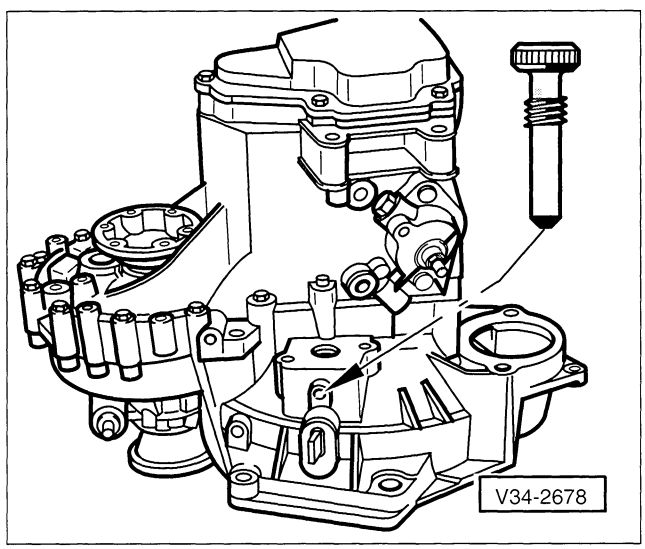
02J transmission, installing

Install the transmission in the reverse order of removal noting the following points:

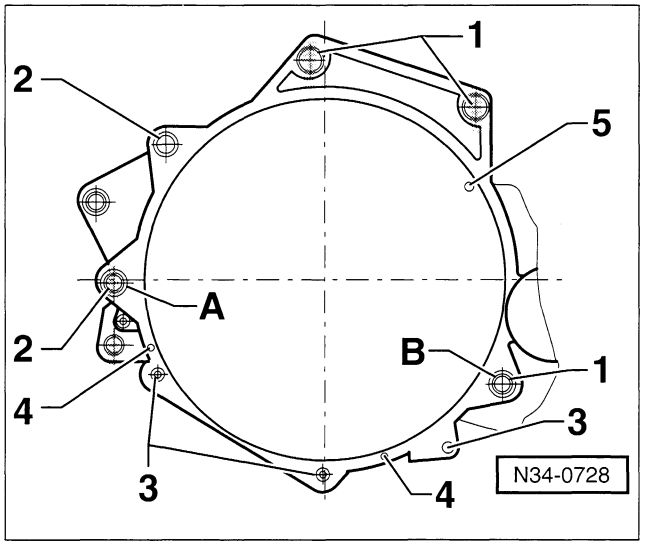
- Check that all engine-to-transmission dowel pins are installed in the engine block. Replace any that are missing or damaged.
- Clean the hub splines of the transmission input shaft and apply a light coat of MoS_2 (Moly) grease (VW/Audi G 000 100) before installing. The clutch disc must be free to slide lightly back and forth on the transmission input shaft.
- Ensure that the intermediate plate is correctly positioned on the engine block.
- When replacing a transmission, transfer Vehicle Speed Sensor (VSS) and appropriate shift linkage from old unit to new unit before installation.
- Depending on the situation, it may also be advantageous to check and/or fill the transmission with the correct specification gear oil before installation.
- Check and/or correct transmission gear oil level if not done previously.
- Always check and adjust gear shift linkage after installation of transmission.
- Replace hardware (bolts and nuts) as indicated and torque to specification.

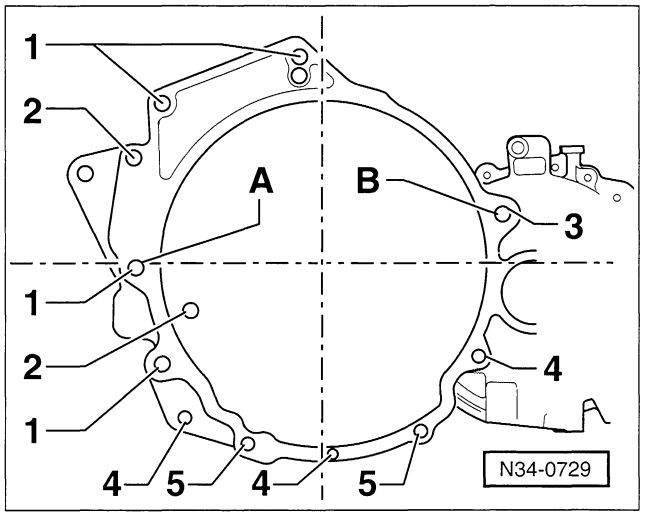


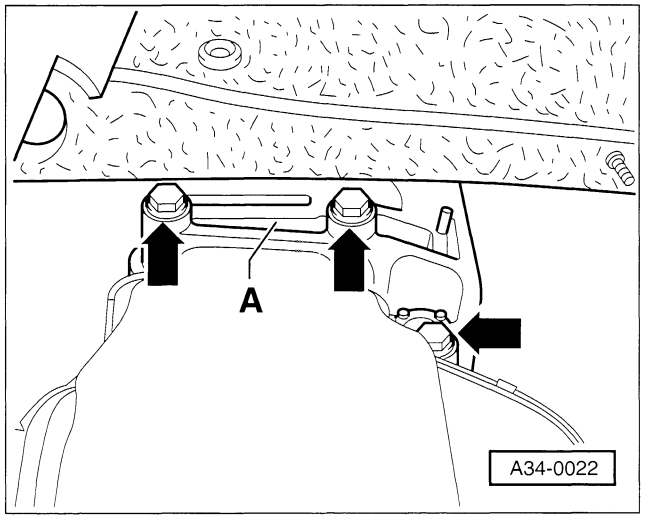
On 4-cylinder engines, ensure that intermediate plate (**upper arrow**) is properly seated on oil seal flange and that engine/transmission locating dowel sleeves are installed and undamaged (**lower arrows**).



Before installing a new transmission or re-installing the original transmission, secure the clutch operating linkage. Press clutch release lever back into the bellhousing area and temporarily secure with a shipping pin or an M8x35 bolt threaded into the cable support bracket as shown. After transmission has been installed, remove bolt. Hole will usually be used by cable support bracket. If not used by support bracket, seal with an appropriate plug or bolt.







02J torque specifications

4-cylinder engine

Transmission-to-engine bolt specifications and tightening torques for 4-cylinder engine are listed below in **Table c**.

Table d. 4-cylinder transmission to engine fasteners

Fastener	Size	Qty.	Tightening torque
1	M12 X 55	3	80 Nm (59 ft-lb)
2[1]	M12 X 150	2	80 Nm (59 ft-lb)
3[2]	M10 X 50	3	60 Nm (44 ft-lb)
4[3]	M7 X 12	2	10 Nm (7 ft-lb)
5[4]	M7 X 12	1	10 Nm (7 ft-lb)
A + B	Locating dowel sleeves	2	

1. Also starter to transmission
2. Only on engines with an aluminum oil pan
3. Large cover plate for flywheel, only on engines with sheet steel oil pan (painted black)
4. Small cover plate for flywheel

6-cylinder engine

Transmission-to-engine bolt specifications and tightening torques for 6-cylinder engine are listed below in **Table d**

Table e. 6-cylinder transmission to engine fasteners

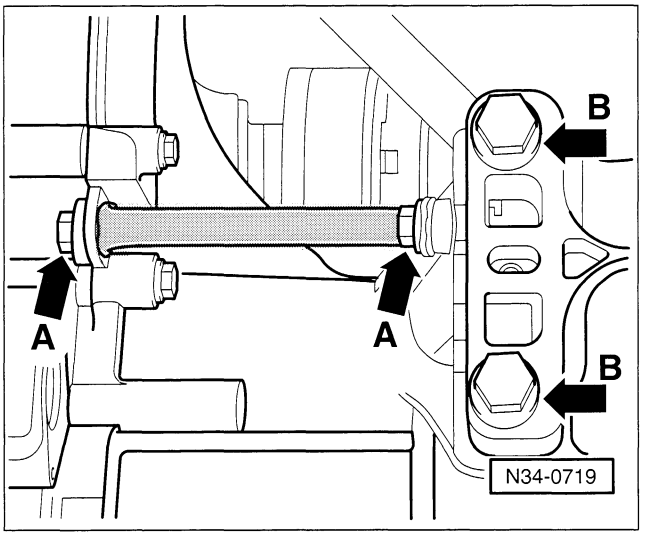
Fastener	Size	Qty.	Tightening torque
1	M12 X 55	4	80 Nm (59 ft-lb)
2[1]	M12 X 55	2	80 Nm (59 ft-lb)
3	M12 X 65	1	80 Nm (59 ft-lb)
4[2]	M10 X 60	3	40 Nm (30 ft-lb)
5[3]	M7 X 12	2	10 Nm (7 ft-lb)
A + B	Locating dowel sleeves	2	

1. Also starter to transmission
2. Only on engines with aluminum oil pan,
   Some engines use M10 x 50 bolts, tighten to 25 Nm (18 ft-lb)
3. Large cover plate for flywheel, only on engines with sheet steel oil pan (painted black)

All vehicles

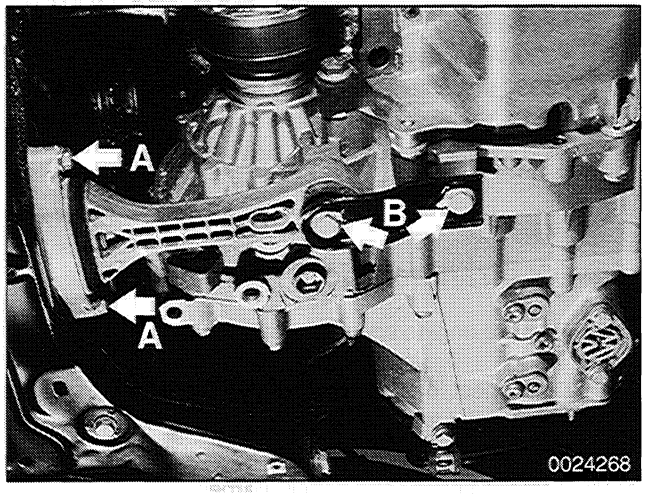
Transmission mount (**A**) to transmission.

- When tightening, be sure there is no stress (preload)
- Always replace bolts (**arrows**)
- Tighten to 50 Nm (37 ft-lb) + ¼ turn (90°)



Transmission to body

- When tightening, be sure there is no stress (preload)
- (**A**) Tighten to 25 Nm (18 ft-lb)
- (**B**) Tighten to 100 Nm (74 ft-lb)



Rear transmission pendulum mount

- When tightening, be sure there is no stress (preload)
- Always replace bolts (**arrows**)
- (**A**) Tighten to 20 Nm (15 ft-lb) plus ¼ turn (90°)
- (**B**) Tighten to 40 Nm (30 ft-lb) plus ¼ turn (90°)

Remaining transmission installation tightening torques are listed below. References to engine type are noted for clarification.

Tightening torques

In addition to the above-noted torque specifications, and table, the following additional torque specifications may apply.

Always replace stretch (torque-to-yield) bolts as noted (stretch bolts have plus ¼ turn (90°) specification)

- Balance weight to transmission selector shaft, always replace ..... 25 Nm (18 ft-lb)
- Clutch slave cylinder mounting bolts 25 Nm (18 ft-lb)
- CV joint to drive flange on transmission, always replace tighten diagonally
  M8 ..... 40 Nm (30 ft-lb)
  M10 ..... 70 Nm (52 ft-lb)
- Drive axle boot protective shield to engine block..... 35 Nm (26 ft-lb)
- Selector cable support bracket to transmission..... 25 Nm (18 ft-lb)
- Selector cable bolt to transmission lever ..... 25 Nm (18 ft-lb)

TRANSMISSION, 02M, REMOVING AND INSTALLING

This procedure describes the removal and installation of the 02M 6-speed manual transmission. In addition to several special tools, the factory specifies special engine lifting and jacking equipment to support and reposition the engine as the transmission is removed from below.

Volkswagen recommended special tools

- 10-222A engine support
- 10-222A/1 adapter
- 10-222A/2 adapter hook
- 10-222A/3 adapter (VR6)
- 3094 hose clamps
- 3282 transmission support fixture
- 3282/27 adjustment plate with 3282/48 pins (2X)
- 3282/52 support
- 3300A engine support
- 3336 adjustable transmission lifting beam
- T10036 support rail
- VAG 1383A transmission jack
- VAS 5024 assembly pliers

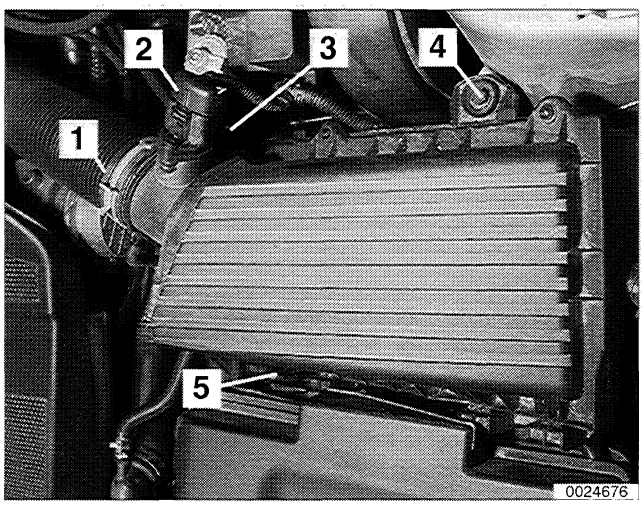
02M transmission, removing

– Remove engine sound absorber cover.

– Disconnect battery ground (GND) strap from battery negative (–) terminal. See the **Cautions** at the beginning of this repair group regarding battery disconnection.

– Remove battery and battery carrier.

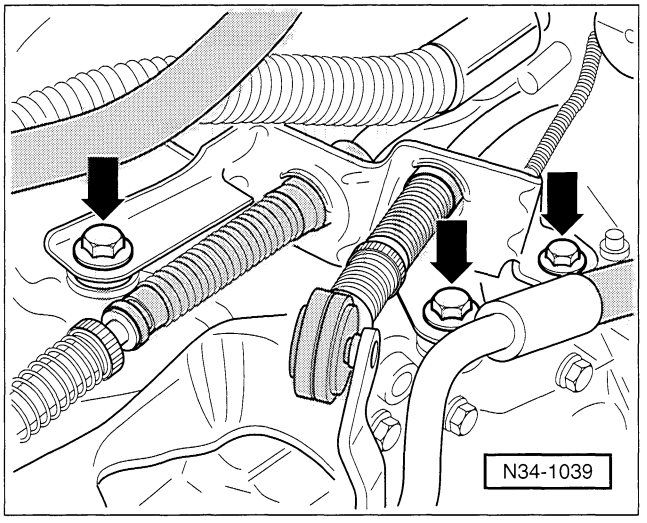
NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.



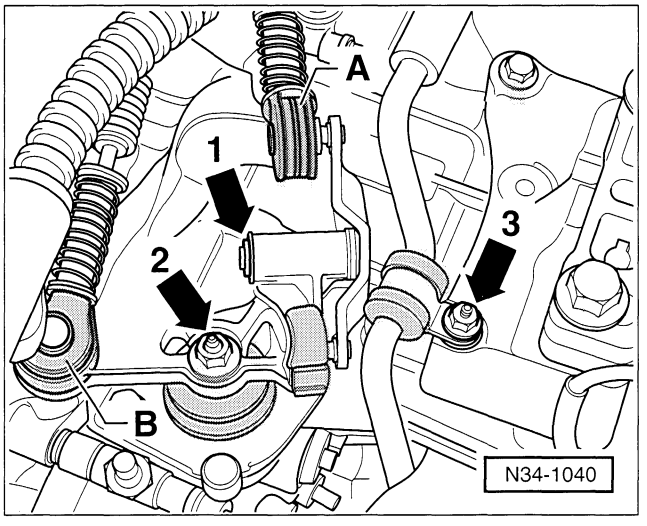
➢ Remove intake air hose (**1**), and harness connector (**2**), from Mass Air Flow (MAF) Sensor.

– Remove vacuum hose (**3**) to air cleaner near MAF, where equipped.

– Remove air cleaner mounting bolts (**4**) and (**5**), remove complete air cleaner assembly.



➢ Unbolt cable support bracket from transmission (**arrows**).

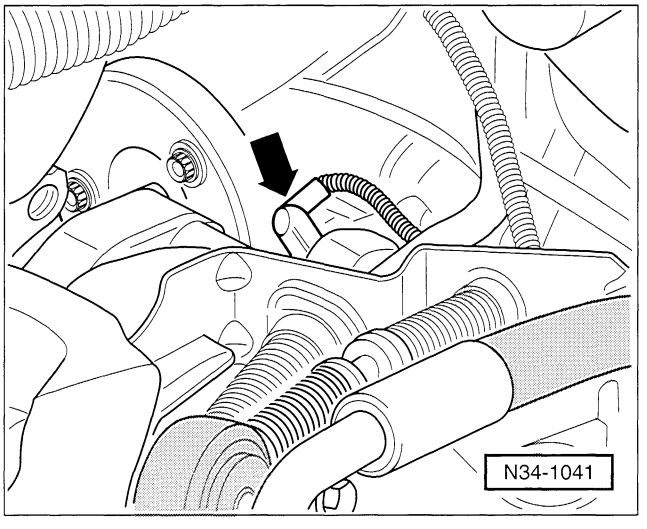


➢ Pull lock washer (**1**) from gate selector cable relay lever (**A**). Remove gear selector cable (**B**) with transmission selector lever by removing nut (**2**).

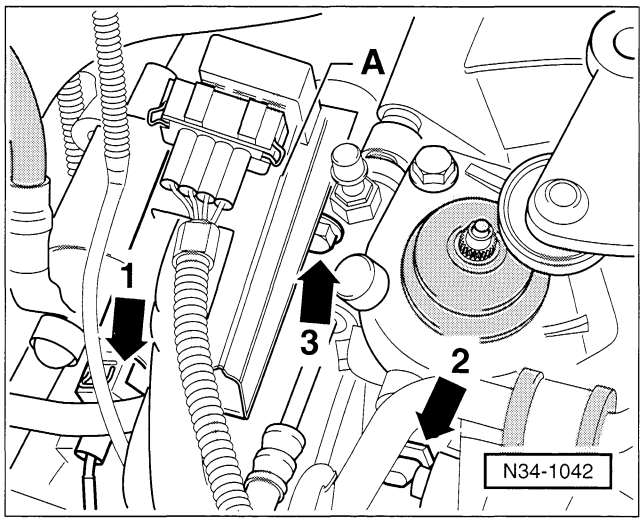
NOTE —

- *Gate selector cable is removed later.*
- *It may be necessary to use a puller such as Kukko 20-10 to remove the selector lever.*

– Remove power steering pipe (**3**).

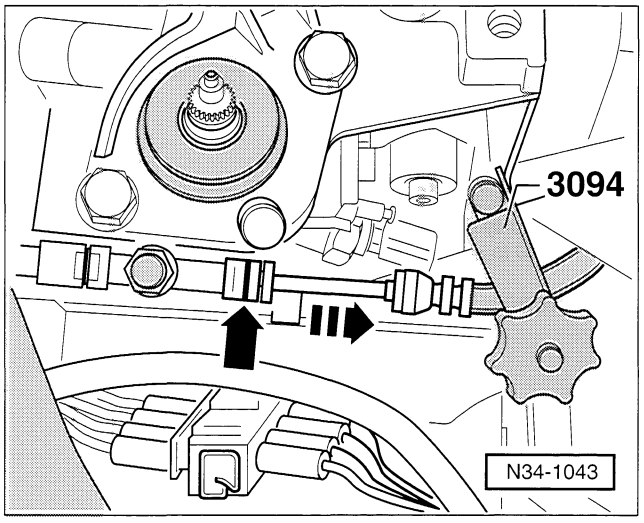


➢ Pull connector (**arrow**) off Vehicle Speedometer Sensor (VSS).



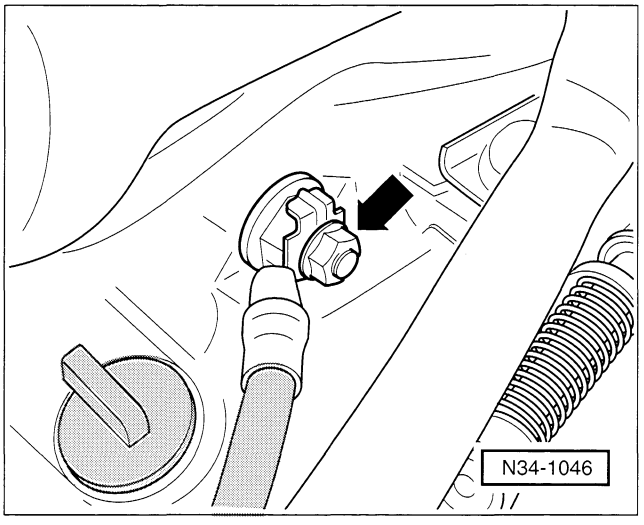
➢ Remove wiring from starter (**1**); disconnect back-up light switch connector (**2**); remove cable retainer (**3**) on starter motor.

– Remove upper securing bolt on starter.



➢ Pinch clutch slave cylinder hydraulic hose with **3094** hose clamp or equivalent. Remove coupling clip (**solid arrow**) and slide line/hose assembly out (**dashed arrow**).

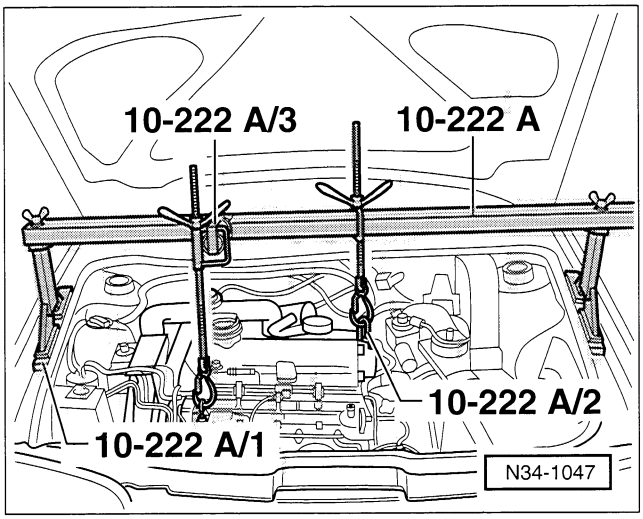
NOTE —
Do not depress clutch pedal while slave cylinder hydraulic line is under clamp and disconnected from transmission.



➢ Remove ground cable at engine/transmission upper securing bolt (**arrow**).

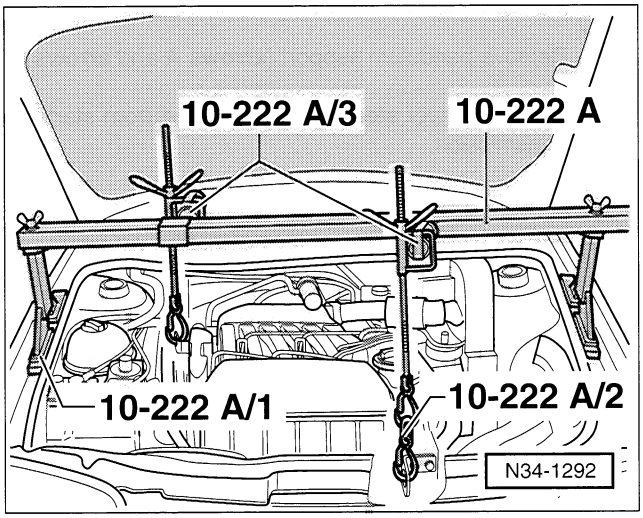
– Remove engine/transmission upper securing bolts/

– If there are hoses or wiring harnesses in the areas of the mounting eyes for special tool 10-222A with attachments, carefully move them aside or disconnect them.



Vehicles with 4-cylinder engines

➤ Fit support bar 10-222A with legs 10-222A/1 and adapters 10-222A/2 and 10-222A/3 as shown.



Vehicles with 6-cylinder engines

➤ Fit support bar 10-222A with legs 10-222A/1 and adapters 10-222A/2 and 10-222A/3 as shown.

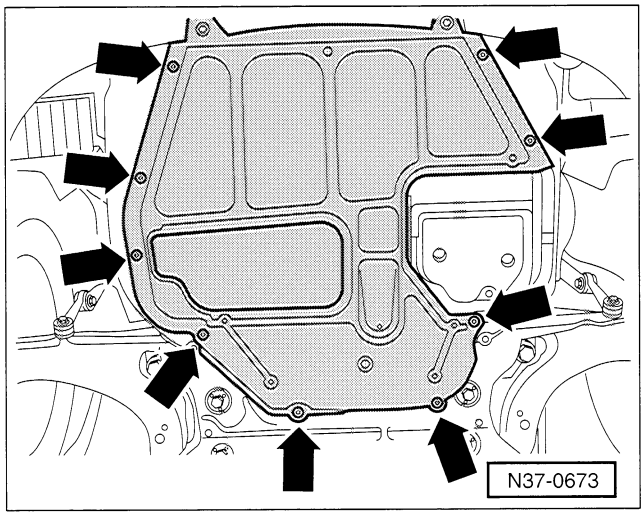
All vehicles

– Take weight off of engine/transmission assembly by turning large wing nuts on support bar.

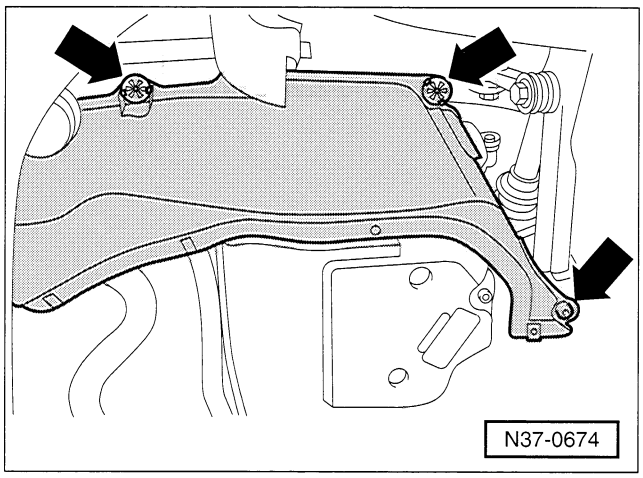
– Turn front wheels to the full left lock position.

– Remove center and left lower sound absorber panels as required.

– Raise/lift vehicle



➤ Remove lower sound absorber panels (belly pans).



➢ Remove left side sound absorber panel.

Vehicles with Diesel engines

– Remove charge air line between charge air cooler (intercooler) and turbocharger.

All vehicles

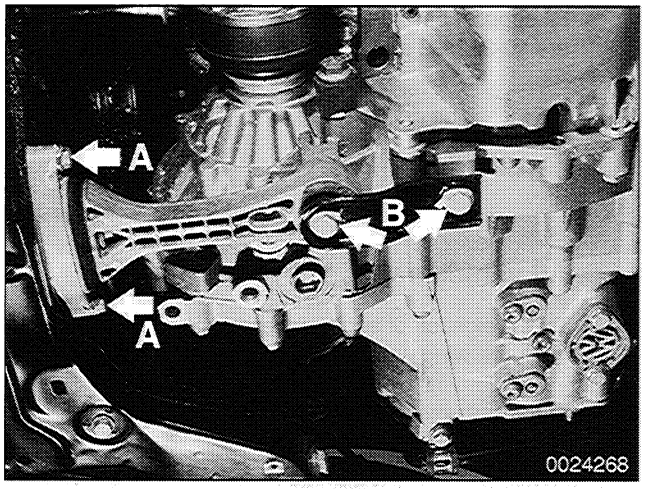
– Remove corresponding right side sound absorber panel.

– Disconnect both inner drive shafts from transmission drive flanges, see **40 Front Suspension and Drive Axles**. Carefully secure drive shafts as high up and out of the way as is possible with wire.

NOTE —

Take care to avoid damage to painted and coated surfaces of axles, boots, and vehicle.

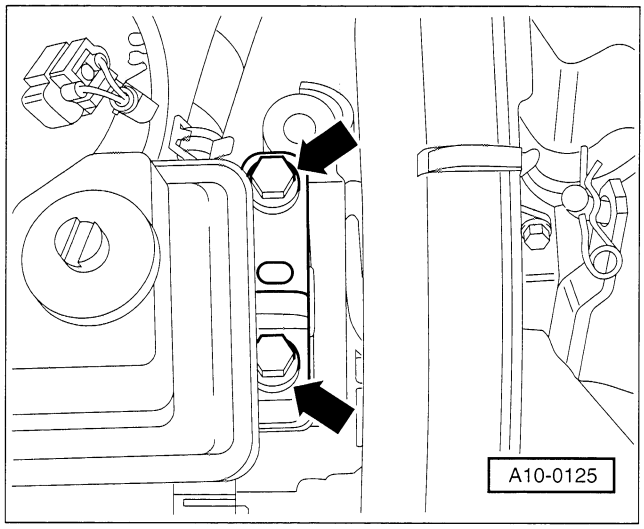
– Separate exhaust system and remove from subframe as needed, see **26 Exhaust System and Emission Controls**.



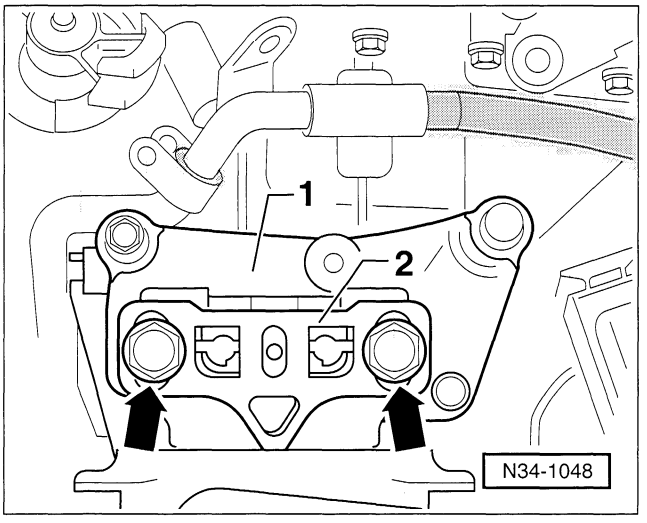
➢ Remove pendulum support (**arrows A** and **arrows B**)

– Remove power steering hydraulic line from starter and transmission.

– Remove starter motor.

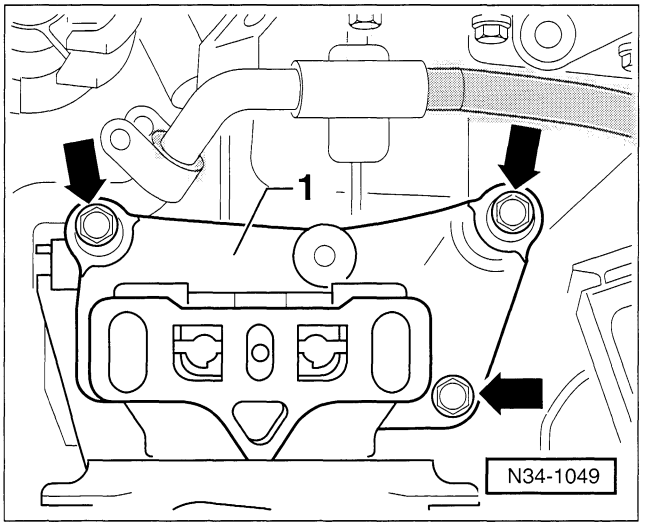


➢ Unbolt engine side of assembly mounting from engine carrier from above (**arrows**).

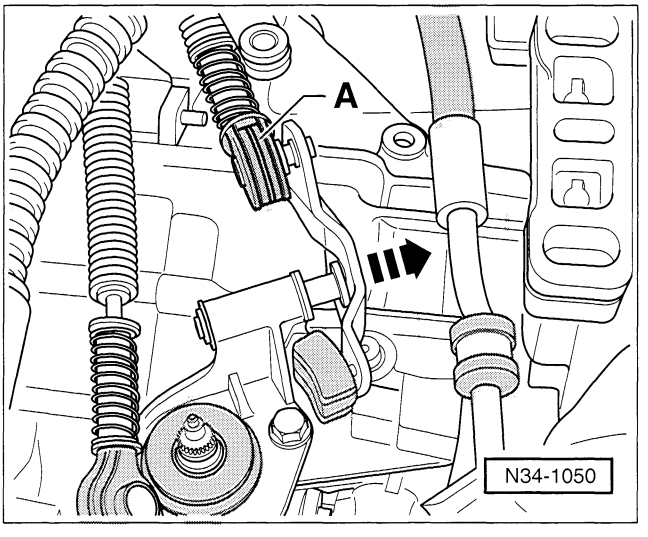


➢ Remove left side assembly (**2**) mounting bolts (**arrows**) from left mount (**1**).

– Tilt engine/transmission assembly down on the left side by turning large wing nuts on support bar approximately 60 mm (2.36 in).



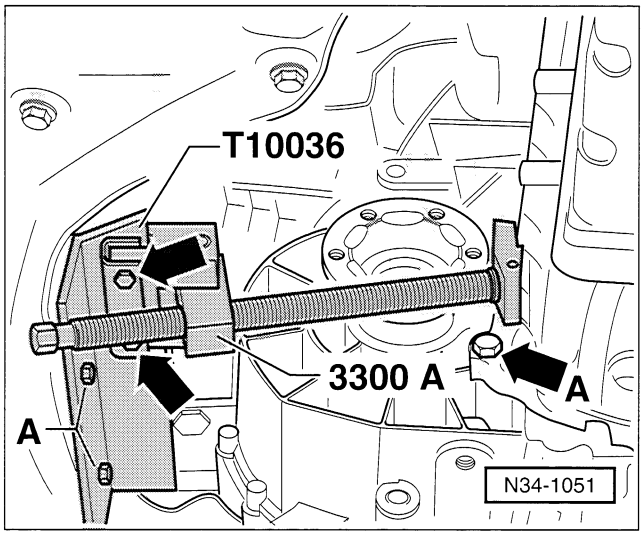
➢ Remove left side mount (**1**) from transmission (**arrows**).



➢ Pull off gate selector cable (**A**) with relay lever in direction indicated (**dashed arrow**).

– Carefully secure gear selector cable and gate selector cable with relay lever up and out of the way with wire.

– Tilt engine/transmission assembly down further on the left side by turning large wing nuts on support bar.



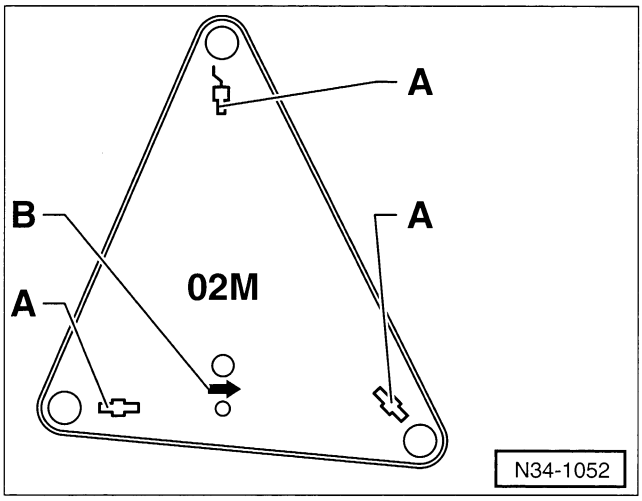
➢ Bolt support rail T10036 to both pendulum support bolt holes on subframe (**A**).

– Install support 3300A to support rail T10036 (**left arrows**) and turn threaded shaft so that it just touches engine.

– Turn threaded shaft of 3300A and move engine/transmission forward slightly.

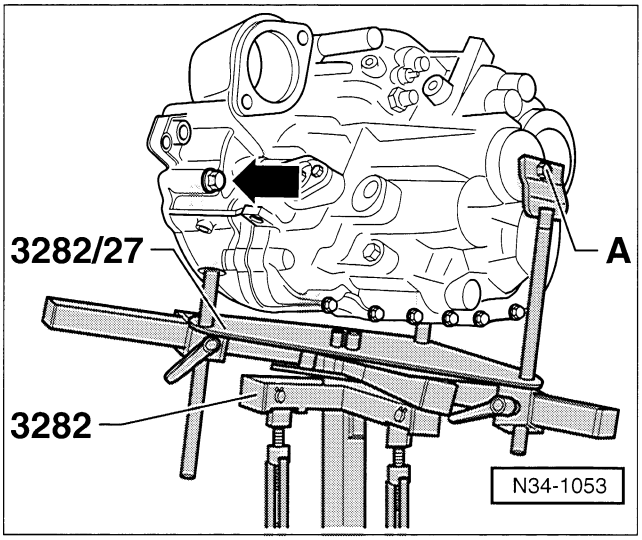
– Remove lower rear engine/transmission securing bolts (**arrow A**).

NOTE —
Take care to avoid damage to connecting lines and hoses when moving engine/transmission assembly.



➢ Assemble transmission jack with transmission support fixture 3282 and 3282/27 adjustment plate (marked **02M**).

- Place adjustment plate 3282/27 on support fixture 3282 noting that plate fits properly in one direction only and that arrow (**B**) points to the front of the vehicle.
- Align arms of support fixture with holes in adjustment plate and attach pins 3282/48 to arms as indicated (**A**).



➢ Position transmission jack under vehicle so that arrow on adjustment plate points to the front of vehicle.

– Align adjustment plate parallel to transmission, attach and lock pins to transmission at locations indicated.

– Secure transmission to transmission support 3282 with bolt (**A**).

– Remove remaining engine/transmission securing bolt (**A**).

– Press transmission off of dowel pins on engine block and carefully swing towards subframe.

– Lower transmission slightly and tilt to the left by turning adjusters on transmission support fixture 3282.

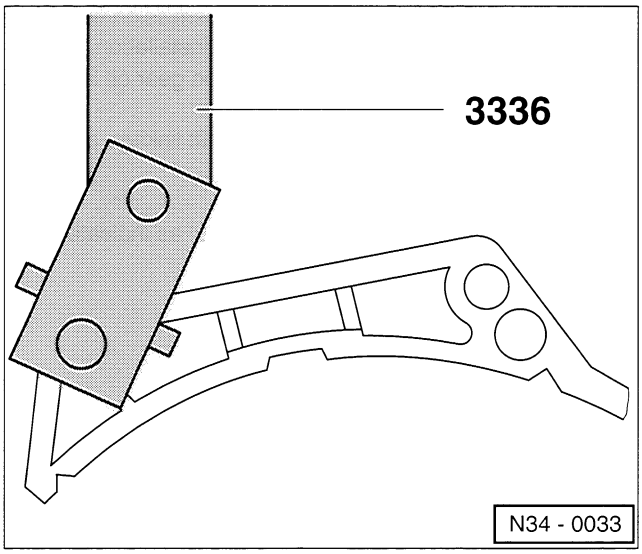
– Lower transmission carefully guiding the right side drive flange past the area of the flywheel as shown. Guide left side drive flange when in the area of the subframe.

NOTE —

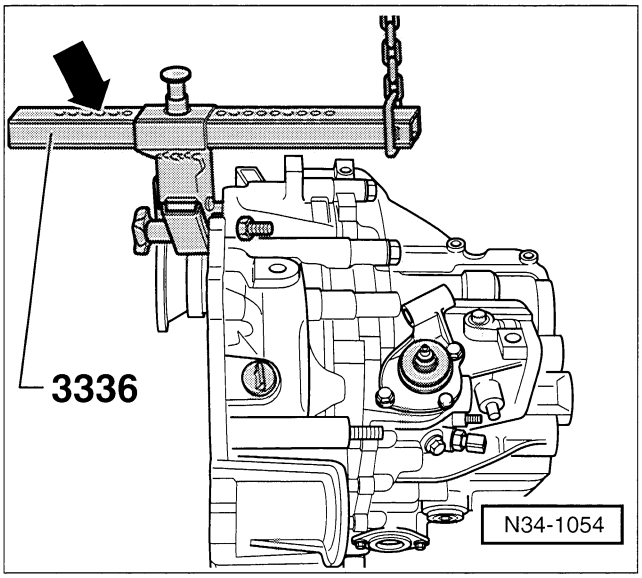
- *When lowering, change position of transmission by turning adjusters on transmission support fixture 3282.*
- *Take care to avoid damage to power steering hydraulic lines when lowering transmission assembly.*

02M transmission, transporting

Due to weight, size and bulk, the transmission is best moved by fitting the adjustable transmission lifting beam, 3336. Use of this support in conjunction with a suitable shop crane will minimize the chance of damage to the transmission.



➢ Bolt transmission lifting device 3336 to upper mounting holes as shown.



➢ Position support arm on sliding piece with locking pin (**arrow**) so that 6 holes are visible.

– Lift transmission with 3336 with a suitable shop crane and transport to work area or shipping container to avoid personal injury and/or damage to transmission.

– Remove lifting device when done.

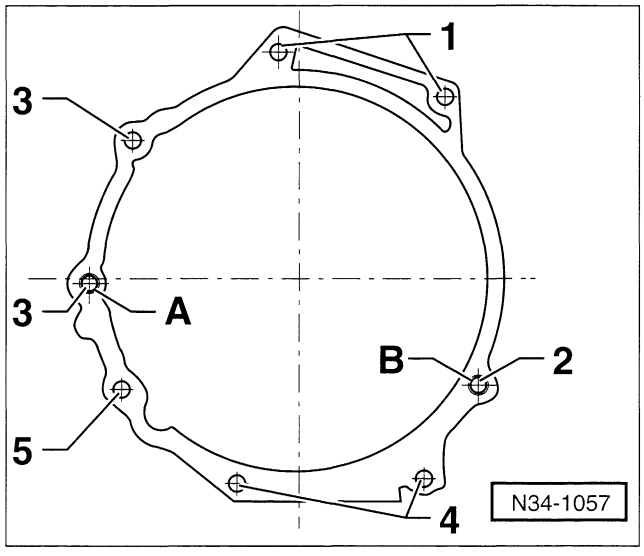
02M transmission, installing

Install the transmission in the reverse order of removal noting the following points:

- Check that all engine-to-transmission dowel pins are installed in the engine block. Replace any that are missing or damaged.
- Clean the hub splines of the transmission input shaft and apply a light coat of MoS_2 (Moly) grease (VW/Audi G 000 100) before installing. The clutch disc must be free to slide lightly back and forth on the transmission input shaft.
- Ensure that the intermediate plate is correctly positioned on the engine block.
- When replacing a transmission, transfer Vehicle Speed Sensor (VSS) and appropriate shift linkage from old unit to new unit before installation.
- Depending on the situation, it may also be advantageous to check and/or fill the transmission with the correct specification gear oil before installation.
- Check and/or correct transmission gear oil level if not done previously.
- Always check and adjust gear shift linkage after installation of transmission.
- Bleed hydraulic clutch system.
- Replace hardware (bolts and nuts) as indicated and torque to specification.

02M torque specifications

4-cylinder engine

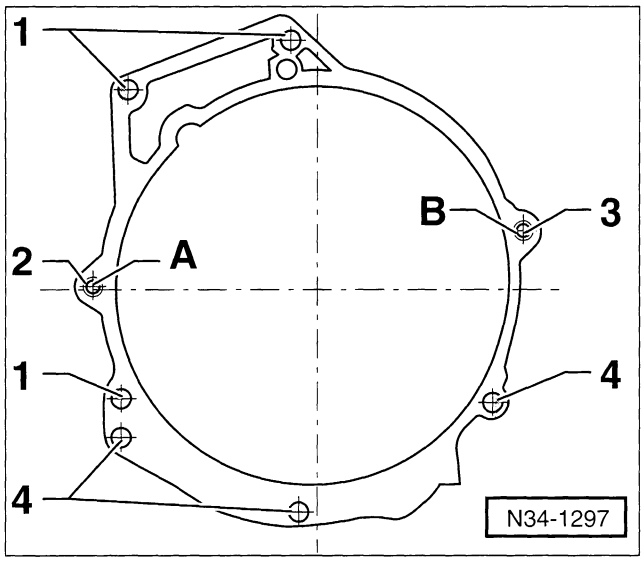


Transmission-to-engine bolt specifications and tightening torques for 4-cylinder engine are listed below in **Table e**.

Table f. 4-cylinder transmission to engine fasteners

Fastener[1]	Size	Qty.	Tightening torque
1	M12 X 55	2	80 Nm (59 ft-lb)
2	M12 X 70	1	80 Nm (59 ft-lb)
3[2]	M12 X 165	2	80 Nm (59 ft-lb)
4	M10 X 50	2	40 Nm (30 ft-lb)
5	M10 X 105	1	60 Nm (43 ft-lb)
A & B	Dowel sleeves	2	

1. Always replace all bolts.
2. Also starter to transmission bolt



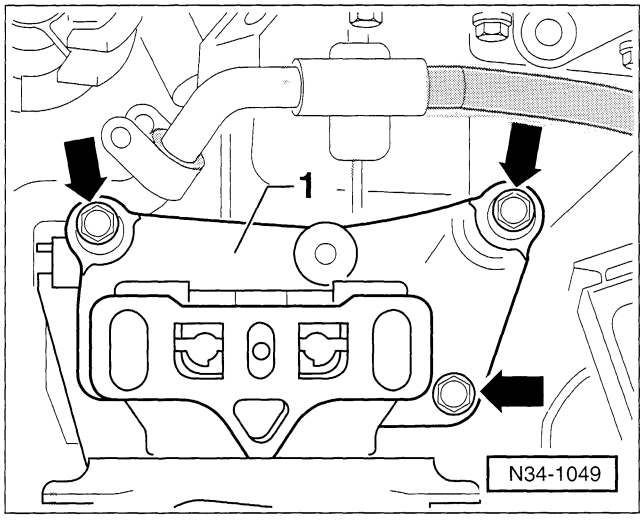
6-cylinder engine

Transmission-to-engine bolt specifications and tightening torques for 6-cylinder engine are listed below in **Table f.**

Table g. 6-cylinder transmission to engine fasteners

Fastener[1]	Size	Qty.	Tightening torque
1	M12 X 55	3	80 Nm (59 ft-lb)
2	M12 X 65	1	80 Nm (59 ft-lb)
3[2]	M12 X 80	1	80 Nm (59 ft-lb)
4	M10 X 50	3	45 Nm (33 ft-lb)
A & B	Dowel sleeves	2	n/a

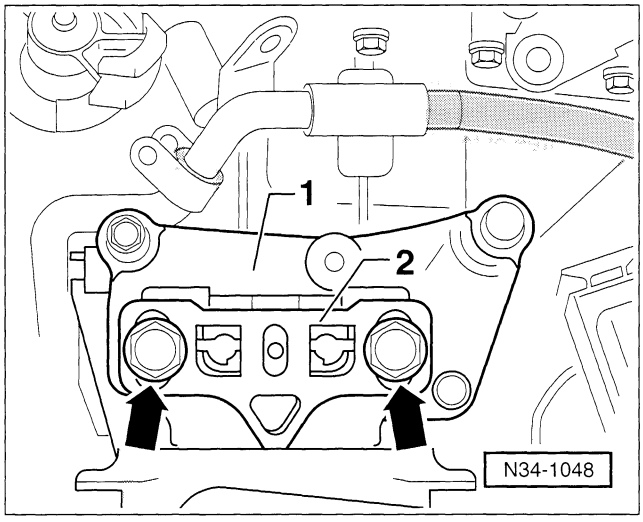
1. Always replace all bolts.
2. Also starter to transmission bolt



All vehicles

Transmission mount (**1**) to transmission.

- Always replace bolts (**arrows**)
- Tighten to 50 Nm (37 ft-lb) + ¼ turn (90°)



Transmission mount (**1** and **2**) to body.

- When tightening, be sure there is no stress (preload)
- Always replace bolts (**arrows**)
- Tighten to 100 Nm (74 ft-lb)

Tightening torques

In addition to the above-noted torque specifications, and table, the following additional torque specifications may apply.

Always replace stretch (torque-to-yield) bolts as noted (stretch bolts have plus ¼ turn (90°) specification)

- Pendulum mount to subframe
  M8 . . . . . 25 Nm (18 ft-lb)
- Pendulum mount bracket to transmission
  M10 . . . . . 50 Nm (37 ft-lb)
- Balance weight to transmission selector shaft, always replace . . . . . 20 Nm (15 ft-lb)
- CV joint to drive flange on transmission, always replace tighten diagonally
  M8 . . . . . 40 Nm (30 ft-lb)
  M10 . . . . . 70 Nm (52 ft-lb)
- Drive axle boot protective shield to engine block . . . . . .35 Nm (26 ft-lb))
- Selector cable support bracket to transmission . . . . . 25 Nm (18 ft-lb)
- Hydraulic pipe to transmission . . . . . 25 Nm (18 ft-lb)

QUALITY REVIEW

When you have finished working under the hood and around other areas of the vehicle, it is advisable to take a moment to quality check or review your work. This helps to insure that the operation or repair has been completed properly with all affected systems functioning within normal parameters. These may include the following:

- Make sure that there are no air, vacuum or exhaust leaks.
- Make sure that all components involved in the repair are positioned correctly and function properly.
- Make sure all tools, shop cloths, and temporary hanging wires are removed.
- Install the engine/transmission mounts so that they are free of tension. See **10 Engine–Removing and Installing** for specific engine/transaxle installation procedures.
- Check the transmission oil level. See **0 Maintenance**.
- Adjust gear selector mechanism, see **Gear selector mechanism, adjusting**.
- Check the operation of the clutch hydraulics. See **30 Clutch**.
- Top off transmission with appropriate gear oil, see **0 Maintenance**.
- Road test vehicle and check for proper gear selection and transmission operation.

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GENERAL

This section covers the 01M 4-speed, and the 09A 5-speed automatic transmissions. Both automatic transmissions are controlled electro-hydraulically and feature adaptive programming and On-Board Diagnostic (OBD) capabilities.

Transmission Types

- 01M . . . . . 4-speed automatic transmission
- 09A . . . . . 5-speed automatic transmission

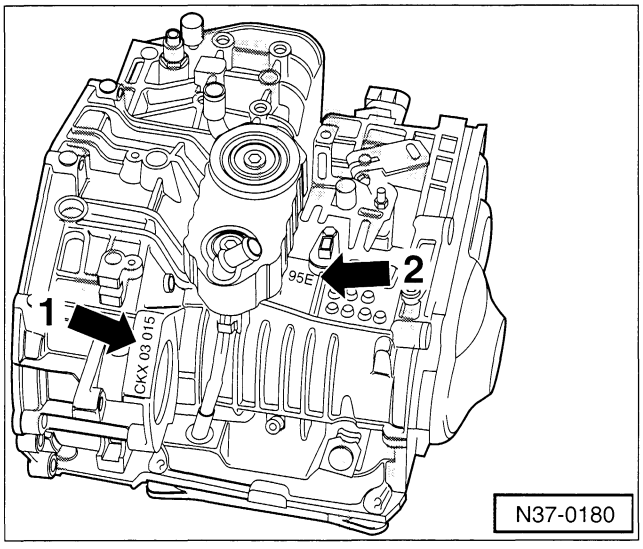
NOTE —

- *For information on drive axles, including drive flange oil seals, see* **39 Differential and Final Drive**.
- *ATF draining and filling procedures, including ATF screen (filter) replacement, is covered in* ***0 Maintenance***.

WARNING —

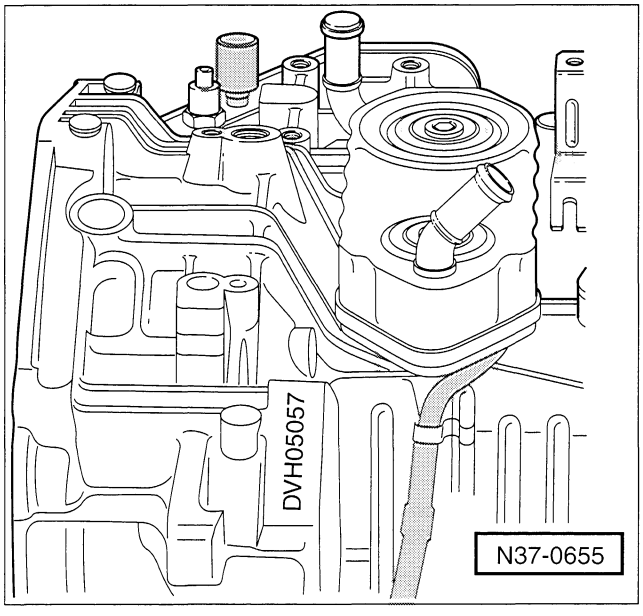
- *Before working on the transmission or gear selector mechanism, disconnect the negative (–) battery cable.*
- *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) will need to be re-set using a VAG 1551/1552, VAS 5051/5052 or equivalent scan tool or scan tool computer program.*

Transmission code location

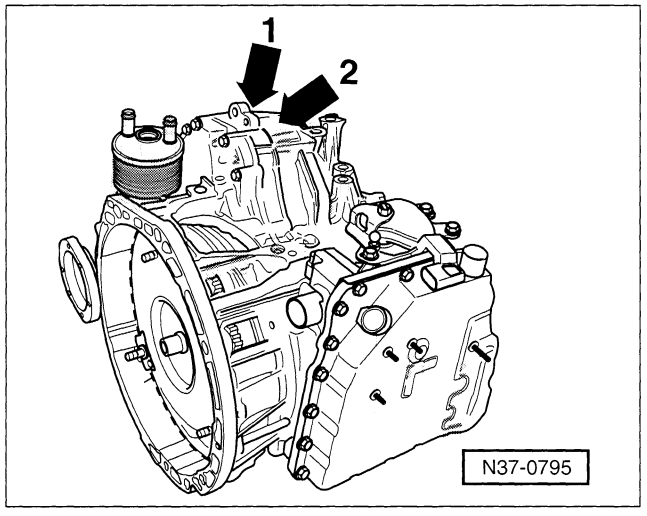


The transmission code and production number can be found stamped on the transmission case for both types of transmissions. See the following illustrations. The transmission code letters can also be found on the vehicle data stickers located in the luggage compartment and attached to the Vehicle Maintenance Manual.

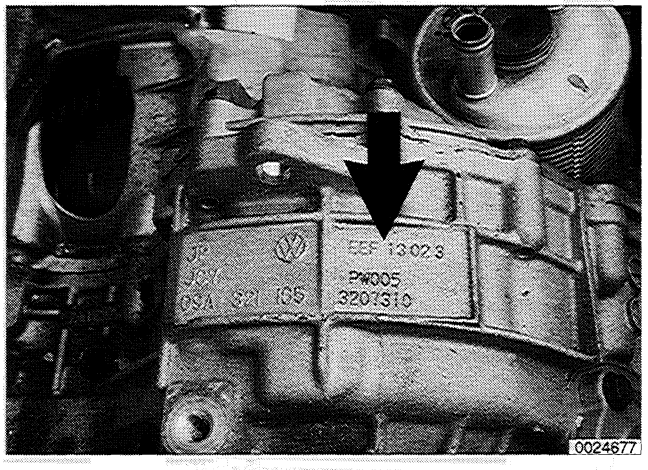
01M: Transmission code letters and date of manufacture for the 01M are stamped into machined area on the forward part of the transmission housing (**1**) near the starter motor mounting. Transmission type designation, 01M, is cast into transmission housing near the ATF cooler (**2**) and at several other locations.



01M: Transmission code letters and date of manufacture can be decoded for this **DVH 05057** transmission as follows: transmission is code **DVH**, manufactured on the 5th day of the 5th month in 1997 (very early production).



09A: Transmission code letters and date of manufacture for the 09A are stamped into machined area on top of the transmission housing (**1**). Transmission type designation, 09A, is cast into transmission housing (**2**) near the type designation and at several other locations.



09A: Transmission code letters and date of manufacture can be decoded for this **EEF 13023** transmission as follows: transmission is code **EEF**, manufactured on the 13th day of the 02nd month in 2003.



Automatic transmission fluid

Volkswagen requirements for ATF depend on the transmission type.

Automatic Transmission Fluid (VW ATF)

- 01M transmission (4-speed). . . . . .G 052 162 A2
- 09A transmission (5-speed) . . . . . .G 052 990 A2

Volkswagen supplies two different types of ATF for automatic transmissions. G 052 990 A2 (**left**) is specified for the 09A 5-speed and G 052 162 A2 (**right**) is specified for the 01M 4-speed transmission. See **0 Maintenance** for additional information.

Tables a lists the transmission applications, gear ratios, and other data for the different versions on the 01M 4-speed automatic transmission. **Table b** covers the same data for the 09A 5-speed.

Table a. 01M 4-speed automatic transmission specifications

Code letters	**DVH**	**ECP**	**ELU**	**EPC**
Engine application, horsepower	1.8L, 150 hp	1.8L, 150 hp	1.8L, 150 hp	1.8L, 150 hp
Ratio: pinion:ring Final drive	15:68 = 4.533	15:68 = 4.533	15:68 = 4.533	15:68 = 4.533
Intermediate drive	45:44 = 0.978	45:44 = 0.978	45:44 = 0.978	45:44 = 0.978
1st gear	2.714	2.714	2.714	2.714
2nd gear	1.441	1.441	1.441	1.441
3rd gear	1.000	1.000	1.000	1.000
4th gear	0.742	0.742	0.742	0.742
Reverse gear	2.884	2.884	2.884	2.884
Torque converter code (for turbine shaft with sleeve bushing as applicable, see **32 Torque Converter**)	QCDC	QCDC	QCDC	n/a
Torque converter code (for turbine shaft without sleeve bushing)	QCDD	QBDD	QCDD	QCDD
Valve body code	QFB	QFB	QFB	QFB
Clutch plates: inner/outer Clutch K1	5/5	5/5	5/5	5/5
Clutch K2	5/5	5/5	5/5	5/5
Clutch K3	6/5	6/5	6/5	6/5
Brake B1	6/6	6/6	6/6	6/6
Brake B2	5/6	5/6	5/6	5/6
Lubricant: Automatic section (initial filling, lifetime fill; no change required)	5.3 liters (5.6 qt.) VW/Audi special ATF (VW/Audi G052 162 A1 or G 052 162 A2)			
Final drive (initial filling, lifetime fill; no change required)	0.75 liters (0.8 qt.) synthetic oil, SAE 75W/90 (VW/Audi G 052 045 A1 or G 052 145 A2)			
Driveshaft flange	Triple roller	Triple roller	Triple roller	Triple roller
ATF cooler	Pressure side 6-row	Pressure side 6-row	Pressure side 6-row	Pressure side 6-row

Table a. (continued) 01M 4-speed automatic transmission specifications

Code letters	FDC	DMP	ECN	ELT
Engine application, horsepower	1.8L, 150 hp	1.9L, 90 hp TDI	1.9L, 90 hp TDI	1.9L, 90 hp TDI
Ratio: pinion:ring				
Final drive	15:68 = 4.533	20:74 = 3.700	20:74 = 3.700	20:74 = 3.700
Intermediate drive	45:44 = 0.978	45:44 = 0.978	45:44 = 0.978	45:44 = 0.978
1st gear	2.714	2.714	2.714	2.714
2nd gear	1.441	1.441	1.441	1.441
3rd gear	1.000	1.000	1.000	1.000
4th gear	0.742	0.742	0.742	0.742
Reverse gear	2.884	2.884	2.884	2.884
Torque converter code (for turbine shaft with sleeve bushing as applicable, see **32 Torque Converter**)	n/a	QCDC	QCDC	QCDC
Torque converter code (for turbine shaft without sleeve bushing)	QCDD	QCDD	QCDD	QCDD
Valve body code	QFB	QFB	QFB	QFB
Clutch plates: inner/outer				
Clutch K1	5/5	5/5	5/5	5/5
Clutch K2	5/5	5/5	5/5	5/5
Clutch K3	6/5	6/5	6/5	6/5
Brake B1	6/6	5/5	5/5	5/5
Brake B2	5/6	5/6	5/6	5/6
Lubricant:				
Automatic section (initial filling, lifetime fill; no change required)	5.3 liters (5.6 qt.) VW/Audi special ATF (VW/Audi G052 162 A1 or G 052 162 A2)			
Final drive (initial filling, lifetime fill; no change required)	0.75 liters (0.8 qt.) synthetic oil, SAE 75W/90 (VW/Audi G 052 045 A1 or G 052 145 A2)			
Driveshaft flange	Triple roller	Triple roller	Triple roller	Triple roller
ATF cooler	Pressure side 6-row	Pressure side 6-row	Pressure side 6-row	Pressure side 6-row

Table a. (continued) 01M 4-speed automatic transmission specifications

Code letters	EPB	EPP	FDB	DMN
Engine application, horsepower	1.9L, 90 hp TDI	1.9L, 90 hp TDI	1.9L, 90 hp TDI	2.0L, 115 hp
Ratio: pinion:ring				
Final drive	20:74 = 3.700	22:72 = 3.273	20:74 = 3.700	16:78 = 4.875
Intermediate drive	45:44 = 0.978	45:44 = 0.978	45:44 = 0.978	45:44 = 0.978
1st gear	2.714	2.714	2.714	2.714
2nd gear	1.441	1.441	1.441	1.441
3rd gear	1.000	1.000	1.000	1.000
4th gear	0.742	0.742	0.742	0.742
Reverse gear	2.884	2.884	2.884	2.884
Torque converter code (for turbine shaft with sleeve bushing as applicable, see **32 Torque Converter**)	n/a	n/a	n/a	QADC
Torque converter code (for turbine shaft without sleeve bushing)	QCDD	QCDD	QCDD	QADD
Valve body code	QFB	QFA	QFB	QFB
Clutch plates: inner/outer				
Clutch K1	5/5	5/5	5/5	5/5
Clutch K2	5/5	5/5	5/5	4/4
Clutch K3	6/5	6/5	6/5	5/4
Brake B1	5/5	5/5	5/5	5/5
Brake B2	5/6	5/6	5/6	4/5
Lubricant:				
Automatic section (initial filling, lifetime fill; no change required)	5.3 liters (5.6 qt.) VW/Audi special ATF (VW/Audi G052 162 A1 or G 052 162 A2)			
Final drive (initial filling, lifetime fill; no change required)	0.75 liters (0.8 qt.) synthetic oil, SAE 75W/90 (VW/Audi G 052 045 A1 or G 052 145 A2)			
Driveshaft flange	Triple roller	Triple roller	Triple roller	Triple roller
ATF cooler	Pressure side 6-row	Pressure side 6-row	Pressure side 6-row	Pressure side 6-row

Table a. (continued) 01M 4-speed automatic transmission specifications

Code letters	DYQ	ECV	EFB	ELY
Engine application, horsepower	2.0L, 115 hp	2.0L, 115 hp	2.0L, 115 hp	2.0L, 115 hp
Ratio: pinion:ring				
Final drive	16:78 = 4.875	16:78 = 4.875	15:68 = 4.533	16:78 = 4.875
Intermediate drive	61:63 = 1.033	61:63 = 1.033	45:44 = 0.978	61:63 = 1.033
1st gear	2.714	2.714	2.714	2.714
2nd gear	1.551	1.551	1.441	1.551
3rd gear	1.000	1.000	1.000	1.000
4th gear	0.679	0.679	0.742	0.679
Reverse gear	2.111	2.111	2.884	2.111
Torque converter code (for turbine shaft with sleeve bushing as applicable, see **32 Torque Converter**)	QBDC	QBDC	QBDC	QBDC
Torque converter code (for turbine shaft without sleeve bushing)	QBDD	QADD	QBDD	QBDD
Valve body code	QFB	QFB	QFB	QFB
Clutch plates: inner/outer				
Clutch K1	5/5	5/5	5/5	5/5
Clutch K2	4/4	4/4	4/4	4/4
Clutch K3	5/4	5/4	5/4	5/4
Brake B1	5/5	5/5	5/5	5/5
Brake B2	4/5	4/5	4/5	4/5
Lubricant:				
Automatic section (initial filling, lifetime fill; no change required)	5.3 liters (5.6 qt.) VW/Audi special ATF (VW/Audi G052 162 A1 or G 052 162 A2)			
Final drive (initial filling, lifetime fill; no change required)	0.75 liters (0.8 qt.) synthetic oil, SAE 75W/90 (VW/Audi G 052 045 A1 or G 052 145 A2)			
Driveshaft flange	Triple roller	Triple roller	Triple roller	Triple roller
ATF cooler	Pressure side 6-row	Pressure side 6-row	Pressure side 6-row	Pressure side 6-row

Table a. (continued) 01M 4-speed automatic transmission specifications

Code letters	ELZ	EPG	EPH	FDF
Engine application, horsepower	2.0L, 115 hp	2.0L, 115 hp	2.0L, 115 hp	2.0L, 115 hp
Ratio: pinion:ring				
Final drive	15:68 = 4.533	16:78 = 4.875	15:68 = 4.533	16:78 = 4.875
Intermediate drive	45:44 = 0.978	61:63 = 1.033	45:44 = 0.978	61:63 = 1.033
1st gear	2.714	2.714	2.714	2.714
2nd gear	1.441	1.551	1.441	1.551
3rd gear	1.000	1.000	1.000	1.000
4th gear	0.742	0.679	0.742	0.679
Reverse gear	2.884	2.111	2.884	2.111
Torque converter code (for turbine shaft with sleeve bushing as applicable, see **32 Torque Converter**)	n/a	n/a	n/a	n/a
Torque converter code (for turbine shaft without sleeve bushing)	QBDC	QBDD	QBDD	QBDD
Valve body code	QFB	QFB	QFB	QFB
Clutch plates: inner/outer				
Clutch K1	5/5	5/5	5/5	5/5
Clutch K2	4/4	4/4	4/4	4/4
Clutch K3	5/4	5/4	5/4	5/4
Brake B1	5/5	5/5	5/5	5/5
Brake B2	4/5	4/5	4/5	4/5
Lubricant:				
Automatic section (initial filling, lifetime fill; no change required)	5.3 liters (5.6 qt.) VW/Audi special ATF (VW/Audi G052 162 A1 or G 052 162 A2)			
Final drive (initial filling, lifetime fill; no change required)	0.75 liters (0.8 qt.) synthetic oil, SAE 75W/90 (VW/Audi G 052 045 A1 or G 052 145 A2)			
Driveshaft flange	Triple roller	Triple roller	Triple roller	Triple roller
ATF cooler	Pressure side 6-row	Pressure side 6-row	Pressure side 6-row	Pressure side 6-row

Table a. (continued) 01M 4-speed automatic transmission specifications

Code letters	FDG	DVG	ECM	ENZ
Engine application, horsepower	2.0L, 115 hp	2.8L, 174 hp	2.8L, 174 hp	2.8L, 174 hp
Ratio: pinion:ring				
Final drive	15:68 = 4.533	15:64 = 4.267	15:64 = 4.267	15:64 = 4.267
Intermediate drive	45:44 = 0.978	45:44 = 0.978	45:44 = 0.978	45:44 = 0.978
1st gear	2.714	2.714	2.714	2.714
2nd gear	1.441	1.441	1.441	1.441
3rd gear	1.000	1.000	1.000	1.000
4th gear	0.742	0.742	0.742	0.742
Reverse gear	2.884	2.884	2.884	2.884
Torque converter code (for turbine shaft with sleeve bushing as applicable, see **32 Torque Converter**)	n/a	QCDR	QDDT	QDDT
Torque converter code (for turbine shaft without sleeve bushing)	QBDD	QADD	QCDH	QDDJ
Valve body code	QFB	QFB	QGA	QGA
Clutch plates: inner/outer				
Clutch K1	5/5	5/5	5/5	5/5
Clutch K2	4/4	5/5	5/5	5/5
Clutch K3	5/4	6/5	6/5	7/6
Brake B1	5/5	5/5	5/5	6/6
Brake B2	4/5	5/6	5/6	6/7
Lubricant:				
Automatic section (initial filling, lifetime fill; no change required)	5.3 liters (5.6 qt.) VW/Audi special ATF (VW/Audi G052 162 A1 or G 052 162 A2)			
Final drive (initial filling, lifetime fill; no change required)	0.75 liters (0.8 qt.) synthetic oil, SAE 75W/90 (VW/Audi G 052 045 A1 or G 052 145 A2)			
Driveshaft flange	Triple roller	Triple roller	Triple roller	Triple roller
ATF cooler	Pressure side 6-row	Pressure side 6-row	Pressure side 6-row	Pressure side 6-row

Table a. (continued) 01M 4-speed automatic transmission specifications

Code letters	**EPJ**	**FCZ**		
Engine application, horsepower	2.8L, 174 hp	2.8L, 174 hp		
Ratio: pinion:ring Final drive	15:64 = 4.267	15:64 = 4.267		
Intermediate drive	45:44 = 0.978	45:44 = 0.978		
1st gear	2.714	2.714		
2nd gear	1.441	1.441		
3rd gear	1.000	1.000		
4th gear	0.742	0.742		
Reverse gear	2.884	2.884		
Torque converter code (for turbine shaft with sleeve bushing as applicable, see **32 Torque Converter**)	n/a	n/a		
Torque converter code (for turbine shaft without sleeve bushing)	QDDJ	QDDJ		
Valve body code	QGA	QGA		
Clutch plates: inner/outer Clutch K1	5/5	5/5		
Clutch K2	5/5	5/5		
Clutch K3	7/6	7/6		
Brake B1	6/6	6/6		
Brake B2	6/7	6/7		
Lubricant: Automatic section (initial filling, lifetime fill; no change required)	5.3 liters (5.6 qt.) VW/Audi special ATF (VW/Audi G052 162 A1 or G 052 162 A2)			
Final drive (initial filling, lifetime fill; no change required)	0.75 liters (0.8 qt.) synthetic oil, SAE 75W/90 (VW/Audi G 052 045 A1 or G 052 145 A2)			
Driveshaft flange	Triple roller	Triple roller		
ATF cooler	Pressure side 6-row	Pressure side 6-row		

Table b. 09A 5-speed automatic transmission specifications

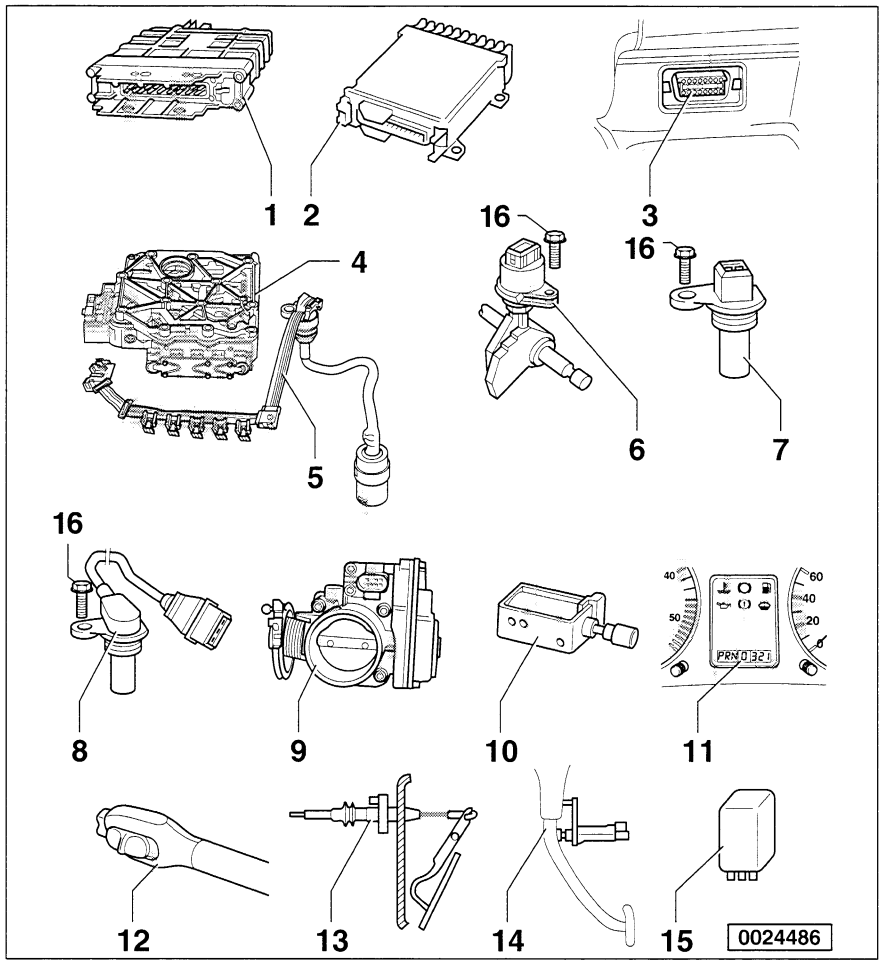
Code letters	EYN	EYP	EEB	EEF
Engine application, horsepower	1.8L, 170 hp	1.8L, 170 hp	2.8L, 200 hp	2.8L, 200 hp
Ratio: pinion:ring				
Final drive	20:69 = 3.450	20:69 = 3.450	20:69 = 3.450	24:65 = 2.708
Intermediate drive	52:67 = 1.288	52:67 = 1.288	52:67 = 1.288	52:67 = 1.288
1st gear	3.801	3.801	3.801	3.801
2nd gear	2.131	2.131	2.131	2.131
3rd gear	1.364	1.364	1.364	1.364
4th gear	0.935	0.935	0.935	0.935
5th gear	0.685	0.685	0.685	0.685
Reverse gear	2.970	2.970	2.970	2.970
Torque converter codes	AAA/DCD	AAA/DCD	EFJ/BBJ	EFJ/BBJ
Clutch plates: inner/outer				
Clutch K1	7/7	7/7	7/7	7/7
Clutch K2	2/2	2/2	2/2	2/2
Clutch K3	5/5	5/5	5/5	5/5
Clutch K4	4/4	4/4	4/5	4/5
Brake B1	7/6	7/6	7/6	7/6
Brake B2	3/3	3/3	3/3	3/3
Brake band piston diameter:				
Brake B3	58 mm	58 mm	58 mm	58 mm
Lubricant:				
Automatic section ***and*** Final drive (initial filling, lifetime fill; no change required)	7.0 liters (7.4 qt.) VW special ATF (VW/Audi G052 990 A2)			
Driveshaft flange	Triple roller	Triple roller	Triple roller	Triple roller
ATF cooler	external	external	external	external

AUTOMATIC TRANSMISSION ELECTRONIC AND ELECTRIC COMPONENTS

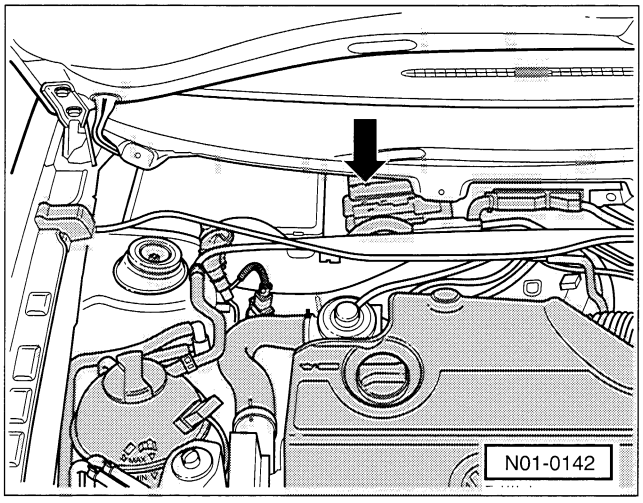
The 01M and 09A automatic transmissions are electronically controlled. Because of the different design elements, the electronic and electrical components are completely different and not interchangeable in spite of similar functionality.

Most diagnostic and repair procedures will require the use of a scan tool such as the VAG 1551, VAG 1552, VAS 5051, VAS 5052 or equivalent aftermarket scan tool or scan tool program. In addition, some adjustment procedures will require special tools.

Automatic transmission electronic and electrical components (01M)



1. **Transmission Control Module, TCM (J217)**
   - Located in air plenum, center/right
   - Factory coded, no user changes possible
   - Removing and installing, see **TCM removing and installing**
2. **Engine Control Module, ECM**
   - Located in air plenum, center
   - Removing and installing, see **23 Fuel Injection–Diesel** or **24 Fuel Injection–Motronic** (for appropriate engine code)
3. **Data Link Connector (DLC)**
   - Located under dashboard on driver's side
4. **Valve body**
   - Located above oil pan, bolted to interior of transmission housing
   - Solenoid valves (N88, N89, N90, N91, N92, N93, N94) are attached to the valve body
   - Valves are checked by On-Board Diagnostics (OBD)
5. **Conductor strip (printed circuit foil) with integrated Automatic Transmission Fluid, (ATF) temperature sensor (G93)**
   - Located in oil pan, attached to valve body
   - Checked by OBD
   - Can be replaced without removing valve body or transmission
6. **Multi-function Transmission Range, TR switch (F125)**
   - Location, see **Transmission Range switch, location**
   - Removing, installing, and adjusting, see **Transmission Range (TR) switch, removing, installing, and adjusting (01M).**
   - Checked by OBD
7. **Transmission vehicle speed sensor (G38)**
   - Located on top of transmission closer to engine
   - Signal used by TCM only
   - Removing and installing, see **Transmission VSS (G38) removing and installing**
   - Checked by OBD
8. **Vehicle speed sensor (G68)**
   - Located on top of transmission, farther from engine
   - Signal used by TCM only
   - Removing and installing, see **VSS (G68) removing and installing**
   - Checked by OBD
9. **Throttle position sensor (G69)**
   - Gasoline engines with cable operated throttle: located on throttle valve housing, integral with throttle valve control module
   - Gasoline engines with Electronic Power Control, EPC: located on accelerator pedal, integral with Throttle Position Sensor, TPS
   - Diesel engines: located on accelerator pedal, integral with Throttle Position Sensor, TPS
   - Function, **see TP sensor function**
   - Checked by OBD
10. **Shift lock solenoid (N110)**
    - Location, see **Shift mechanism, assembly (01M).**
    - Checked by OBD
11. **Instrument cluster with OBD data bus (J533)**
    - With transmission selector lever position display (Y5)
12. **Cruise control switch (E45)**
13. **Kick down switch (F8)**
    - Gasoline engines with cable operated throttle: integral with throttle cable and located on bulkhead in engine compartment
    - Gasoline engines with Electronic Power Control, EPC: not a separate component, function is integral with Throttle Position Sensor, TPS
    - Diesel engines: not a separate component, function is integral with Throttle Position Sensor, TPS
14. **Brake light switch (F)**
    - Located on brake pedal bracket
15. **Park/Neutral Position, PNP relay (J226)**
    - Located on additional relay panel under instrument panel, left side
    - Marked with production number "175"
16. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)

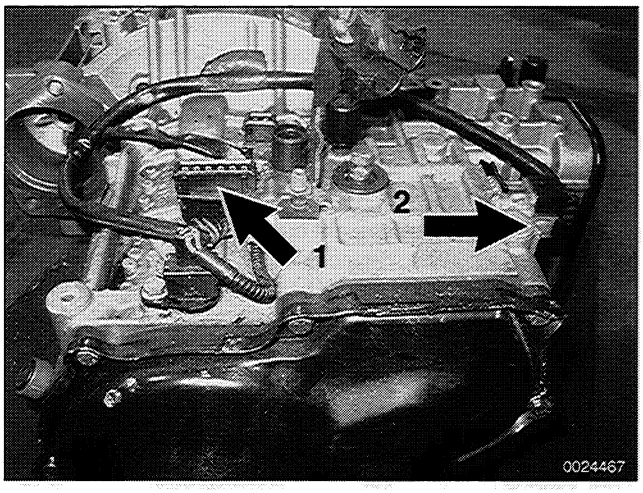


TCM removing and installing

- Same position (**arrow**) and removal as for 09A TCM
- Switch off ignition.
- Remove wiper arms, rubber plenum seals, and inner plenum cover.
- Release multi-pin connector lock and slide connector off toward center of vehicle.
- Remove TCM mounting screws that are below connector.
- Installation is the reverse.

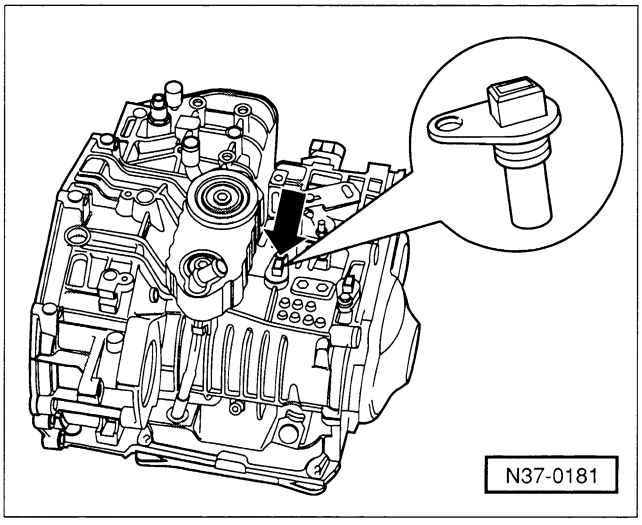
NOTE —

Use extra care when working around edges of windshield during plenum cover removal.



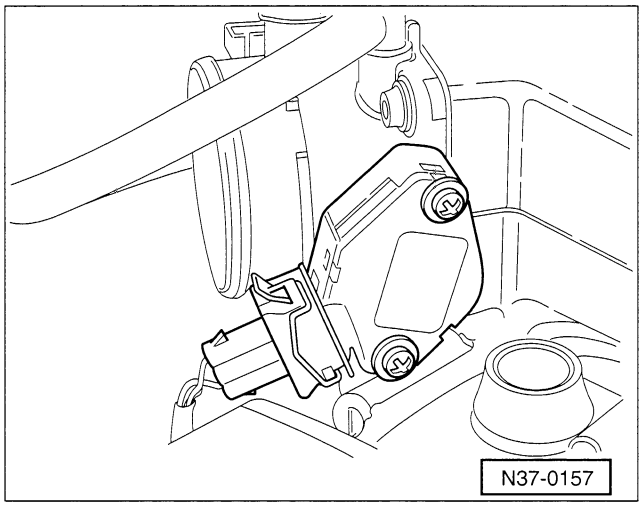
TR switch, location

- On rear of transmission in cavity on transmission housing (**2**).
- Attached to extension wiring harness (**1**) running to connector on upper transmission housing.
- TR switch can be disconnected at either point.



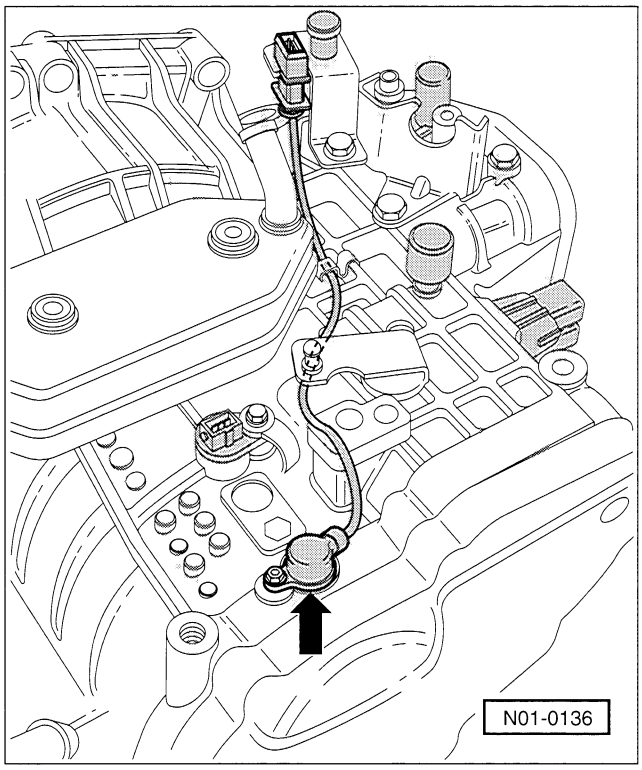
Transmission VSS (G38) removing and installing

- Switch off ignition, remove harness connector and retaining bolt. Pull straight out.
- When installing, replace seal.
- Tighten retaining clamp bolt to 10 Nm (7 ft-lb).
- Signal used by transmission electronics only.



TP sensor function

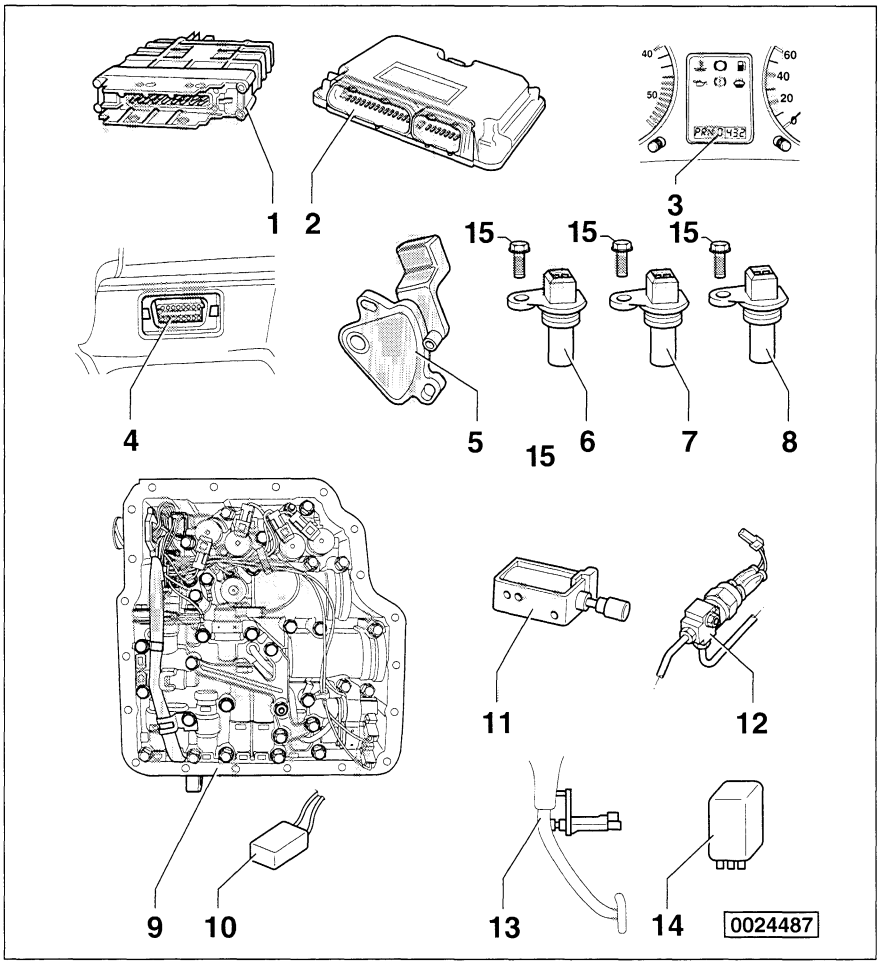
- On vehicles with cable operated throttle, signal is sent to ECM which sends signal to the TCM via dedicated wiring.
- On drive-by-wire vehicles with CAN-bus system, the TCM receives the TP sensor signal from the CAN-bus.
- The on-board diagnostics of the transmission only checks the signal, not the TP sensor. On vehicles without CAN-bus the wiring for the signal is also checked.
- Early version shown.



VSS, (G68) removing and installing

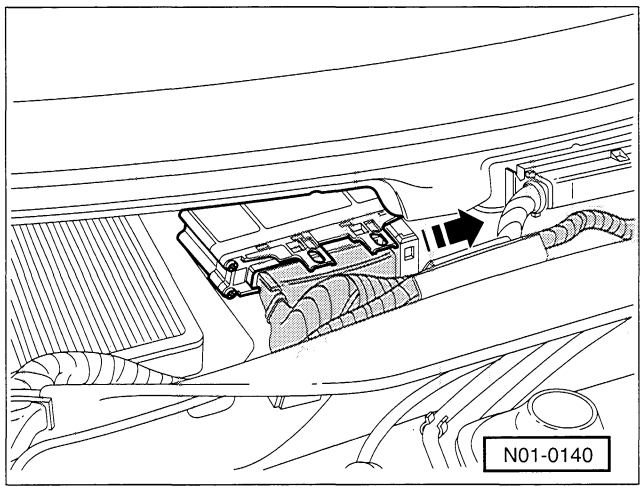
- When transmission is installed the sensor is covered by left transmission mount.
- Transmission must be unbolted from mounts and lowered approximately 2.5 in. to access sensor, see **Transmission, Removing and Installing.**
- Switch off ignition, remove harness connector and retaining bolt. Pull straight out.
- When installing, replace seal.
- Tighten retaining clamp bolt to 10 Nm (7 ft-lb).
- Signal used by transmission electronics only.

Automatic transmission electronic and electrical components (09A)



1. **Transmission Control Module, TCM (J217)**
   - Located in air plenum, center/right
   - Factory coded, no user changes possible
   - Removing and installing, see **TCM removing and installing**
2. **Engine Control Module, ECM**
   - Located in air plenum, center
   - Removing and installing, see **24 Fuel Injection–Motronic** (for appropriate engine code)
3. **Instrument cluster with OBD data bus (J533)**
   - With transmission selector lever position display (Y5)
4. **Data Link Connector (DLC)**
   - Located under dashboard on driver's side
5. **Multi-function Transmission Range, TR switch (F125)**
   - Location, see **Transmission Range switch, location**
   - Removing, installing, and adjusting, see **Transmission Range (TR) switch, removing, installing, and adjusting (09A).**
   - Checked by OBD
6. **Intermediate shaft speed sensor (G265)**
   - Signal pickup from spur gear A
   - Located inside transmission near spur gear section
   - Not accessible from outside
   - Inductive sensor
   - Checked by OBD
7. **Vehicle speed sensor (G68)**
   - Signal pickup for transmission output (road) speed
   - Located inside transmission near parking lock gear
   - Not accessible from outside
   - Inductive sensor
   - Signal used by speedometer
   - Checked by OBD
8. **Transmission speed, RPM sensor (G182)**
   - Signal pickup for transmission input (turbine shaft) speed
   - Located inside transmission near clutch K2
   - Not accessible from outside
   - Inductive sensor
   - Checked by OBD
9. **Valve body (hydraulic control unit)**
   - Located in front of transmission, vertically bolted to transmission housing
   - 9 Solenoid valves (N88, N89, N90, N91, N92, N93, N281, N282, N283) are attached to the valve body
   - Valves are checked by On-Board Diagnostics (OBD)
10. **ATF temperature sensor (G93)**
    - Located inside transmission near spur gear section
    - Checked by OBD
11. **Shift lock solenoid (N110)**
    - Location, see **Shift mechanism, assembly (09A)**
    - Checked by OBD
12. **Brake pressure switch (F270)**
    - Located on bulkhead in brake line to R/F wheel brakes
    - Checked by OBD
13. **Brake light switch (F)**
    - Located on brake pedal bracket
    - Checked by OBD
14. **Park/Neutral Position, PNP relay (J226)**
    - Located on additional relay panel under instrument panel, left side
    - Marked with production number "175"
15. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)

* **Tiptronic switch (F189)** (not shown)
- Located on the printed circuit foil of the symbol insert within the selector mechanism cover
- Includes three Hall sensors
- Integral with printed circuit foil and symbol insert
- See **Tiptronic switch**

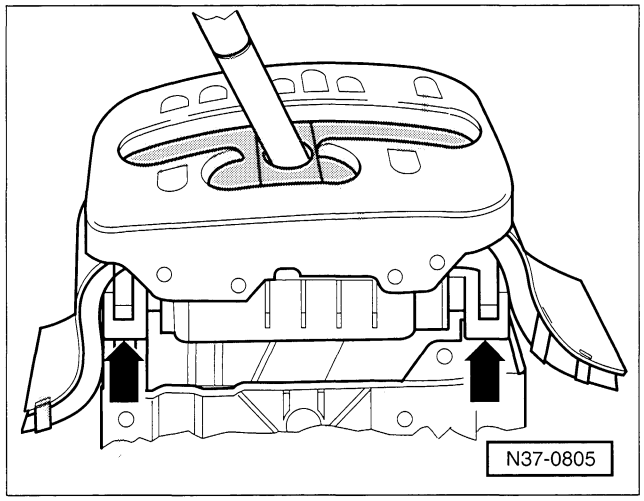


TCM removing and installing

- Same position and removal as for 01M TCM
- Switch off ignition.
- Remove wiper arms, rubber plenum seals, and inner plenum cover.
- Release multi-pin connector lock and slide connector off toward center of vehicle (**arrow**).
- Remove TCM mounting screws that are below connector.
- Installation is the reverse.

NOTE —

Use extra care when working around edges of windshield during plenum cover removal.



Tiptronic switch

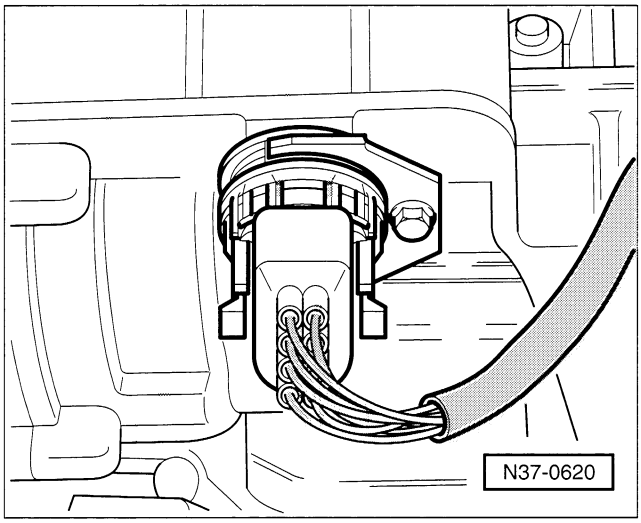
- Located on the printed circuit foil of the symbol insert within the selector mechanism cover.
- Requires cover removal (**arrows**).



Transmission Range (TR) switch, location

- On top of transmission housing (**arrow**).
- Transmission selector shaft passes through TR switch.

Transmission range (TR) switch, removing, installing, adjusting (01M)



TR switch, removing and installing

- Switch off ignition, remove harness connector, bolt, and retaining bracket. Pull straight out.
- When installing, replace seal.
- Tighten retaining clamp bolt to 10 Nm (7 ft-lb).

– TR switch is adjusted correctly when properly installed. No separate adjust is possible.

Transmission range (TR) switch, removing, installing, adjusting (09A)

NOTE —
Installation of TR switch requires special tool T10091 for adjustment.

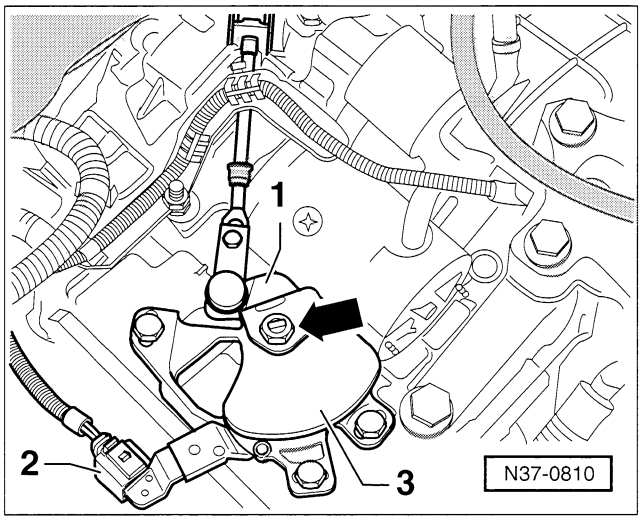
– Obtain anti-theft radio coding.

– Move selector lever into "P" position.

– Switch ignition off and disconnect battery ground strap.

– Remove battery for access.

– Remove battery carrier.



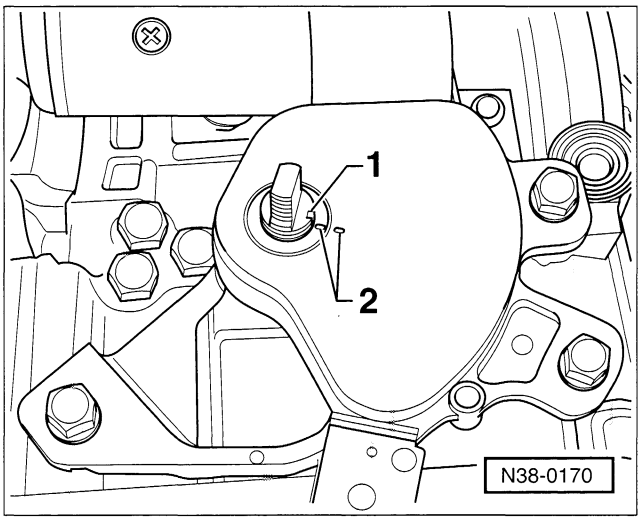
– Remove nut (**arrow**) from selector shaft.

– Pull lever (**1**) off selector shaft.

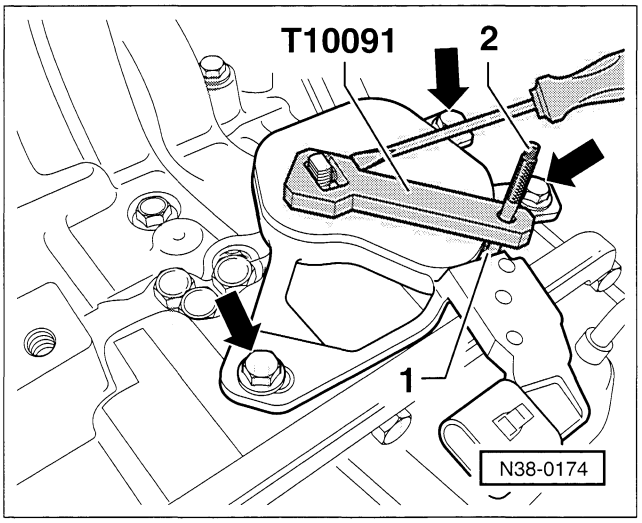
– Pull off multi-function TR switch connector (**2**).

– Remove three hex head securing bolts.

– Slide Multi-function TR switch F125 (**3**) up and off selector shaft.



To install, slide TR switch onto transmission selector shaft and align groove (**1**) in selector shaft with index markings (**2**) on TR switch.



Screw in three hex head securing bolts (**arrows**) finger tight only.

- Position adjusting device T10091 onto machined flats of selector shaft and secure with attached set screw.
- Move selector shaft on transmission to neutral position.
- Turn TR switch until hole on switch housing (**1**) aligns with hole of adjusting tool.
- Insert pin (**2**) from adjusting tool through hole in tool and into hole in TR switch.
- Tighten 3 TR switch securing bolts.

Tightening torques

- TR switch securing bolts . . . . . 6 Nm (53 in-lb)
- Selector lever shaft nut. . . . . 20 Nm (15 ft-lb)

- Install selector shaft lever and nut and tighten.
- Remaining installation is the reverse of removal.
- Check selector cable adjustment,

BASIC SETTINGS

The Transmission Control Module (TCM) and the Engine Control Module (ECM) share data concerning engine and transmission operation. Data that the TCM may not always precisely "know" is throttle range and full throttle position. The acquisition of this data is known as basic setting. The basic setting influences automatic transmission shifting and is set at the time that the vehicle is new.

The basic setting will be lost and should be initiated after completion of the following repairs:

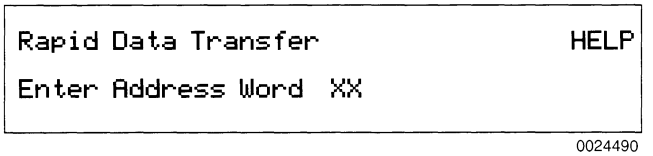
- Engine removing and installing (replacement).
- Transmission removing and installing.
- Replacing or coding the Engine Control Module (ECM).
- Replacing the Transmission Control Module (TCM).
- Removing, installing, adjusting, and/or replacing electronic throttle components at pedal or throttle housing.
- If the battery is disconnected or runs down.
- If the TCM is disconnected.

In these circumstances, the basic settings must be restored to insure proper automatic transmission operation.

Basic settings, initiating

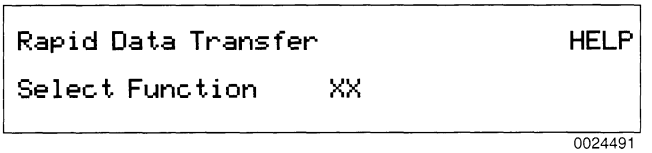
Basic settings can be initiated or restored using a suitable scan tool. Follow the scan tool manufacturer's instructions and/or use the procedure outlined below. In either case, the kickdown switch on the accelerator cable (where applicable) must function properly. Shown here is the display from the VAG 1551. Others scan tool displays are similar.

– Connect scan tool to DLC and switch on ignition, but do not start engine.



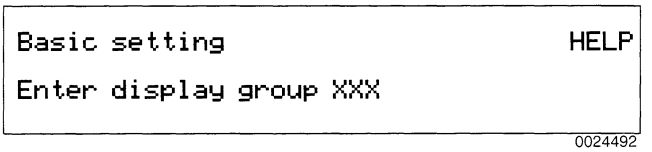
0024490

➢ Advance scan tool to address word menu and enter **02** for transmission electronics.



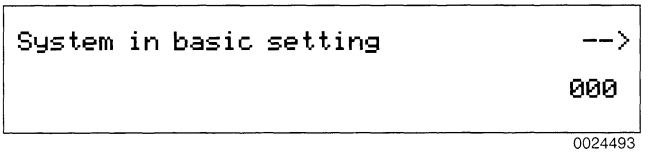
0024491

➢ Advance scan tool to function menu and enter **04** for basic setting.



0024492

➢ Advance scan tool to display group menu and enter **000.**



0024493

➢ Advance scan tool until system confirms that it is in basic setting mode as shown.

– Push accelerator pedal all the way to the floor (past kick-down) and hold it there for a minimum of 3 seconds.

NOTE —
Most scan tools and scan tool programs will not confirm completion of basic settings by any on-screen display.

– Release accelerator pedal.

– Exit program and disconnect scan tool.

– Switch off the ignition.

Basic requirements

If transmission problems are experienced, the following points should be considered before proceeding with in-depth troubleshooting.

- Check ATF. Ensure that the level is correct and that the fluid is clean and of correct type, see **0 Maintenance.**
- Make a visual inspection of the components shown for the appropriate transmission system. Check the wiring and harness connectors for loose, damaged or corroded connections. Check that all related grounds are firmly connected and in good condition. Consult the appropriate wiring diagram, see **97 Wiring Diagrams, Fuses and Relays.**
- Check the shift mechanism for proper function, see **Shift Mechanism.**

Review the conditions listed under **Basic Settings.** If any of the conditions are met, the TCM must be reset to the basic setting using an appropriate scan tool. If the TCM basic settings are not re-established, driveability problems may be encountered. It may also be advantageous to reset the basic settings even if the listed repairs have not been done. This will assure that it is not a factor affecting driveability.

- If no faults are found up to this point, the next logical step is to check for faults using the a scan tool, or scan tool computer program. If the transmission problem is electrical/electronic in nature, specific DTCs will most likely be stored in memory.

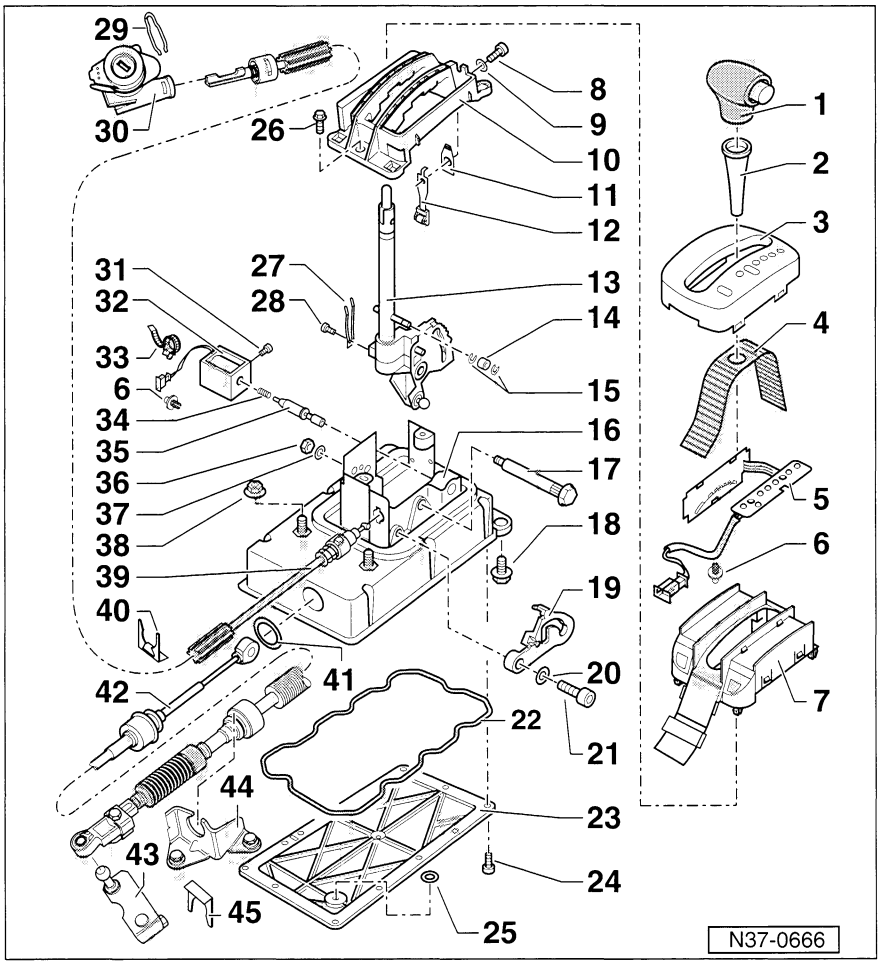
SHIFT MECHANISM

The selector lever handle and shift mechanism components for both the 01M and 09A automatic transmissions are different due, in part, to the addition of Tiptronic® controls for the 09A.

Shift mechanism assembly (01M)

NOTE —
Lubricate all mountings and sliding surfaces with Polyurea grease (VW/Audi part no. G 052 142 A2 or G 000 450 A or equivalent).

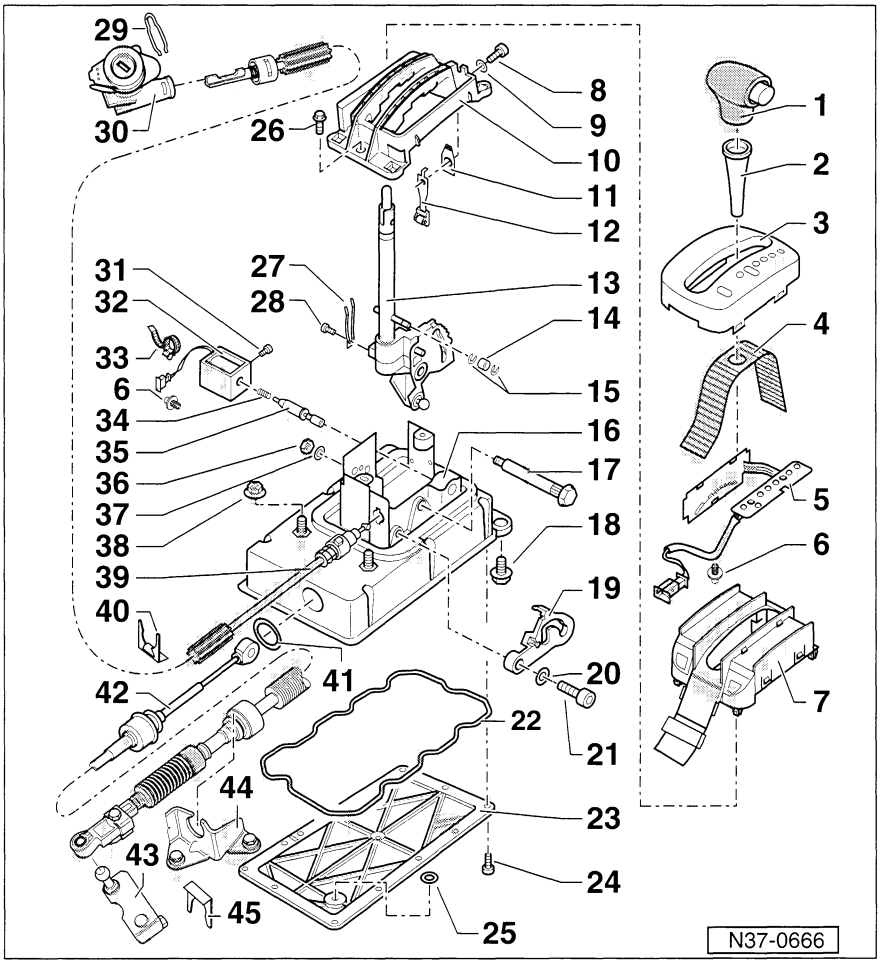
1. **Selector lever handle and release button**
   - Removing: push sleeve (item 2) down while depressing release button and pull handle up and off.
   - Installing: while depressing release button, push handle onto lever until lock engages. Slide sleeve up to lock.
2. **Locking sleeve**
   - Locks selector lever handle
   - Prevents selector lever handle from being pulled off
3. **Cover**
   - With selector indicator
   - Snapped into bracket (item 7)
4. **Cover strip**
   - Slides into bracket (item 7)
   - Use care to avoid kinking during installation
5. **Selector lever position display**
   - Printed circuit for selector lever position display lighting clipped in position.
   - Contacts for selector lever position face towards selector lever contact springs (item 27).
   - Insert fiber optic light guide and wiring to connector housing in the mountings on the frame
   - Note harness routing when installing.
6. **Retainer**
   - Positions connector and wiring in bracket (item 7)



7. **Bracket**
   - Carefully pry off at corners
   - Cover strip (item 4) slides in tracks
   - Installation position: ribs must face down
   - Note position of printed circuit and wiring (item 5).
   - When installing use care to avoid damage to contact springs (item 27) for selector lever position display
8. **Bolt, hex**
   - Attaches locating spring (item 12) and plate (item 11) to bracket (item 7).
   - Tighten to 7 Nm (62 in-lb)
9. **Washer**
10. **Locking segment**
    - Place on centering pins of selector lever housing
11. **Plate**
12. **Detent spring with roller**
    - Engages detent in selector lever (item 13).
13. **Selector lever**
    - With pull rod, spring, detent, and contact spring for selector lever position and shift lock cable release
    - See **Selector lever cable checking and adjusting (01M)**
    - See **Selector lever assembly**
14. **Roller**
    - For releasing shift lock cable
15. **Circlip**
16. **Selector lever housing**
    - Does not need not be removed to replace most individual parts, except for selector lever and shift lock solenoid
    - See **Selector lever assembly**
17. **Splined fulcrum pin**
    - Lubricate with polyurea grease when installing and as otherwise needed
    - Do not turn when installing selector lever

(continued on following page)

Shift mechanism assembly (01M) (continued)



18. Bolt, hex
- Tighten to 25 Nm (18 ft-lb)

19. Locking lever
- For shift lock cable
- Allows locking selector lever in park (**P**) position

20. Washer

21. Bolt

22. Gasket
- Always replace

23. Cover
- For selector lever housing

24. Bolt
- Quantity 14

25. O-ring
- Always replace

26. Bolt
- Quantity 2
- Tighten to 8 Nm (71 in-lb)

27. Contact spring
- For selector lever position display

28. Bolt
- Tighten to 4 Nm (35 in-lb)
- Place selector lever in park (**P**) position to loosen and tighten

29. Clip
- Installing: push clip on from above, angled ends of clip face steering lock

30. Steering column lock (on steering column)

31. Bolt
- Quantity 2
- Attaches solenoid to selector lever housing

32. Shift lock solenoid (N110)
- Remove/install only with selector lever in first gear (**1**) position
- Note position of spring and locking pin when removing
- Remove together with locking pin and spring; move selector lever slightly back and forth slightly to ease removal.
- Route wiring harness to give sufficient clearance when installing
- Checked via OBD

33. Cable tie
- Attaches solenoid wiring to selector lever housing
- Always replace

34. Spring

35. Locking pin

36. Nut, hex
- Always replace
- Tighten to 13 Nm (10 ft-lb)

37. Washer

38. Nut, hex
- Quantity 2
- Always replace
- Tighten to 25 Nm (18 ft-lb)

39. Shift lock cable
- Allows ignition key to be removed with shifter lever locked in park (**P**) position.
- Do not bend or kink
- See **Shift lock cable adjusting, (01M)**
- See **Shift lock operation, functional checking**

40. Clip
- Always replace
- Secures selector lever cable to selector lever housing
- Install angled end toward inside of selector housing

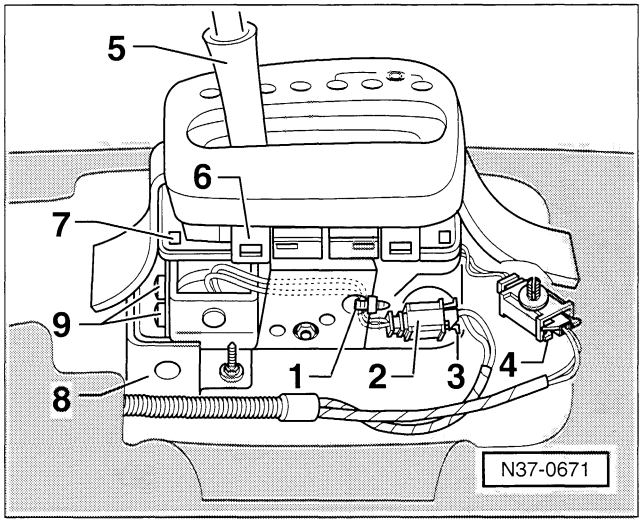
41. Gasket
- Always replace

42. Selector lever cable
- Do not bend or kink
- If outer cable sleeve is damaged, entire selector lever cable must be replaced.
- Lightly grease ball socket and cable ends before installing.
- See **Selector lever cable checking and adjusting (01M)**

43. Lever
- For selector shaft

44. Support bracket
- For securing selector lever cable on transmission

45. Clip
- Always replace



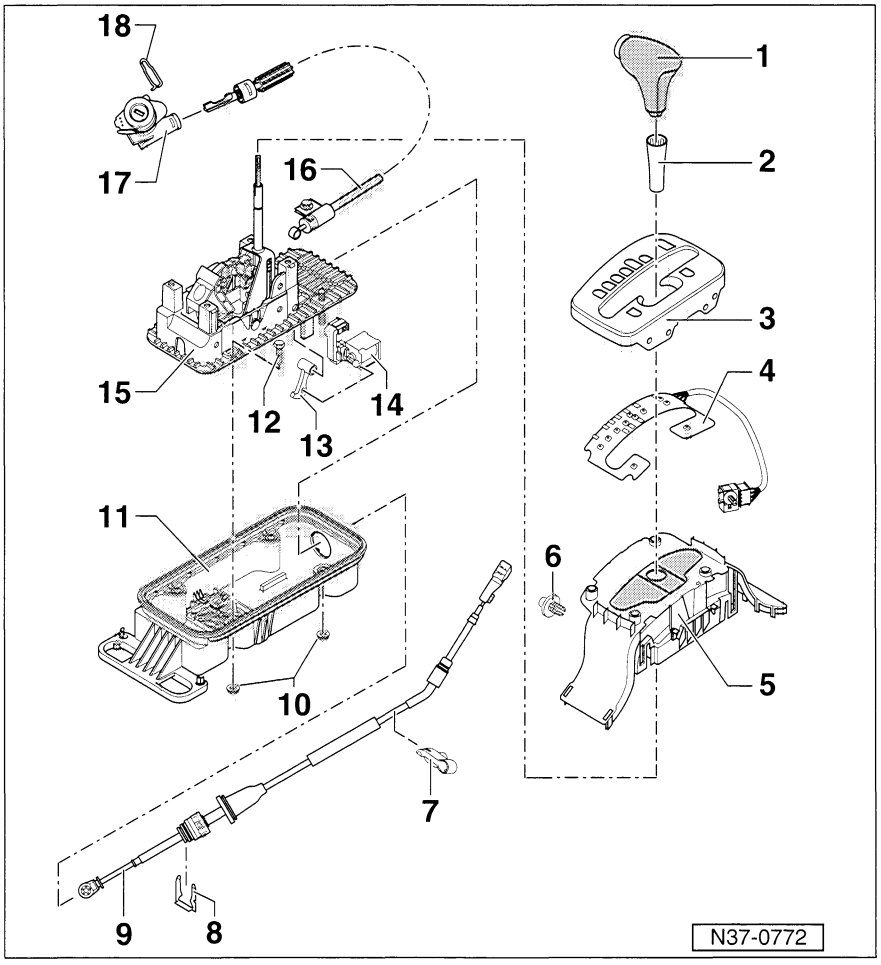
Selector lever assembly

1. Cable tie
2. Connector, shift lock solenoid
3. Connector, shift lock solenoid, harness end
4. Connector, selector lever position display
5. Locking sleeve, selector lever handle
6. Cover retaining tabs (quantity 4)
7. Bracket retainers
8. Retaining bracket (housing) nuts
9. Shift lock solenoid, (N110)

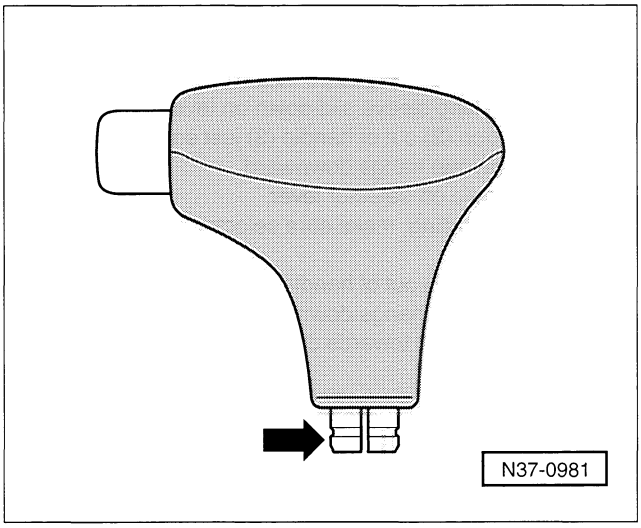
Shift mechanism assembly (09A)

NOTE —
Lubricate all mountings and sliding surfaces with Polyurea grease (VW/Audi part no. G 052 142 A2 or G 000 450 A or equivalent).

1. **Selector lever handle and release button**
   - Two different versions identified by colour. See **Selector lever handle identification.**
   - See, **Selector lever handle removing and installing, early**
   - See, **Selector lever handle removing and installing, late**
2. **Locking sleeve**
   - Locks selector lever handle
   - Prevents selector lever handle from being pulled off
3. **Cover**
   - With selector indicator
   - Snapped into bracket 5
4. **Selector lever position display**
   - Printed circuit for selector lever position display lighting clipped in position.
   - Note harness routing when installing.
   - Checked via OBD
5. **Bracket**
   - Cover strip slides in tracks
6. **Cable clip**
7. **Bracket**
   - For selector lever cable.
   - Attached to front tunnel heat shield.
8. **Locking plate**
   - Secures selector lever cable to mounting bracket
   - Always replace
9. **Selector lever cable**
   - Do not bend or kink
   - If outer cable sleeve is damaged, entire selector lever cable must be replaced.
   - Do not grease cable eye and ball socket.
   - See **Selector lever cable checking and adjusting (09A)**

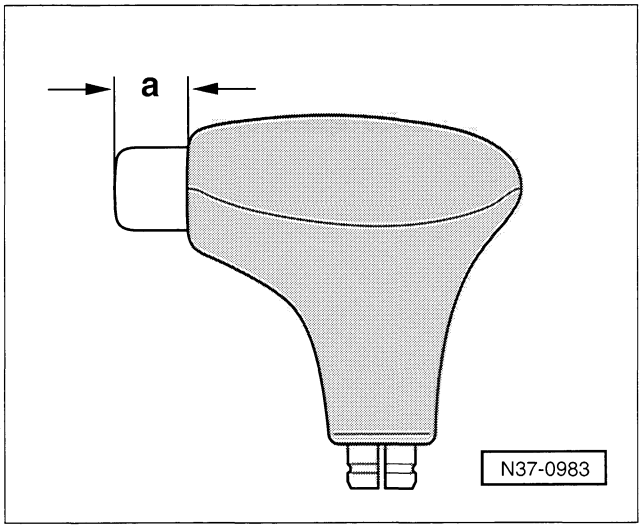


10. **Nut, self locking collared**
    - Quantity 4
    - Attaches to bolt 12
    - Always replace
    - Tighten to 10 Nm (7 ft-lb)
11. **Cover**
    - For mounting bracket
    - With bonded seal
12. **Bolt, hex**
    - Quantity 4
    - Attaches to nut 10
13. **Locking pawl**
    - For shift lock
    - Locks into cable lever of mounting bracket.
14. **Shift lock solenoid (N110)**
    - Can be replaced with selector mechanism installed.
    - Route wiring harness to give sufficient clearance when installing
    - Checked via OBD
15. **Mounting bracket assembly**
    - Mounting point for selector lever, detents and linkage.
16. **Shift lock cable**
    - Allows ignition key to be removed with shifter lever locked in park (**P**) position.
    - Do not bend or kink
    - See **Shift lock cable adjusting, (09A)**
    - See **Shift lock operation, functional checking**
17. **Steering column lock (on steering column)**
18. **Clip**
    - Installing: push clip on from above, angled ends of clip face steering lock.



Selector lever handle identification

- Push locking sleeve down.
- Locking area (**arrow**) colour identifies version.
- Black plastic: early version
- Red-brown plastic: late version



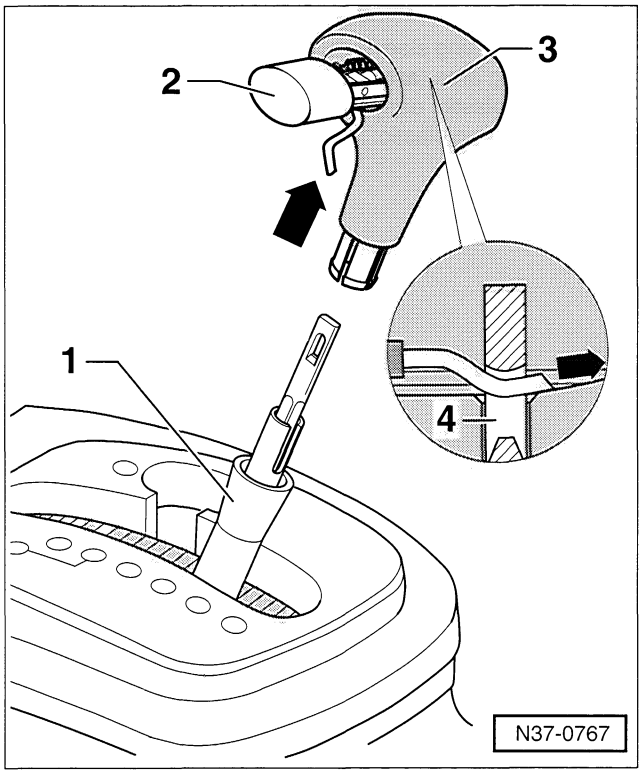
Selector lever handle removing and installing, late (red-brown plastic) version

- With locking sleeve slid down on lever, pull upward on handle.
- Do not press button.

NOTE —

If button is pushed in while removing, it will probably stick in the depressed position. Use a carefully controlled blast of compressed air in the handle opening to push button back out.

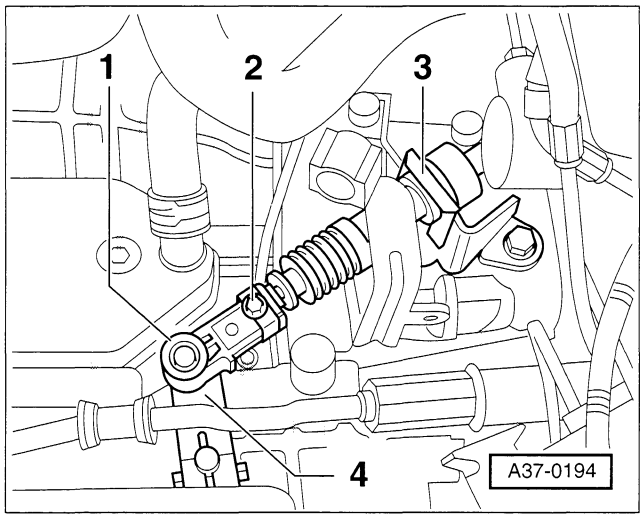
- When installing, make sure that button projects at least 10 mm (dimension **a**) from handle.
- Carefully pull button out by hand past perceptible detent so that it will not slid back in.
- Push handle on to selector lever.
- This version can be used in place of earlier black plastic version.



Selector lever handle removing and installing, early (black plastic) version

- Move selector lever to position **R**.
- Slide locking sleeve slid down on lever.
- Pull button (**2**) out of handle (**3**) just enough so that pull lever (**arrow**) hangs downward.
- Pull handle off selector lever.
- When installing, make sure selector lever is still in position **R**.
- Pull button (**2**) out of handle (**3**) just enough so that pull lever (**arrow**) hangs downward.
- With button (**2**) towards driver, press handle down onto stop.
- Pull button (**2**) out further and guide pull lever (**arrow**) into handle.
- Press button (**2**) so that lever engages pull rod (**4**).
- Button must now spring back to the stop.
- Slide locking sleeve (**1**) upward in a twisting motion until the two wide tabs of the sleeve fit into the slots of the handle (**3**). The handle is locked when the sleeve can be felt clipping into place.
- Move selector lever through all positions to check for proper operation and return to the park position.
- This version can be replaced by the red-brown plastic version.

Selector lever cable, checking and adjusting (01M)



– Move selector lever into **P** position, switch ignition off and set parking brake.

– Open hood and locate selector lever cable and selector shaft lever on transmission.

➤ Use a screwdriver to pry selector lever cable (**1**) off selector shaft lever (**4**) and move cable aside so that the end is free to move.

NOTE —
Do not bend or kink selector lever cable.

– Move selector lever from **P** to **1** to fully extend cable.

– Check protective boot at front of selector cable for damage. If boot is damaged, replace selector cable

– Move selector lever from **1** to **P** and check that shift mechanism and selector lever cable move freely. If necessary replace selector lever cable or service shift mechanism as required.

– Press selector cable (**1**) back onto selector shaft (**4**).

– To adjust cable, move selector lever into **P** position, switch ignition off and set parking brake.

– Ensure that retaining clip (**3**) is properly seated and selector lever cable is secured on selector shaft lever.

– Loosen adjustment bolt (**2**) at selector cable mount.

– Ensure that selector shaft lever (**4**) is in position **P** on transmission.

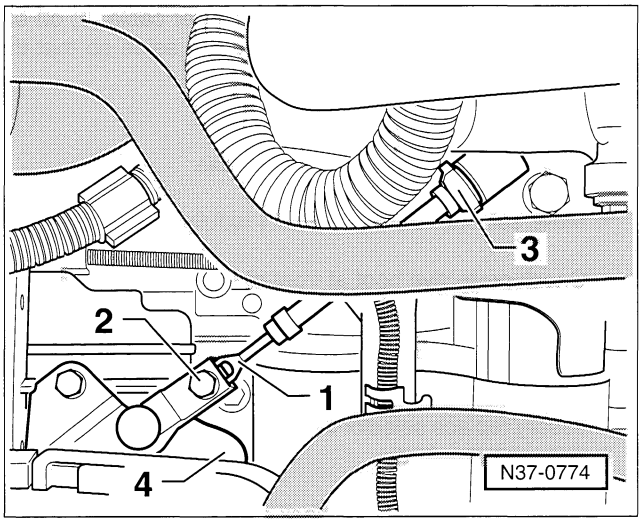
NOTE —
*With selector lever in **P** position, the transmission locking lever (pawl) must be engaged, locking both front wheels.*

– With selector lever in **P**, tighten adjustment bolt (**2**). Ensure that circlip (**3**) is fully seated.

– Shift through all gear positions and check for smooth operation.

Tightening torque

• Selector lever adjustment bolt . . . . . 8 Nm (71 in-lb)



Selector lever cable, checking and adjusting (09A)

– Move selector lever into **P** position, switch ignition off and set parking brake.

– Open hood and locate selector lever cable and selector shaft lever on transmission.

➤ Pull selector lever cable (**1**) upward off selector shaft lever/selector shaft (**4**) and move cable aside so that the end is free to move.

NOTE —
Do not bend or kink selector lever cable.

– Move selector lever from **P** to **2** to fully extend cable.

– Check protective sleeve at front of selector cable for damage. If sleeve is damaged, replace selector cable

– Move selector lever from **2** to **P** and check that shift mechanism and selector lever cable move freely. If necessary replace selector lever cable or service shift mechanism as required.

– Press selector lever cable onto lever/selector shaft with a pair of pliers.

– To adjust cable, move selector lever into **P** position, switch ignition off and set parking brake.

– Ensure that retaining clip (**3**) is properly seated and selector lever cable is secured on selector shaft lever (**4**).

– Loosen adjustment bolt (**2**) at selector cable mount.

– Ensure that selector shaft lever (**4**) is in position **P** on transmission.

NOTE —
*With selector lever in **P** position, the transmission locking lever (pawl) must be engaged, locking both front wheels.*

– With selector lever in **P**, tighten adjustment bolt (**2**).

– Shift through all gear positions and check for smooth operation.

Tightening torque
• Selector lever adjustment bolt . . . . 13 Nm (115 in-lb)

SHIFT LOCK

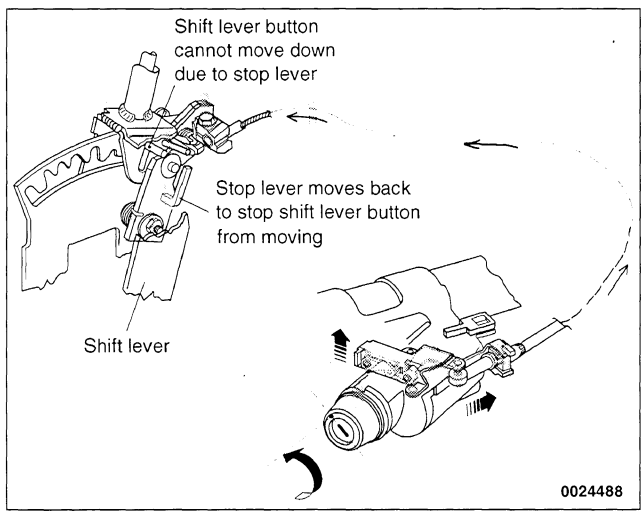
Shift lock is used on all cars with automatic transmissions Operation is essentially the same for both the 01M and 09A transmissions. Shift lock is comprised of two main sections, mechanical via a cable, and electro-mechanical via the shift lock solenoid.

The mechanical section of this feature is independent of the shift lock solenoid. Turning the ignition key on and off operates a bowden cable to lock and unlock the selector lever to enable the following:

- Prevents removal of the ignition key from the ignition lock unless the selector lever is in the Park (**P**) position.
- Prevents movement of the shifter unless the ignition key is turned.

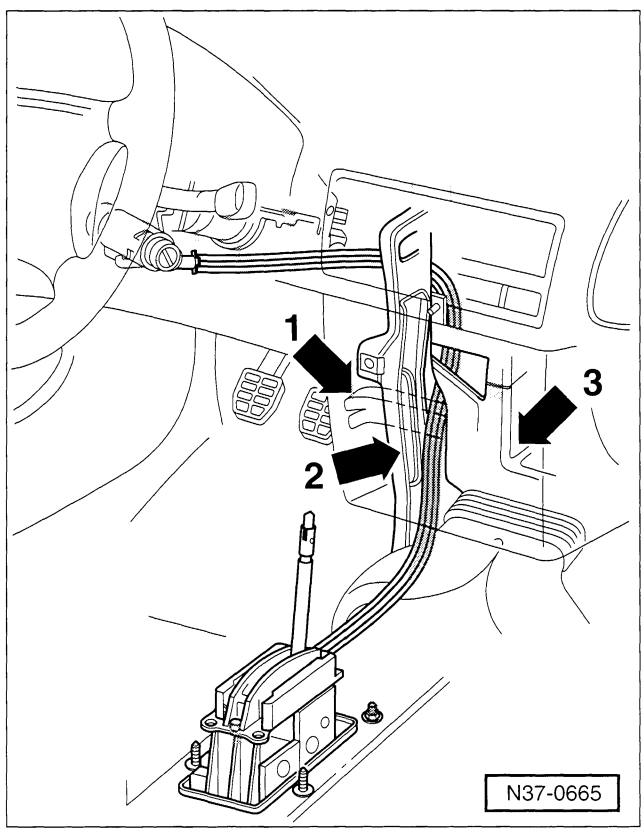
The electro-mechanical section of this feature is independent of the bowden cable. Turning the ignition key on operates a locking solenoid to lock and unlock the selector lever to enable the following:

- Prevents movement of the shifter out of the Park, Reverse, or Neutral positions unless the brake pedal is depressed.



Operation of shift lock is similar for both the 01M and the 09A transmissions. When the ignition key is turned to the off position (shift lever in **P**), the cable pushes the stop lever into the shift lever. This locks the lever button and also allows the ignition key to be withdrawn from the lock cylinder. The key can only be removed from the ignition with the lever in the **P** position. With the key out of the ignition, the selector lever cannot be shifted out of **P** position.

When the key is in the **ON** position, the cable pulls the stop lever away from the shift lever, allowing the shift lever to be moved out of park.

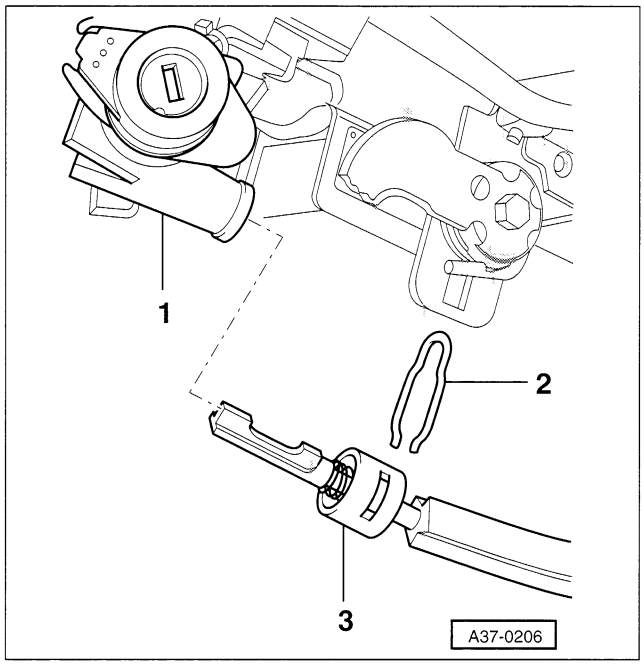


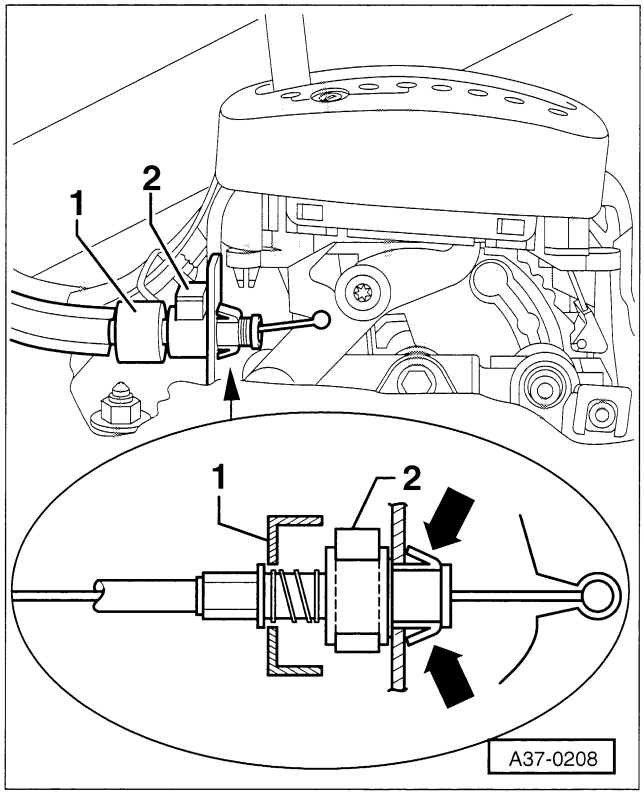
Shift lock cable, removing and installing (01M)

The shift-lock cable is routed through the dashboard and under the center console. Be sure to route the cable correctly when installing.

Installation position of shift lock cable:

1. Footwell vents
2. Instrument panel center support
3. Heater box





– Disconnect battery ground (GND) strap from battery negative (–) terminal. See the **Cautions** at the beginning of this repair group regarding battery disconnection.

NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.

– Remove driver's side airbag and steering wheel. See **48 Steering**.

– Remove trim under left side of instrument panel.

– Remove handle for steering height and telescopic adjustment and covers for ignition/starter lock.

– Turn ignition **ON** and move selector lever to **P**.

➤ Remove shift lock cable clip (**2**) and pull cable (**3**) out of ignition/steering lock assembly (**1**).

– Remove selector lever handle with release button.

– Remove center console and extension, see **70 Trim-Interior**.

➤ Disconnect shift lock cable from locking lever at selector mechanism. Detach cable end from selector mechanism and press tabs (**arrows**) of shift lock cable retaining clip together while pulling locking cable out. Cable sleeve (**1**) and red clip (**2**) are utilized during adjustment procedure.

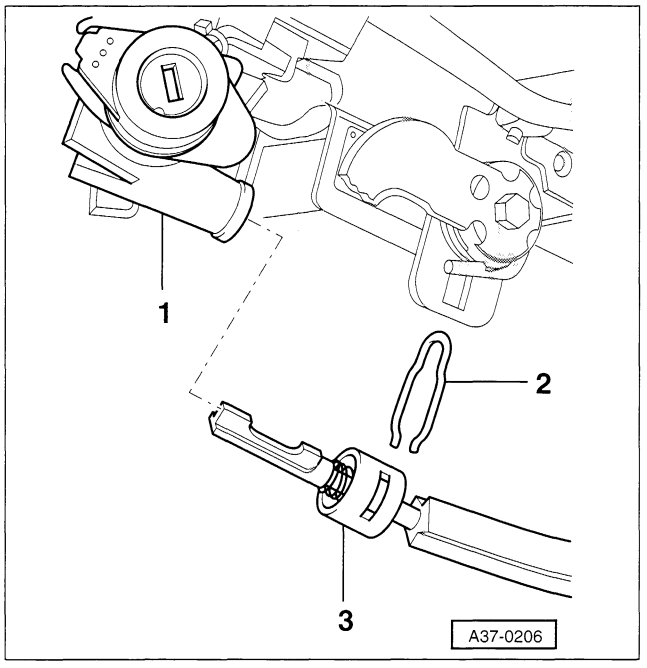
– To install, guide cable between heater box and footwell vent behind instrument panel center support.

WARNING —
- *Be sure cable is routed correctly when installing.*
- *Do not bend or kink cable.*
- *Be sure to adjust cable after installation.*

– Move selector lever to **P**.

– Press shift lock cable into support bracket on selector lever housing until tabs (**arrows**) on retaining clip spread apart.

– Attach shift lock cable end in locking lever.



– Turn ignition on.

➤ Insert shift lock cable (**3**) into ignition lock (**1**) with flattened side facing down.

– Install clip onto cable.

NOTE —
Ensure that clip is properly located and seated.

– Adjust shift lock cable.

– Install covers for ignition/starter lock.

– Install handle for steering height and telescopic adjustment.

– Install trim under left side of instrument panel.

– Install driver's side airbag and steering wheel. See **48 Steering**.

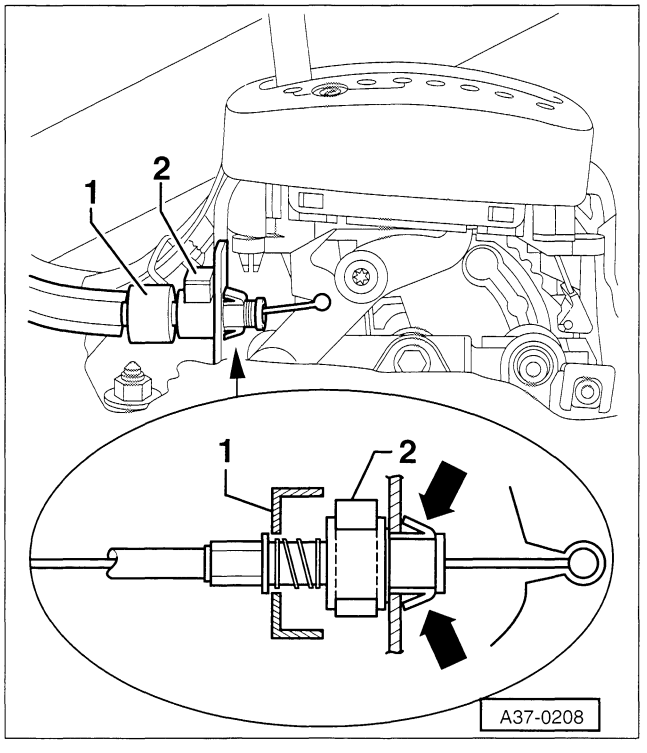
– Re-connect battery. See the **Cautions** at the beginning of this repair group regarding battery.

Shift lock cable, adjusting (01M)

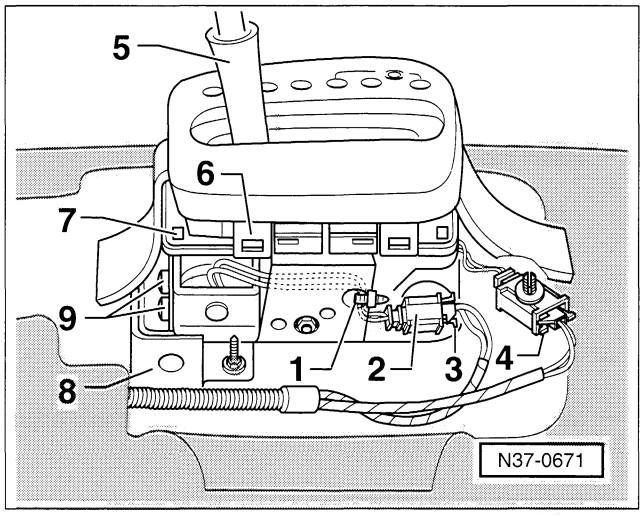
WARNING —
Follow the adjustment procedure exactly as outlined.

Before adjusting the shift lock cable the following points must be observed:

- Center console and extensions must be removed.
- Selector lever handle must be removed.
- Shift lock cable must be correctly installed and routed.
- Selector lever must be in Park position.
- Steering column must be at lowest position and most extended position.
- Ignition key must be removed from ignition lock.

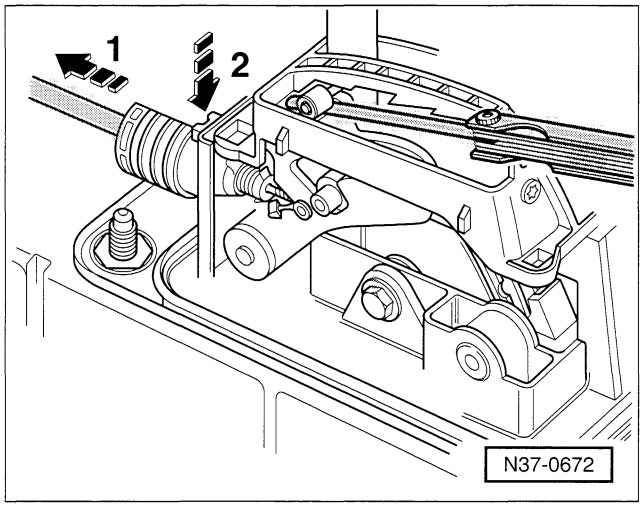


➤ Working at center console, slide cable sleeve (**1**) forward and release red clip (**2**) by pushing up.

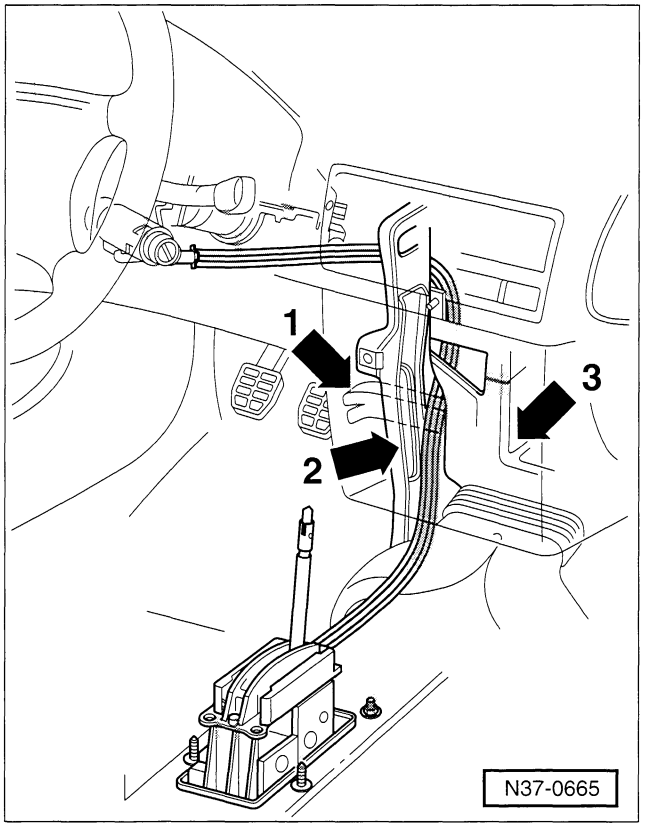


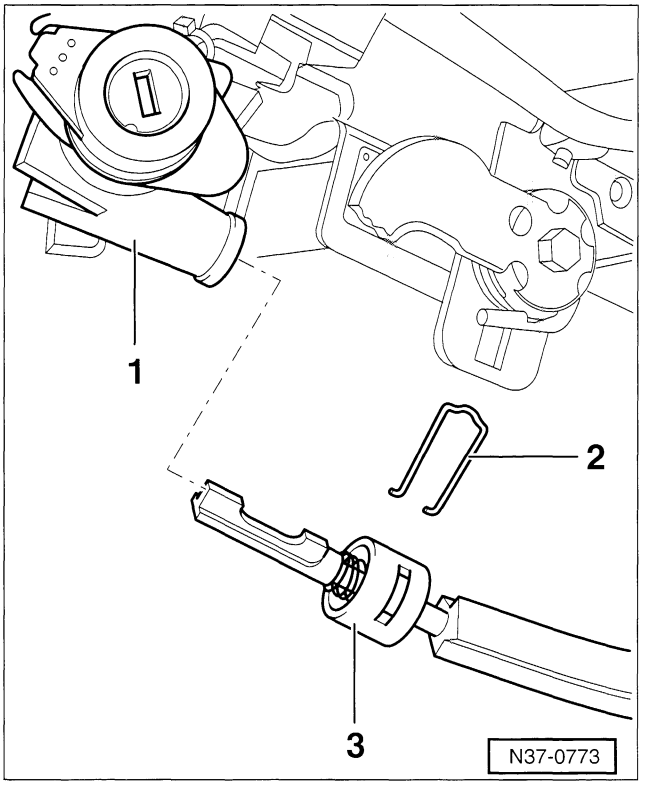
- Remove selector cover and bracket: remove harness connector (**4**), remove selector lever sleeve (**5**), carefully pry up the four tabs (**6**) of selector cover and remove, carefully pry up at four corners of shift lever bracket (**7**) and remove.

NOTE —
Be careful not to damage contact spring for shift lever position indicator.



- Slide 0.8 mm (0.032 in.) feeler gauge between locking lever and selector lever roller from the rear.
- Pull outer sleeve of shift lock cable slightly forward in direction of travel (**arrow 1**) and push red clip down until it engages (**arrow 2**).
- Push sliding sleeve back over clip.
- Check for proper ignition key removal and selector lever function.
- Reinstall selector lever bracket and cover components.
- Replace center console, extension, and removed trim.
- Check shift lock operation, see **Shift lock operation, functional checking**.





Shift lock cable, removing and installing (09A)

The shift-lock cable is routed through the dashboard and under the center console in the same manner as with the 01M version with the primary difference being at the mounting bracket assembly. Be sure to route the cable correctly when installing.

Installation position of shift lock cable:

1. Footwell vents
2. Instrument panel center support
3. Heater box

– Disconnect battery ground (GND) strap from battery negative (–) terminal. See the **Cautions** at the beginning of this repair group regarding battery disconnection.

NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.

– Remove driver's side airbag and steering wheel. See **48 Steering**.

– Remove trim under left side of instrument panel.

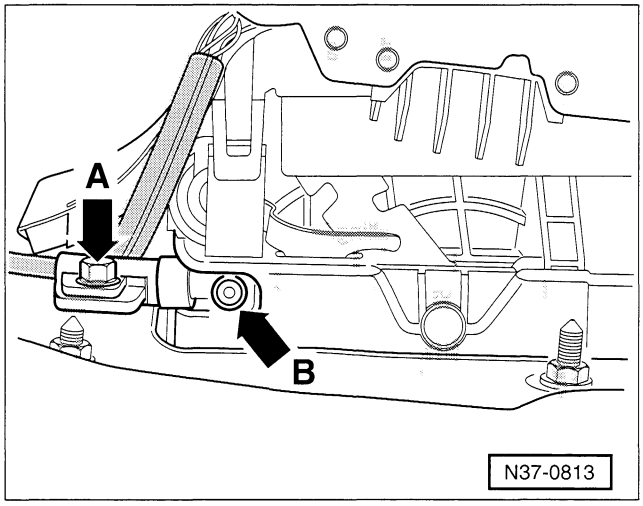
– Remove handle for steering height and telescopic adjustment and covers for ignition/starter lock.

– Turn ignition **ON** and move selector lever to **P**.

Remove shift lock cable clip (**2**) and pull cable (**3**) out of ignition/steering lock assembly (**1**).

– Remove selector lever handle with release button.

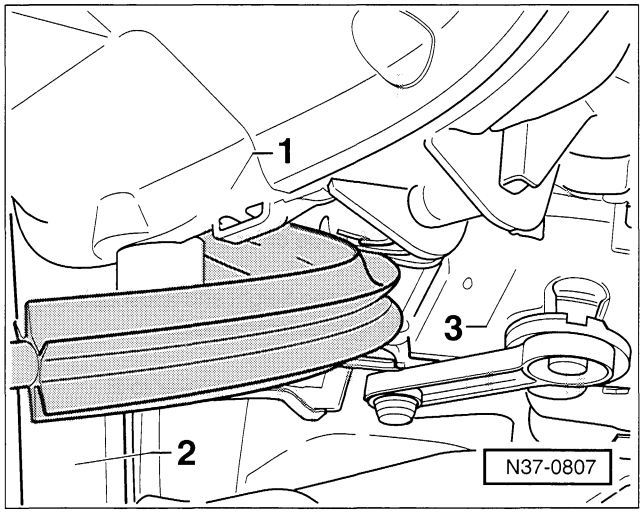
– Remove center console and extension, see **70 Trim-Interior**.



➢ Remove bolt (**A**) from shift lock cable support bracket.

– Remove shift lock cable from selector mechanism and locking lever (**B**).

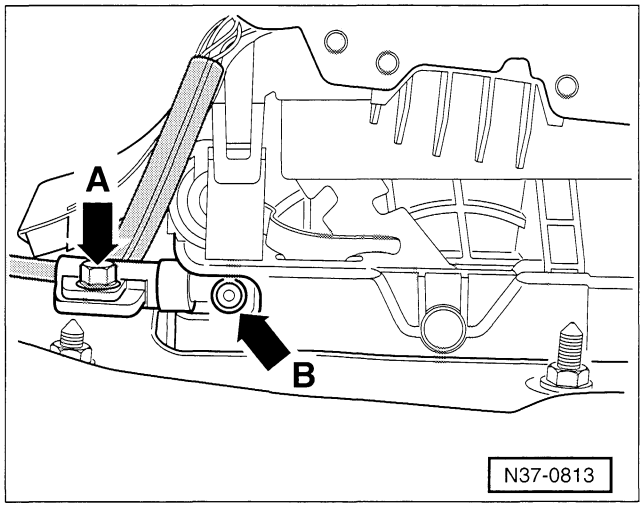
– Pull shift lock cable out from instrument panel.



➢ To install, guide cable between heater box (**3**) and footwell vent (**1**) behind instrument panel center support (**2**).

– Move selector lever to "**P**".

WARNING —
- *Be sure cable is routed correctly when installing.*
- *Do not bend or kink cable.*
- *Be sure to adjust cable after installation.*

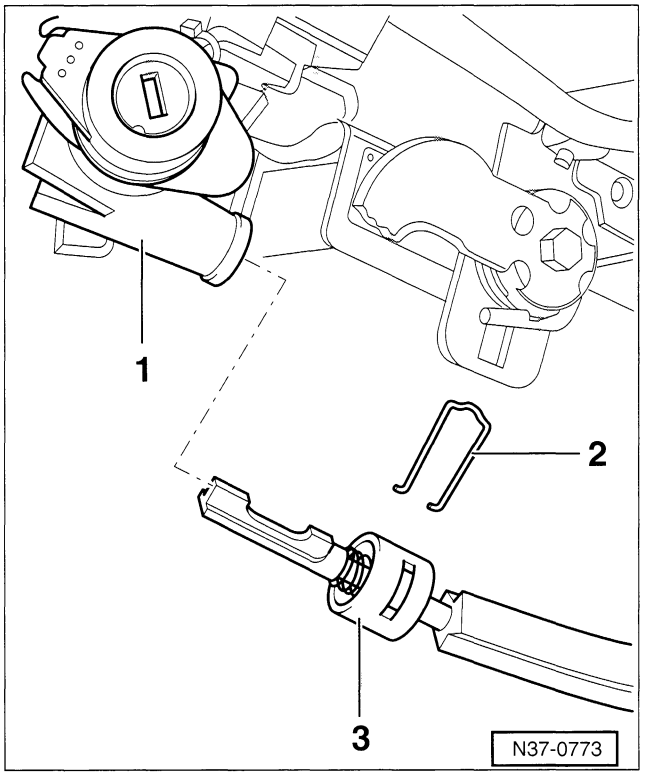


➢ Pull shift lock cable slightly out of outer sleeve and attach in locking lever (**B**).

– Attach cable support bracket to mounting bracket assembly (**A**).

NOTE —
*Shift lock cable is adjusted at bolt **A**. See **Shift lock cable, adjusting (09A)***

– Turn ignition on.



➤ Insert shift lock cable (**3**) into ignition lock (**1**) with flattened side facing down.

– Press clip (**2**) onto cable (**3**) from above. Ensure that angled ends of clip face ignition lock as illustrated.

NOTE —
Ensure that clip is properly located and seated.

– Adjust shift lock cable.

– Install covers for ignition/starter lock.

– Install handle for steering height and telescopic adjustment.

– Install trim under left side of instrument panel.

– Install driver's airbag and steering wheel. See **48 Steering**.

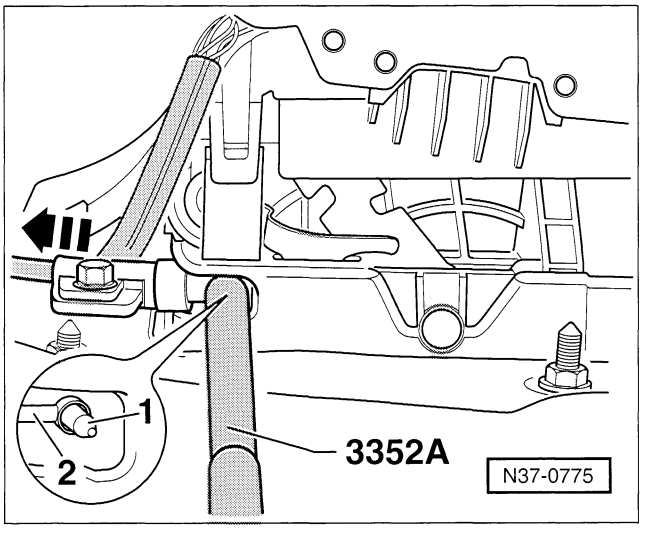
– Re-connect battery. See the **Cautions** at the beginning of this repair group regarding battery.

Shift lock cable, adjusting (09A)

WARNING —
Follow the adjustment procedure exactly as outlined.

Before adjusting the shift lock cable the following points must be observed:

- Center console and extensions must be removed.
- Shift lock cable must be correctly installed and routed.
- Selector lever must be in Park position.
- Steering column must be at lowest position and most extended position.
- Ignition key must be removed from ignition lock.



➤ Working at center console, loosen bolt (**at arrow**) for shift lock cable at support bracket.

– Insert shift lock cable adjustment gauge 3352A between locking lever (**1**) and locking cable eye (**2**).

– To adjust, take up free play by gently pulling shift lock cable forward (**dashed arrow**) and tighten bolt.

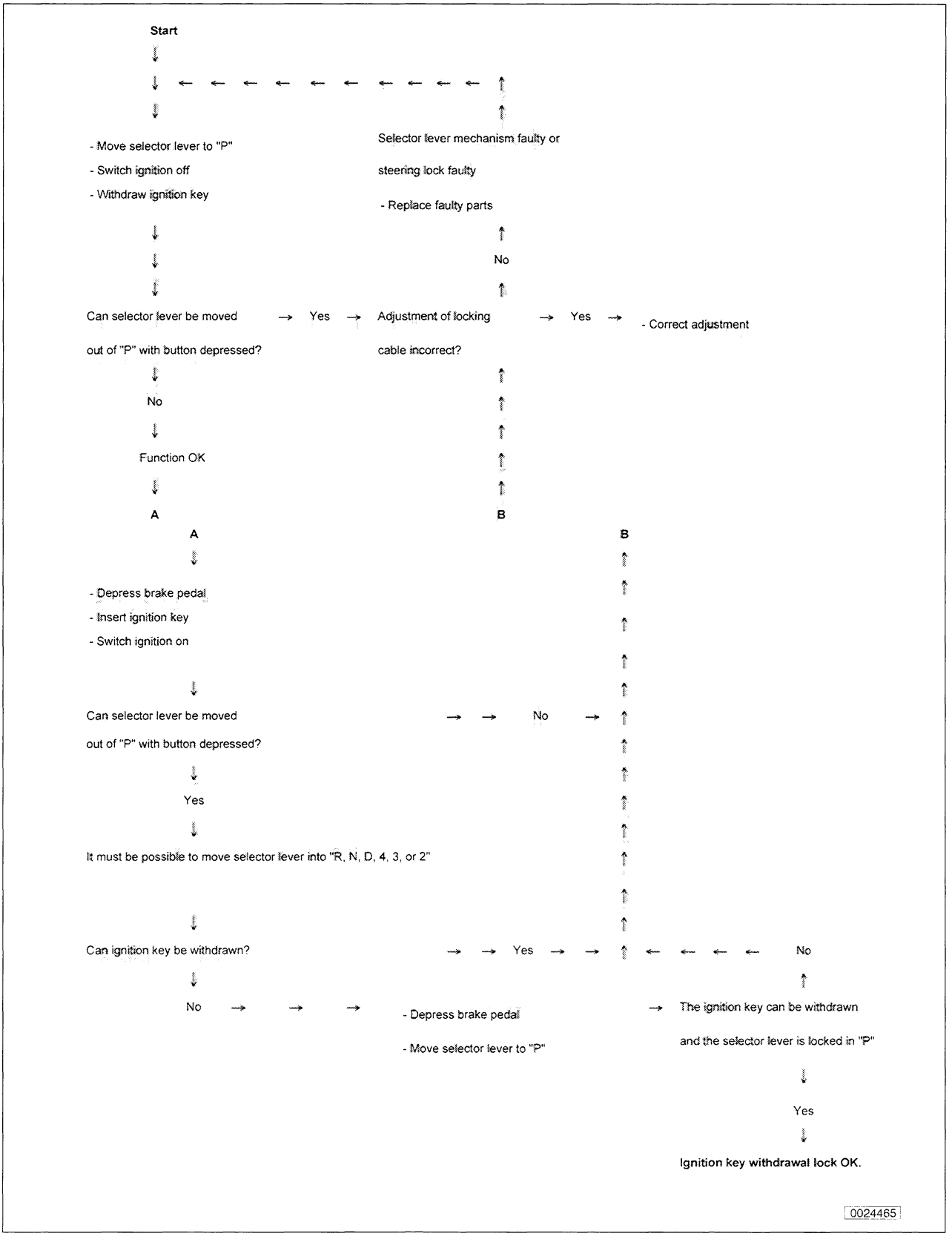
– Adjustment gauge 3352A must be easy to remove and insert when adjustment is correct. Readjust if required.

Tightening torque
- Support bracket adjustment bolt . . . . 10 Nm (7 ft-lb)

– Replace center console, extension, and removed trim.

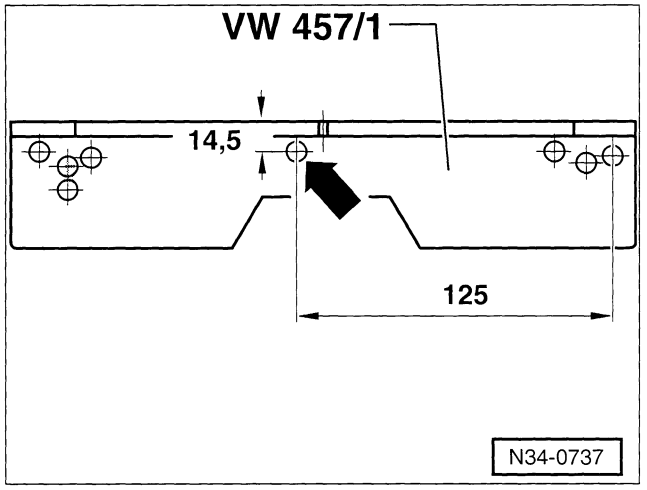
– Check shift lock operation, see **Shift lock operation, functional checking**

Shift lock operation, functional checking



TRANSMISSION, REMOVING AND INSTALLING

This section describes the removal and installation procedure for both automatic transmission 01M and 09A. Several special tools are required along with special engine lifting and jacking equipment. These are needed to support and reposition the engine as the transmission is removed from below.



Special tool, modifying (01M)

Volkswagen special tool 457/1 will need to be modified to allow attachment to the subframe for 01M transmissions.

Modify VW 457/1 by drilling an additional hole as indicated (**arrow**).

- Drill an 8.5 mm (0.335 in.) diameter hole (**arrow**) at location shown. Dimensions shown are in mm.

NOTE —

- *VW 457/1 may have been previously modified with more holes than shown.*
- *This modification is the same as that required for manual transmissions, see **34 Manual Transmission**.*

Transmission, removing (01M)

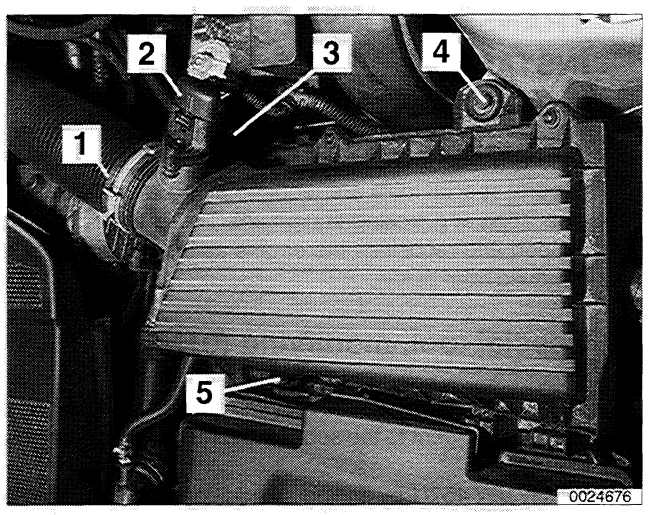
Before beginning removal, check to ensure that the required special tools or their equivalent are readily available and modified as noted.

Volkswagen recommended special tools (01M)

- 10-222A transmission support kit
- 10-222A/1 support legs
- 3094 hose clamps
- 3282 transmission support
- 3282/2 adjustment plate
- 3300A engine support
- 3336 transmission lifting beam
- VAG 1331 torque wrench
- VAG 1332 torque wrench
- VAG 1383A engine/transmission jack
- V/175 socket
- VW 457/1 support rails (modified)

NOTE —

Be sure to have the anti-theft radio code on hand before disconnecting the battery.



– Remove engine cover.

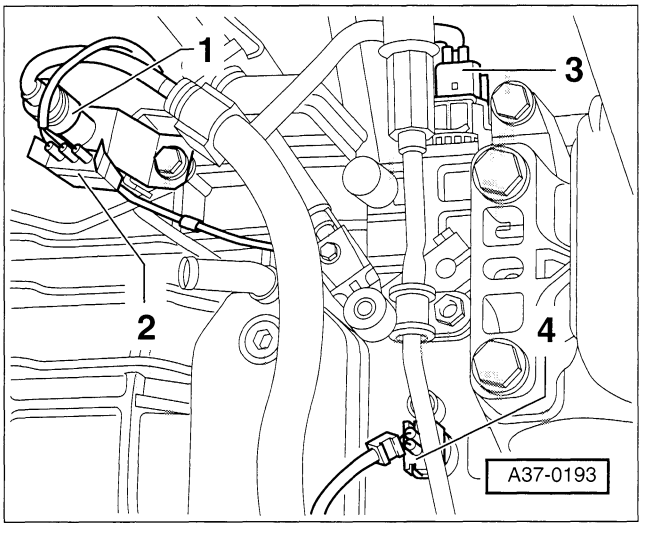
– Disconnect battery ground (GND) strap from battery negative (–) terminal. See the **Cautions** at the beginning of this repair group regarding battery disconnection.

– Disconnect battery positive (+) cable and remove battery and battery tray. See **27 Engine Electrical**.

Remove intake air hose (**1**), and harness connector (**2**), from Mass Air Flow (MAF) Sensor.

– Remove vacuum hose (**3**) to air cleaner near MAF, where equipped.

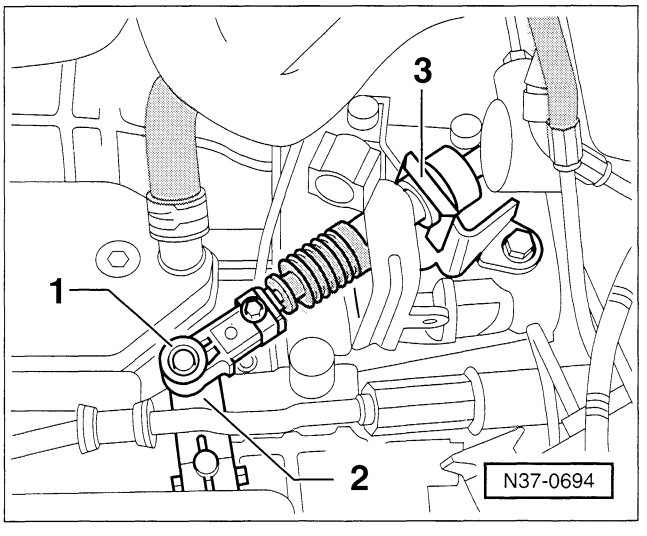
– Remove complete air cleaner housing assembly by unscrewing bolts (**4**) and (**5**).



Disconnect harness connector for solenoid valves (**1**), vehicle speed sensor (**2**), Transmission Range (TR) switch (**3**), and transmission Vehicle Speed Sensor (VSS) (**4**).

NOTE —
Disconnect TR switch and transmission VSS from extension harness connections on top of transmission if equipped and move wiring to the side.

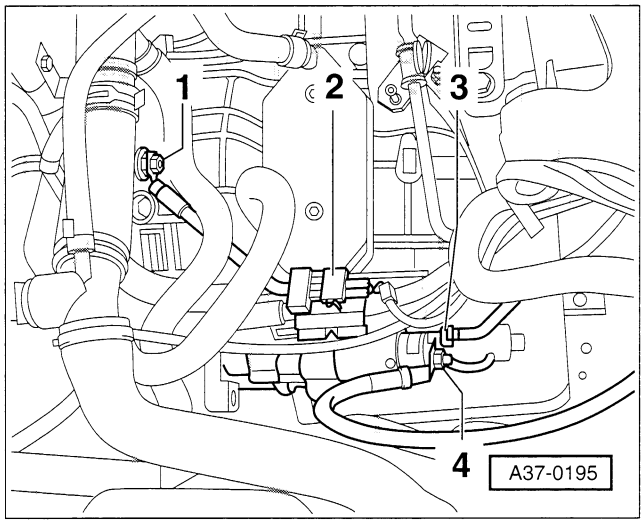
– Remove bracket for power steering hose with retainer for wiring harness from transmission.



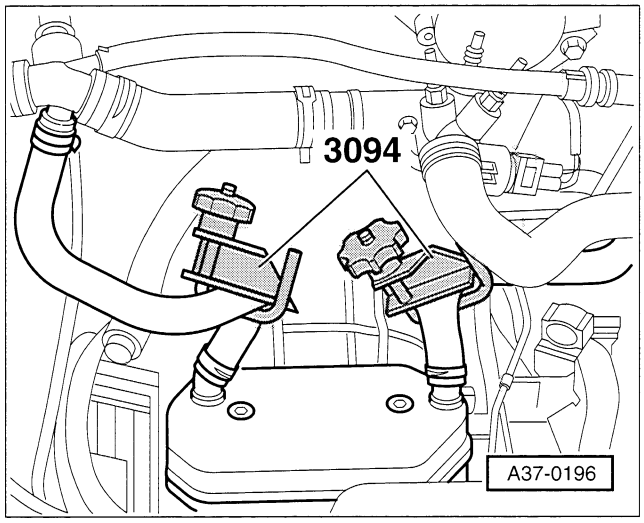
Move selector lever to park, **P**. Using a screwdriver, pry selector lever cable (**1**) off selector shaft lever (**4**). Adjustment bolt (**2**) should not be loosened.

– Remove clip (**3**) at selector lever cable support bracket and remove selector lever cable.

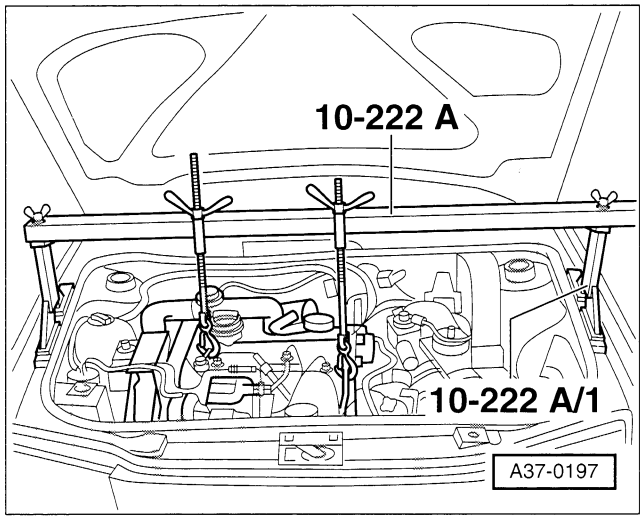
NOTE —
Do not bend or kink selector lever cable.



- For all vehicles, disconnect ground cable (**1**) from upper engine/transmission bolt, electrical connections at starter motor (**3**, **4**), and harness connector on top of starter motor (**2**).
- Pull harness connector out of retainer on top of starter motor and remove retainer.
- Remove upper starter mounting bolt.

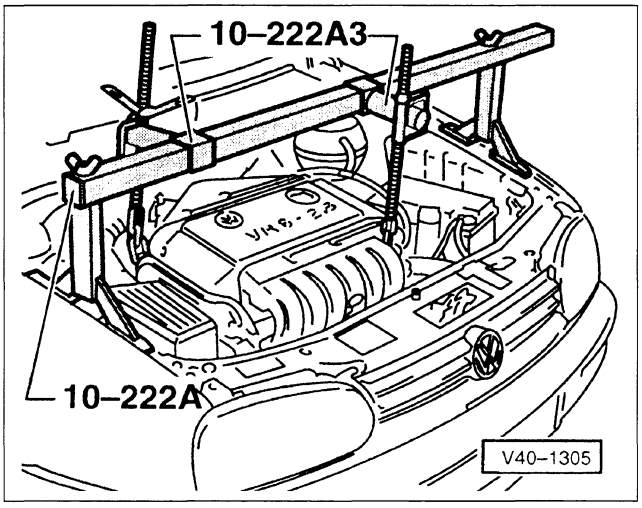


- Clamp-off ATF cooler hoses with special tool 3094 clamps or equivalent and detach at ATF cooler. Seal ATF cooler with clean plugs.
- Remove upper engine/transmission bolts.



- On 4-cylinder engines, attach engine support tool 10-222A with appropriate adapters and legs as shown. Adjust the support until the weight of the engine is fully supported.

> ***WARNING —***
> - *Before installing the engine lifting hooks, disconnect all hoses and wiring in the vicinity of the engine lifting eyes, to prevent damage.*
> - *Do not position engine sling legs on the fender mounting bolts.*



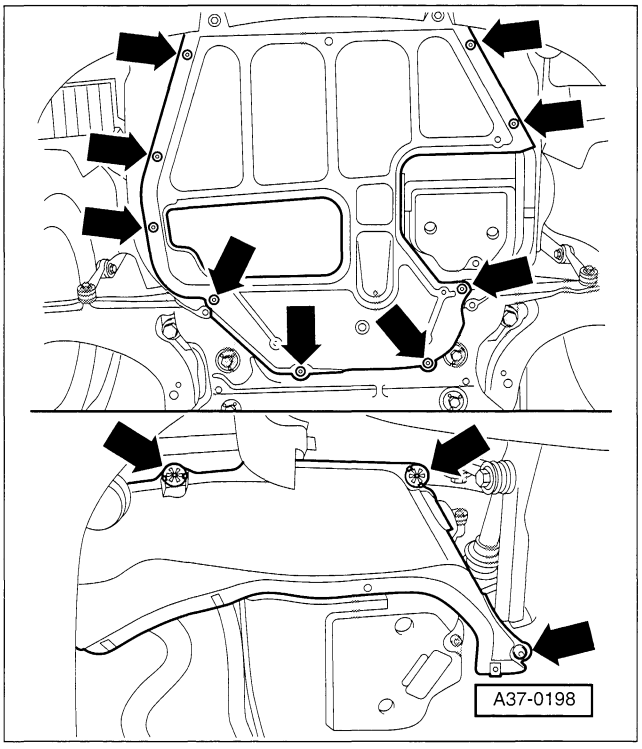
On 6-cylinder engines, attach engine support tool 10-222A with appropriate adapters and legs as shown. As with 4-cylinder engines, adjust the support until the weight of the engine is fully supported.

– Loosen left front wheel bolts.

– Raise vehicle and support with suitable jack stands or lift. See **0 Maintenance** for proper lifting procedure.

> ***WARNING —***
> *Observe all warnings and cautions associated with lifting vehicle in **0 Maintenance**.*

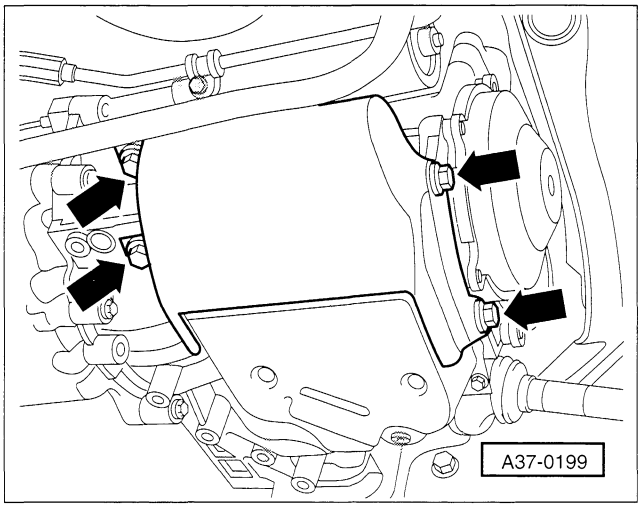
– Remove left front wheel.



Remove left lower and center sound absorber panels (belly pans) (**arrows**).

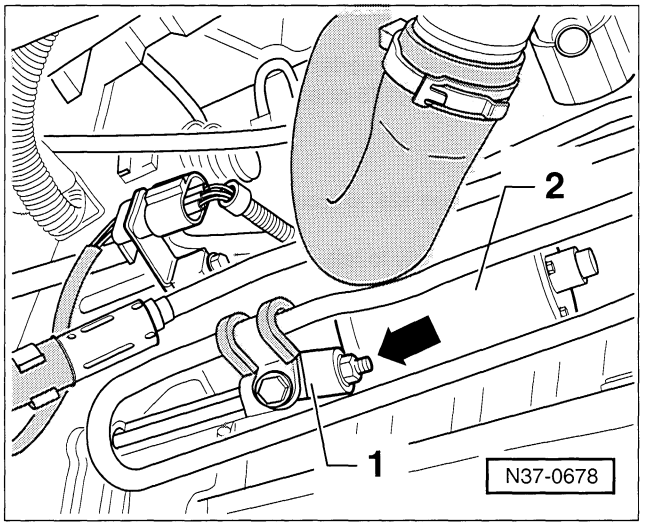
> ***NOTE —***
> *Some sound insulator fasteners are best removed and re-installed with long needle nose pliers.*

– On vehicles with 1.9L TDI engine, remove intake air duct between intake air cooler and turbocharger, see **21 Turbocharger and Intercooler**.



Remove bolts (**arrows**) for forward transmission/ATF oil pan shield.

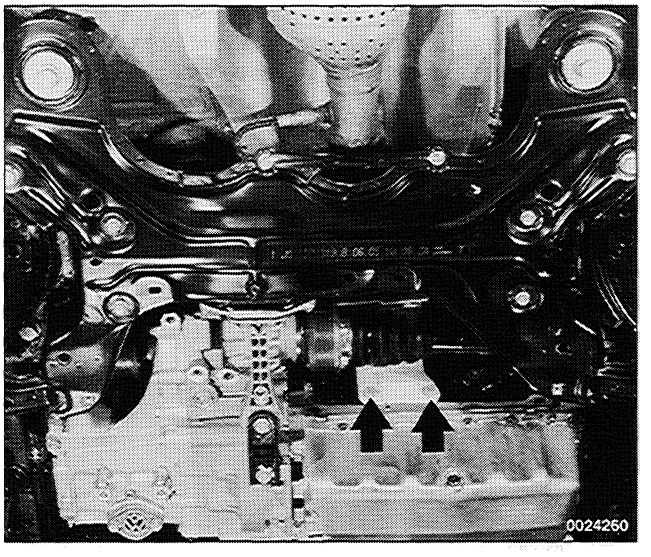
TRANSMISSION, REMOVING AND INSTALLING



➤ Remove bracket (**1**) for power steering pressure line near lower starter mounting bolt (**arrow**).

– Remove lower starter mounting bolt and starter (**2**).

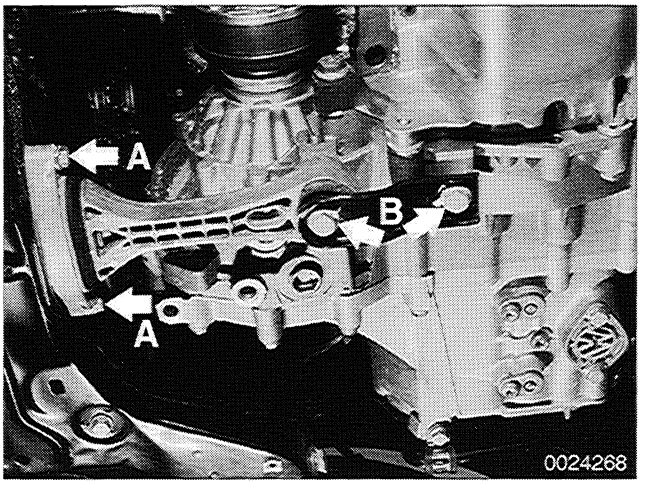
NOTE —
Use care not to bend, kink, or damage the power steering line.



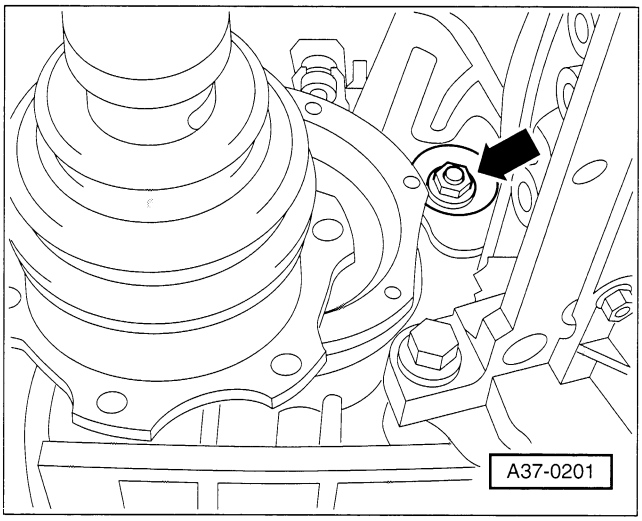
➤ Remove right inner drive axle boot shield (**arrows**) from engine, if installed.

– Unbolt both drive shafts at transmission drive flanges and secure (tie) up as high as possible.

NOTE —
When tying up axle shafts use care not to damage the paint on the body panels or the axles, or the axle boots.



➤ Remove bolts for pendulum mount (**arrows A** and **B**).

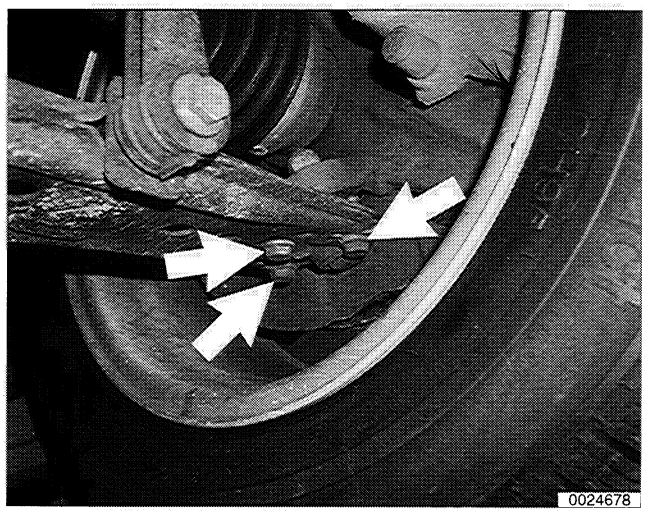


– Remove access cap for torque converter nuts.

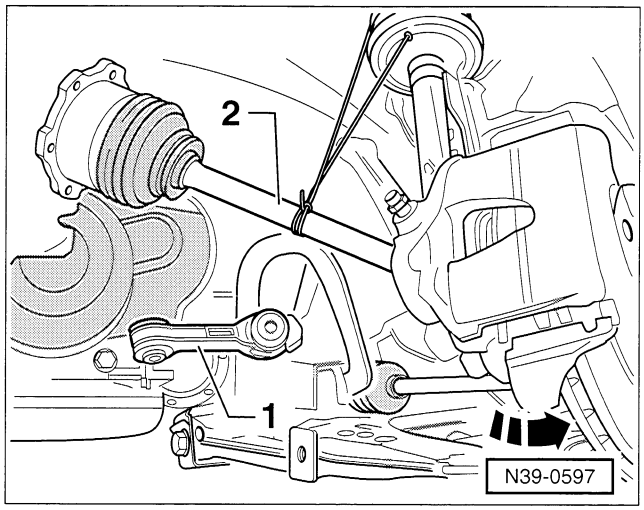
➢ Remove torque converter nuts (**arrow**) (quantity 3) with special socket (V/175 or equivalent).

NOTE —
Turn crankshaft 120° to access each nut.

– Turn steering fully to left.

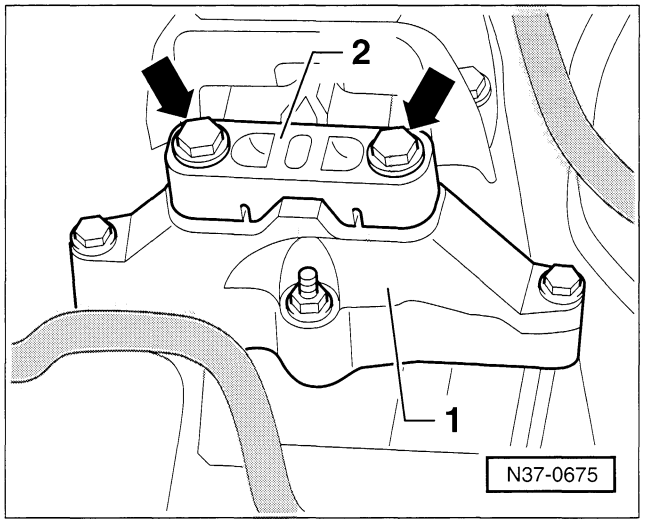


➢ Mark installation position of ball joint bolts (**arrows**) on left control arm and remove left control arm bolts.



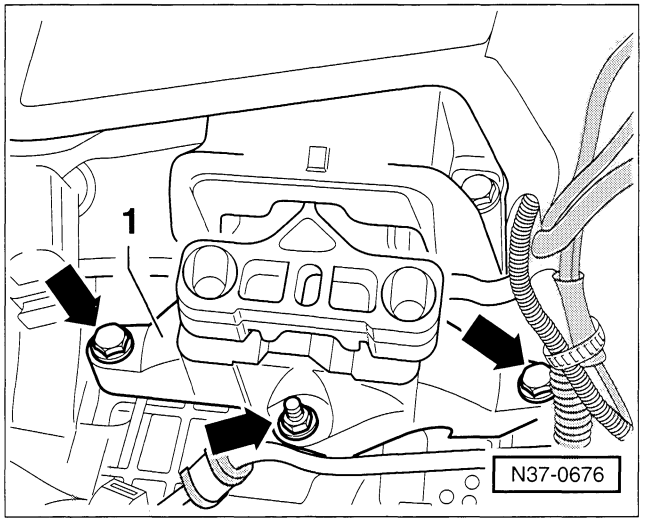
➢ Unbolt left stabilizer connecting link (**1**) from control arm and turn connecting link upward. Swing wheel bearing housing outward and guide left drive shaft (**2**) out between subframe and transmission.

– Lift drive shaft and secure to suspension strut with wire as shown.



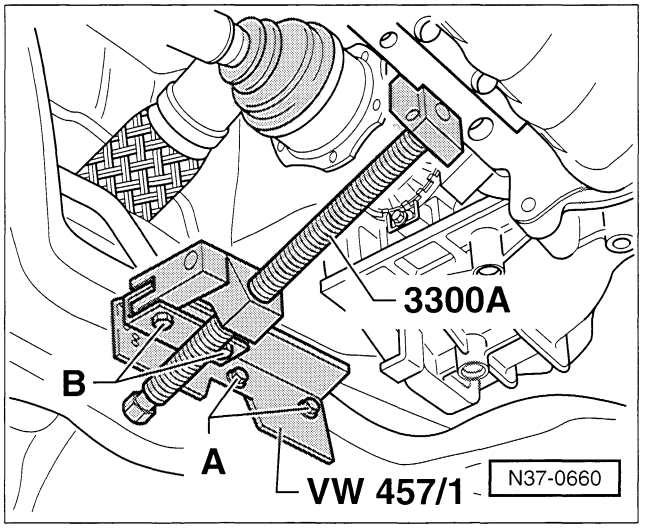
➢ Remove mounting bolts (**arrows**) for left engine/transmission mount (**2**) from support (**1**).

– Carefully tilt the engine/transmission assembly down by approximately 60 mm (2¼ in.) by turning the large wing nuts on the left side of the support bar.



➢ Remove left mount and support (**1**) from transmission (**arrows**).

– Disconnect exhaust at down pipe. Remove front exhaust support if necessary, see **26 Exhaust System/Emission Controls**.



➢ Working from underneath vehicle, bolt modified support rail VW457/1 to both pendulum support securing holes on subframe with spacers totalling 6 mm between subframe and support rail (**A**). Bolts must be M8x25.

– Secure support 3300A to support rail VW457/1 with bolts (**B**) and extend to engine as shown.

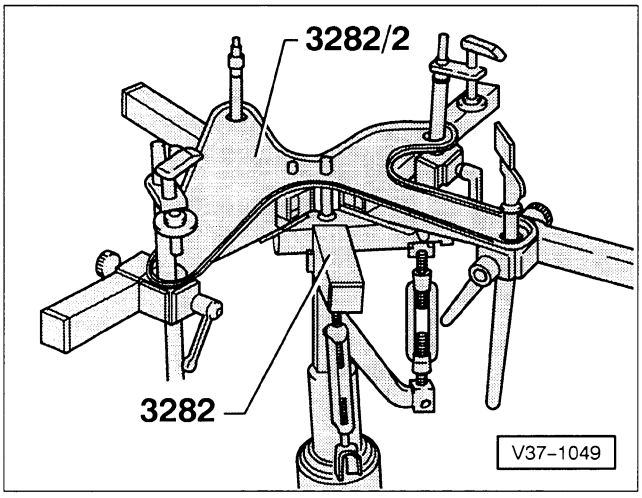
NOTE —

- *Volkswagen special tool 457/1 must have been previously modified as described earlier under* **Special tools, modifying**.
- *Spacers totaling a thickness of 6 mm must be inserted between the subframe and the support rail VW 457/1.*

– Carefully push engine/transmission assembly forward using a wrench on end of threaded section of 3300A.

NOTE —

Take care to avoid damage to power steering hydraulic lines when moving engine/transmission assembly.

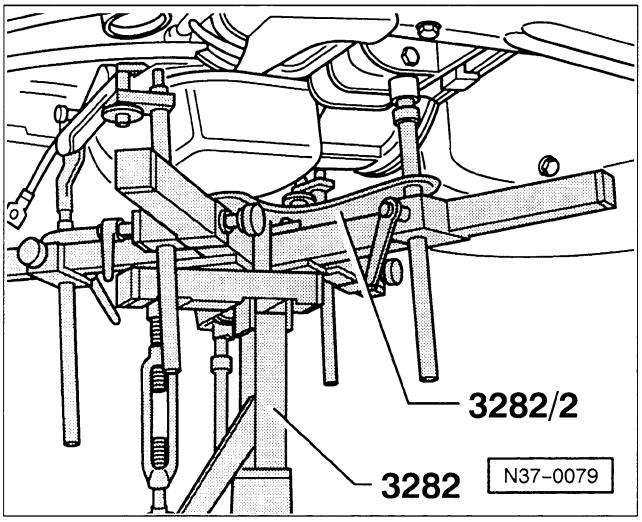


➢ Assemble transmission jack with transmission support fixture 3282, 3282/2 adjustment plate (marked 096/01M), and support/clamping elements.

- Place adjustment plate 3282/2 on support fixture 3282 noting that plate fits properly in one direction only and that embossed arrow points to the front of the vehicle.
- Align arms of support fixture with holes in adjustment plate and attach pins to arms as indicated on plate

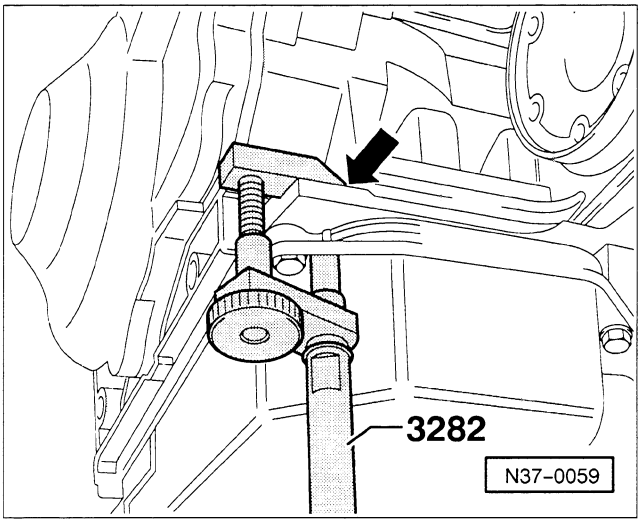
NOTE —

Arrow on adjustment plate 3282/2 must point toward front of vehicle.

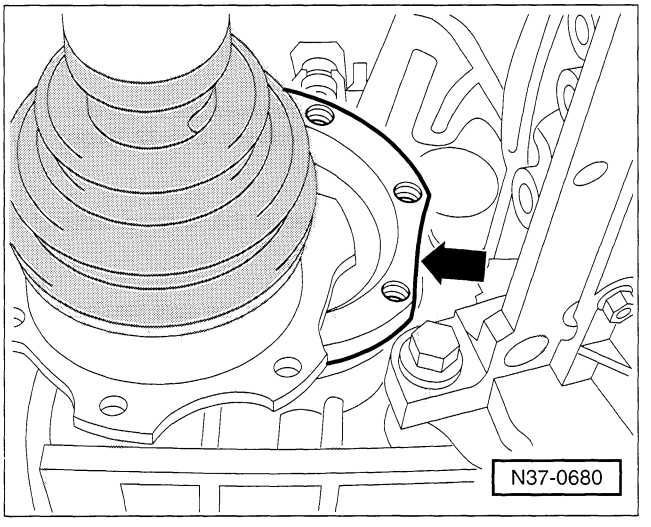


➢ Place assembled transmission jack under transmission.

– Align adjustment plate to transmission and lock safety supports on transmission jack.



➢ Place safety support pin (**arrow**) on oil pan and secure it to transmission housing.



➢ Turn right side transmission drive flange until the flat section (**arrow**) is vertical.

– Remove lower engine/transmission securing bolts.

> ***WARNING —***
> *Before unbolting lower engine-to-transmission mounting bolts be sure to support the weight of the vehicle at all four corners with jack stands designed for that purpose. Removal of the transmission can upset the weight balance of the vehicle and cause it to fall off the lift.*

– Separate transmission from engine while pushing torque converter away from drive plate so that it stays within the transmission bell housing.

> ***WARNING —***
> *The torque converter should come off with the transmission. Secure the torque converter to the transmission to prevent damage.*

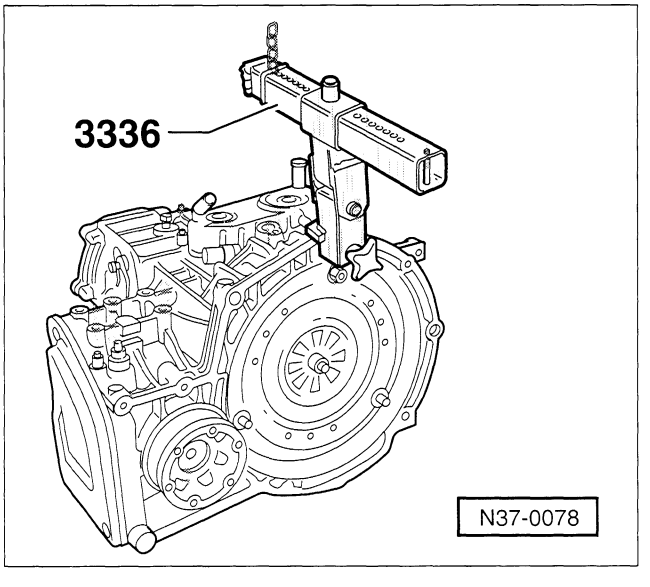
– Lower transmission slightly.

> ***NOTE —***
> *While lowering transmission, guide power steering hydraulic line past transmission.*

– Tilt transmission by turning the large wing nuts on the left side of the support bar. While lowering, ensure transmission end cover is guided closely past wheel housing.

– Swivel transmission and carefully lower.

> ***NOTE —***
> - *While lowering transmission, guide right axle joint at engine past support 3300 A.*
> - *Be careful not to let multi-function switch contact engine/transmission mount.*
> - *Secure torque converter to prevent it from falling out.*

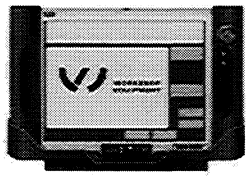


Transmission, transporting (01M)

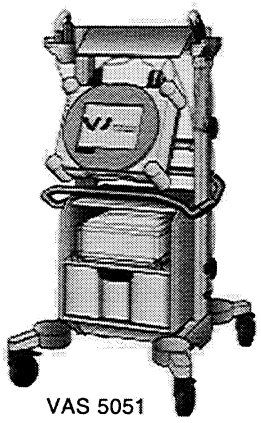
Due to size, bulk, and especially weight, the transmission is best moved by fitting the adjustable transmission lifting beam, 3336. Use of this support in conjunction with a suitable shop crane will minimize the chance of damage to the transmission.

➢ Position support arm on sliding piece with locking pin so that 8 holes are visible.

– Lift transmission with 3336 attached with a suitable shop crane and transport to work area or shipping container to avoid personal injury and/or damage to transmission.



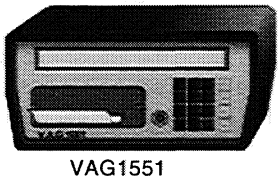
VAS 5052



VAS 5051



VAG 1552



VAG1551

0024463

Transmission, installing (01M)

NOTE —
If torque converter has been removed, the torque converter seal will need to be replaced. See ***32 Torque Converter.***

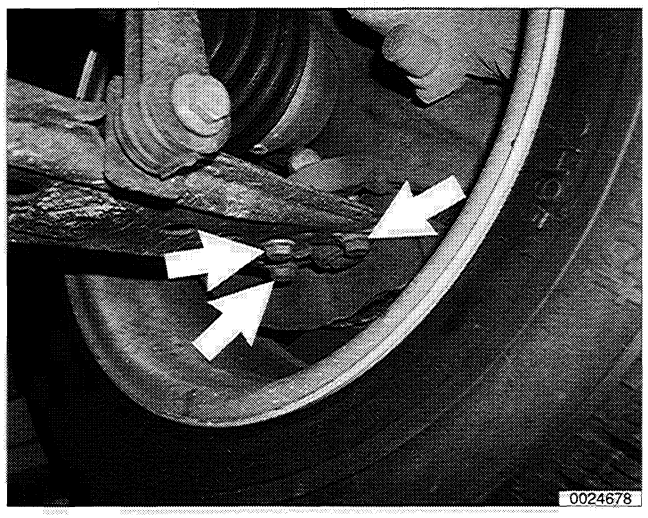
The transmission is installed in the reverse order of removal, noting the following:

- When installing torque converter, be sure that both drive pins engage in the ATF pump inner wheel recesses.
- Before installing transmission, be sure that the dowel sleeves are correctly located.
- When installing transmission, check that torque converter contact is properly positioned on drive plate.
- Replace selector cable locking circlip.
- Adjust selector lever cable, see **Selector lever cable, checking and adjusting (01M)**.
- Check and top up ATF level.
- Connect scan tool VAG 1551/1552, VAS 5051/5052 or equivalent, or scan tool computer program and check diagnostic trouble code memory and initiate basic settings.
- Have the front wheels professionally aligned once installation is complete.
- When installing transmission, ensure that mounts and bolts are installed without any pre-load, tension, or stress.

Use the following tightening torques when installing the automatic transmission. Note that some bolts are torque-to-yield, or stretch bolts and must be replaced as noted.

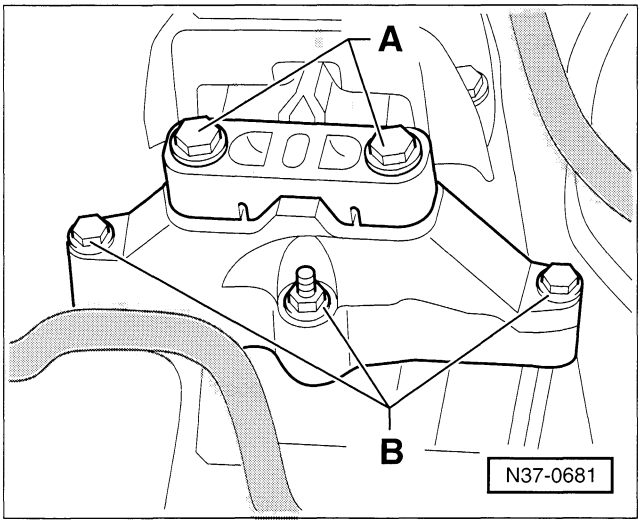
Tightening torques

- Drive shaft to transmission drive flange (tighten diagonally)
  - Stage I . . . . . 10 Nm (7½ ft-lb)
  - Stage II (M8) . . . . . 40 Nm (30 ft-lb)
  - Stage II (M10) . . . . . 70 Nm (52 ft-lb)
- Torque converter to drive plate. . . . . 60 Nm (44 ft-lb)
- Transmission to engine
  - (M10) . . . . . 60 Nm (44 ft-lb)
  - (M12) . . . . . 80 Nm (59 ft-lb)
- Transmission to oil pan (M10) . . . . . 25 Nm (18 ft-lb)
- Connecting link to control arm . . . . . 45 Nm (33 ft-lb)
- Wheel bolts to wheel hub. . . . . 120 Nm (89 ft-lb)
- Protective cover for drive axle boot to engine block. . . . . 35 Nm (26 ft-lb)



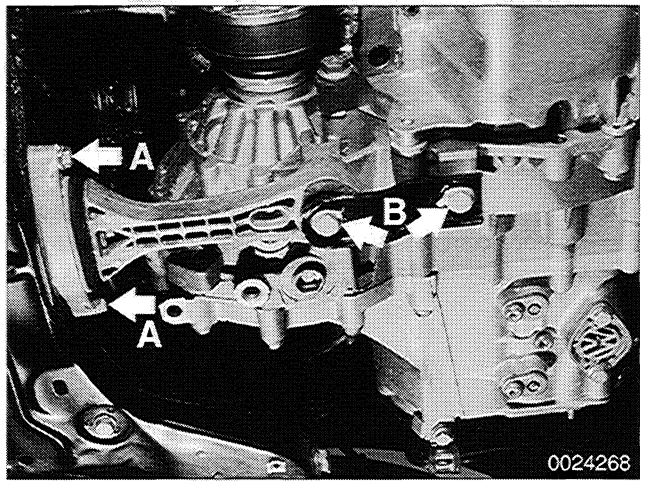
Replace bolts (**arrows**) for ball joint to control arm.

Tightening torque
Always replace bolts
- Ball joint to control arm . . . . . 20 Nm (15 ft-lb) plus ¼ turn (90°)



Replace bolts for transmission mount (**A**) and support (**B**).

Tightening torque
Always replace bolts
- Transmission mount (**A**) . . . . . 60 Nm (44 ft-lb) plus ¼ turn (90°)
- Transmission support (**B**) . . . . . 40 Nm (30 ft-lb) plus ¼ turn (90°)



Replace bolts for pendulum mount to body and pendulum mount bracket (**A**) and support (**B**).

Tightening torque
Always replace bolts
- Pendulum mount to body (**A**) . . . . . 20 Nm (15 ft-lb) plus ¼ turn (90°)
- Pendulum mount bracket (**B**) . . . . . 40 Nm (30 ft-lb) plus ¼ turn (90°)

Transmission, removing (09A)

Before beginning removal, check to ensure that the required special tools or their equivalent are readily available and modified as noted.

Volkswagen recommended special tools (01M)

- 10-222A transmission support kit
- 10-222A/2 hooks
- 10-222A/3 supports
- 10-222A/8 support legs
- 10-222A/12 shackles
- 3094 hose clamps
- 3282 transmission support
- 3282/32 adjustment plate
- 3300A engine support
- 3336 transmission lifting beam
- VAG 1331 torque wrench
- VAG 1332 torque wrench
- VAG 1383A engine/transmission jack
- V/175 socket
- T10099 multi-point bit, 12 mm
- T10099/1 multi-point bit, 14 mm
- T10036 support rails

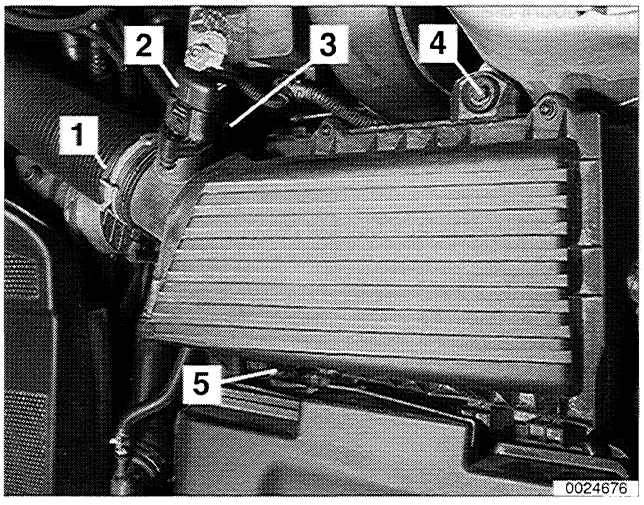
NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.

– Place selector lever into the P position.

– Remove engine cover.

– Disconnect battery ground (GND) strap from battery negative (–) terminal. See the **Cautions** at the beginning of this repair group regarding battery disconnection.

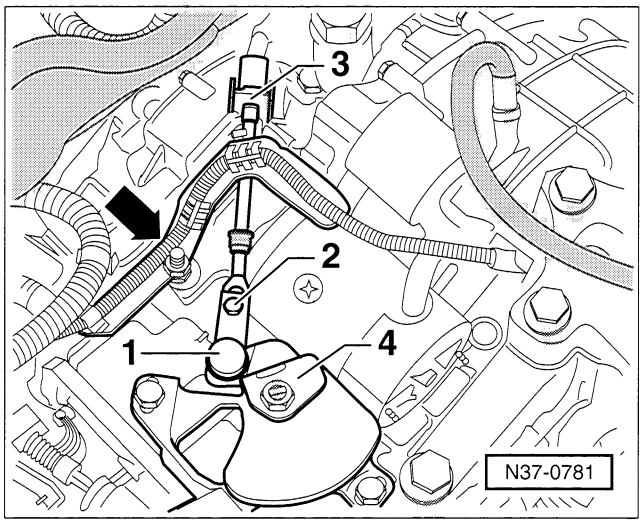
– Disconnect battery positive (+) cable and remove battery and battery tray. See **27 Engine Electrical**.



➢ Remove intake air hose (**1**), and harness connector (**2**), from Mass Air Flow (MAF) Sensor.

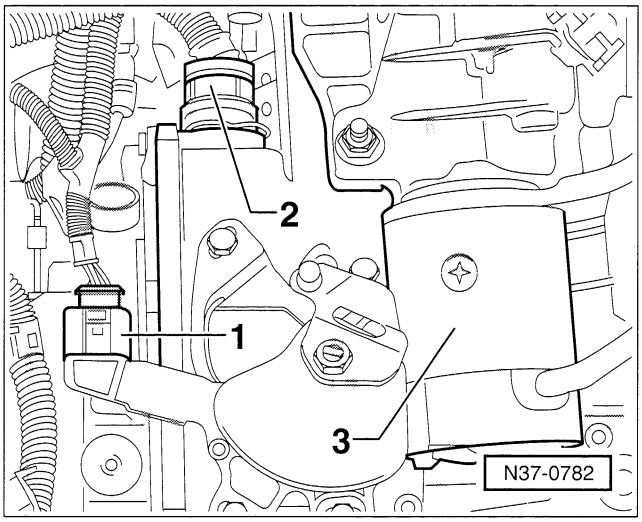
– Remove vacuum hose (**3**) to air cleaner near MAF, where equipped.

– Remove complete air cleaner housing assembly by unscrewing bolts (**4**) and (**5**).

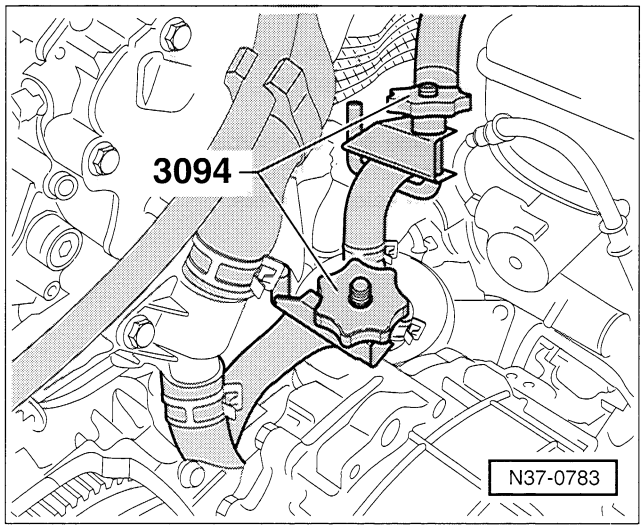


- Remove harness retainer (arrow) from transmission.
- Move selector lever to park, **P**. Using a screwdriver, pry selector lever cable (**1**) off selector shaft lever (**4**). Adjustment bolt (**2**) should not be loosened.
- Remove clip (**3**) at selector lever cable support bracket and remove selector lever cable.

NOTE —
Do not bend or kink selector lever cable.

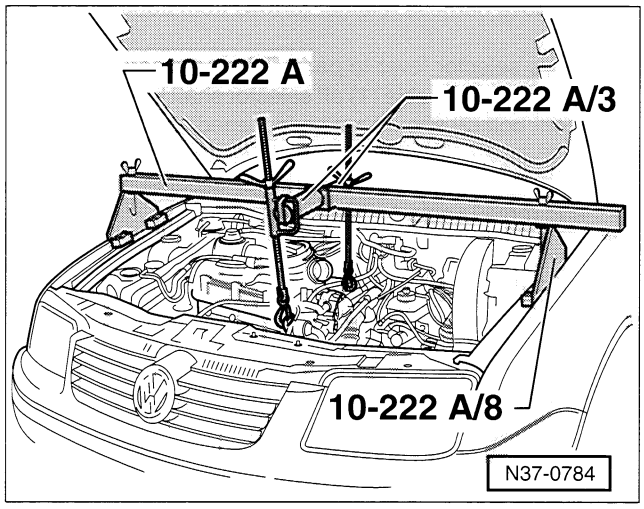


- Disconnect harness connector for Transmission Range (TR) switch (**1**).
- Turn locking lever (**2**) and disconnect harness connector for transmission wiring harness.
- Disconnect electrical connections on starter motor.
- Remove starter (**3**). See **27 Engine Electrical**.



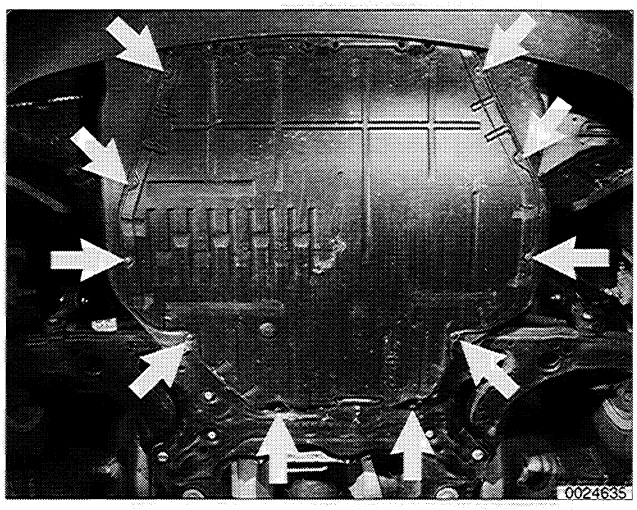
- Clamp-off ATF cooler hoses with special tool 3094 clamps or equivalent and detach at ATF cooler. Seal ATF cooler with clean plugs.
- Remove upper engine/transmission bolts with multi-point bit T10099/1 or equivalent.
- Disconnect fuel line/fuel hose from cylinder head cover.
- Check for interference with hose and cable connections in area of engine mounting eye near attaching point for support 10-222A. Remove or reposition as required.

WARNING —
- *Before installing the engine lifting hooks, disconnect all hoses and wiring in the vicinity of the engine lifting eyes, to prevent damage.*
- *Do not position engine sling legs on the fender mounting bolts.*



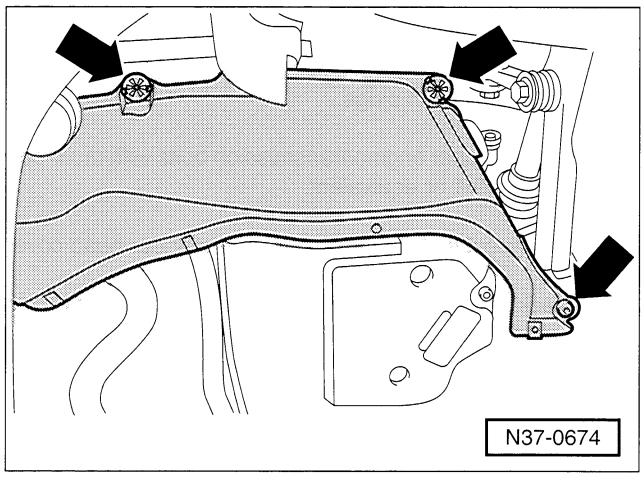
- Attach engine support tool 10-222A with appropriate adapters and legs as shown. Adjust the support until the weight of the engine is fully supported.
- Remove left front wheel bolts.
- Raise vehicle and support with suitable jack stands or lift. See **0 Maintenance** for proper lifting procedure.

> ***WARNING —***
> *Observe all warnings and cautions associated with lifting vehicle in **0 Maintenance**.*

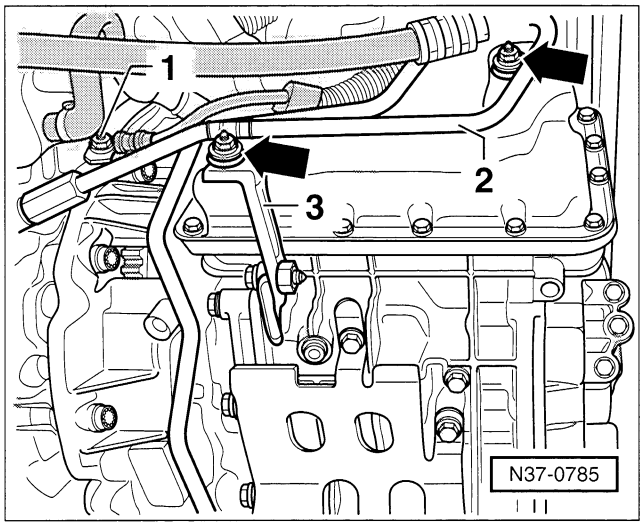


- Remove center sound absorber panels (belly pans) (**arrows**).

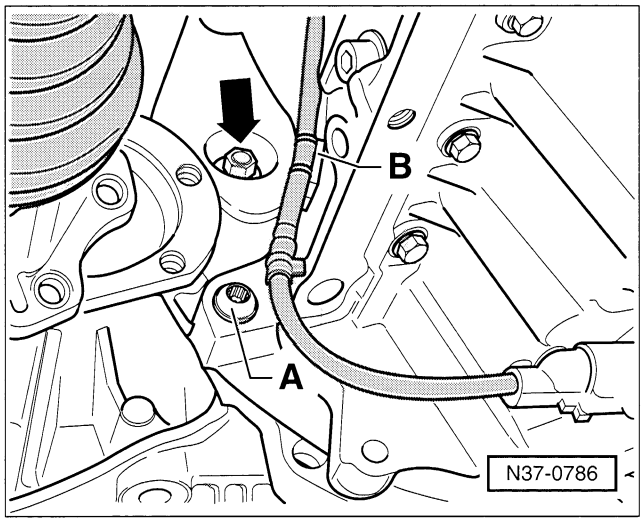
> ***NOTE —***
> *Some sound insulator fasteners are best removed and re-installed with long needle nose pliers.*



- Remove left sound absorber panel (belly pan) (**arrows**).
- Remove intake air duct between intake air cooler and turbocharger from body support.
- Remove right side sound absorber panel.remove front exhaust system with catalytic converter. See **26 Exhaust System and Emission Controls**.



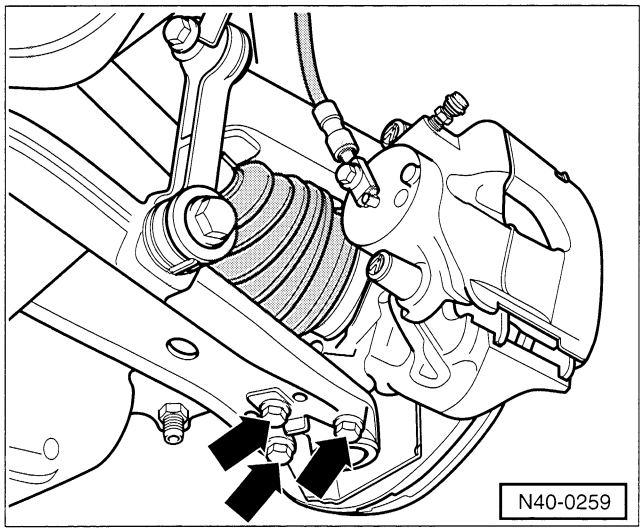
- Remove ground strap (**1**) from retainer on transmission.
- Remove power steering hydraulic line (**2**) from rear of transmission (**arrows**).
- Remove retainer (**3**).
- Remove power steering hydraulic line from rear of transmission (in area of pendulum support) and secure (tie) out of the way with wire.
- Remove retaining bracket from valve body cover.
- Unbolt both drive shafts at transmission drive flanges and secure (tie) up as high as possible.



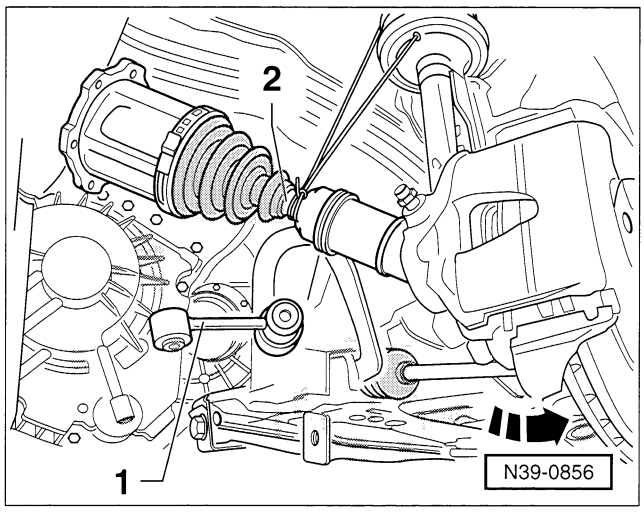
- Remove lower rear engine/transmission securing bolt (**A**).
- Remove access cap for torque converter nuts.
- Remove torque converter nuts (**arrow**) (quantity 3) with special socket (V/175 or equivalent).

NOTE —
Turn crankshaft 120° to access each nut.

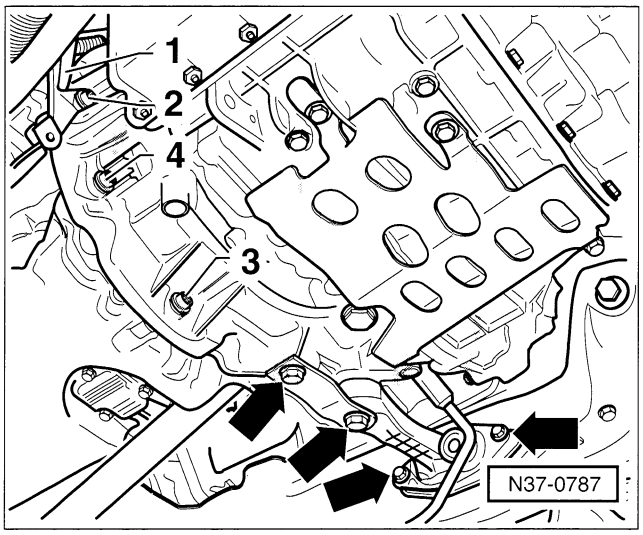
- Loosen retainer (**B**) for oil level/temperature sensor cable and turn to the side.
- Turn steering fully to left.



- Mark installation position of ball joint bolts (**arrows**) on left control arm and remove left control arm bolts.



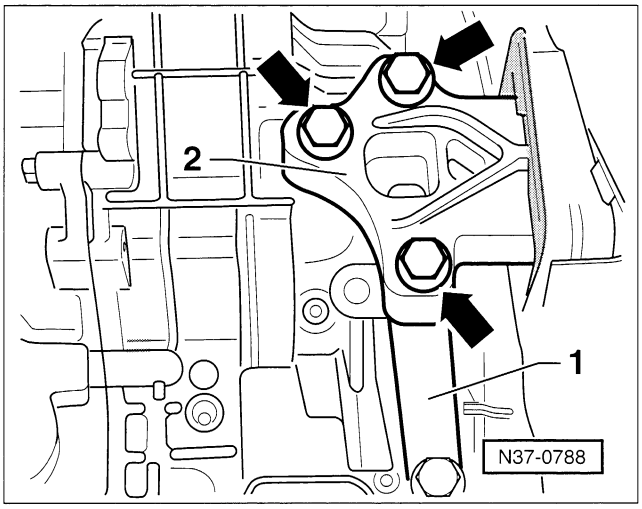
- Unbolt left stabilizer connecting link (**1**) from control arm and turn connecting link upward. Swing wheel bearing housing outward and guide left drive shaft (**2**) out between subframe and transmission.
- Lift drive shaft and secure (tie) to suspension strut with wire as shown.



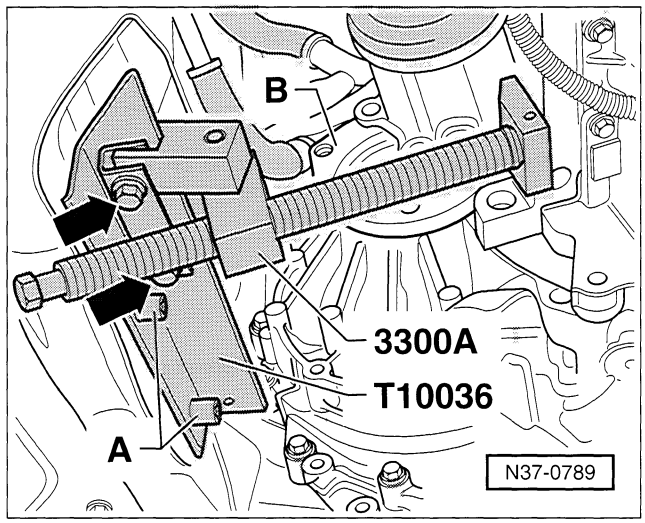
- Remove lower engine/transmission bolts (**2, 3**).
- Remove ground strap retainer (**1**) from transmission.
- Remove transmission shield/

NOTE —
*Do not remove bolt (**4**) at this time.*

- Remove pendulum support.

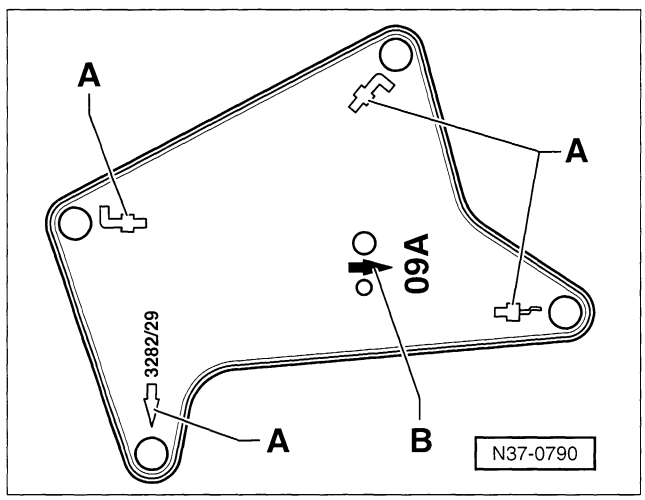


- Remove left assembly (**2**) mounting bolts (**arrows**) from left mount (**1**).
- Carefully tilt the engine/transmission assembly down by approximately 90 mm (3 $^{5}/_{8}$ in.) by turning the large wing nuts on the left side of the support bar.



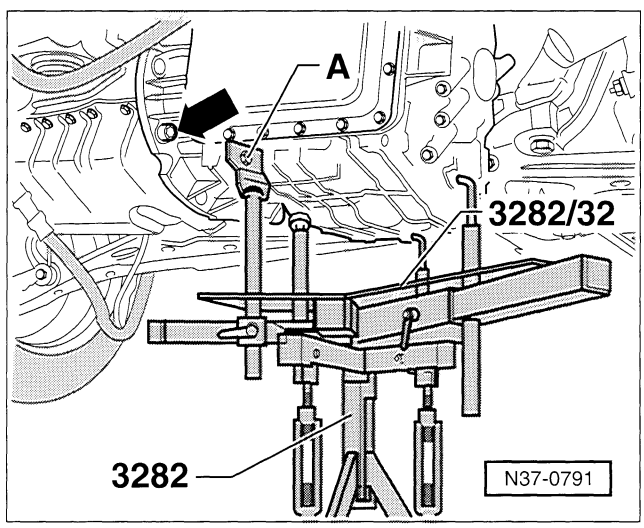
- Turn right side transmission drive flange (**B**) until the flat section is vertical.
- Bolt support rail T10036 to both pendulum support securing holes on subframe (**A**) and tighten.
- Secure support 3300A to support rail T10036 with bolts (**arrows**) and extend to engine as shown.
- Carefully push engine/transmission assembly forward using a wrench on end of threaded section of 3300A.

NOTE —
Take care to avoid damage to power steering hydraulic lines when moving engine/transmission assembly.



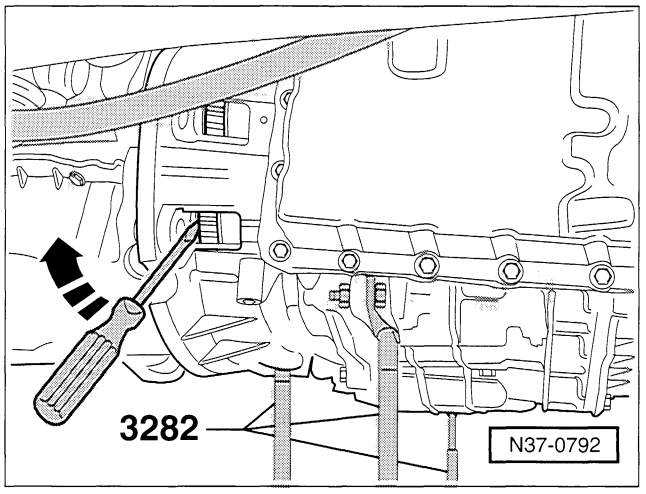
- Assemble transmission jack with transmission support fixture 3282, 3282/32 adjustment plate (marked 09A), and support/clamping elements.
  - Place adjustment plate 3282/32 on support fixture 3282 noting that plate fits properly in one direction only and that embossed arrow points to the front of the vehicle.
  - Align arms of support fixture with holes in adjustment plate and attach pins to arms as indicated on plate
  - Symbols on plate (**A**, **B**) indicate type of clamps required.

NOTE —
Arrow on adjustment plate 3282/32 must point toward front of vehicle.



- Place assembled transmission jack under transmission.
- Align adjustment plate to transmission and lock safety supports on transmission jack.
- Secure transmission to support 3282 with bolt (**A**).
- Remove engine/transmission bolt (**arrow**).

WARNING —
Before unbolting lower engine-to-transmission mounting bolts be sure to support the weight of the vehicle at all four corners with jack stands designed for that purpose. Removal of the transmission can upset the weight balance of the vehicle and cause it to fall off the lift.



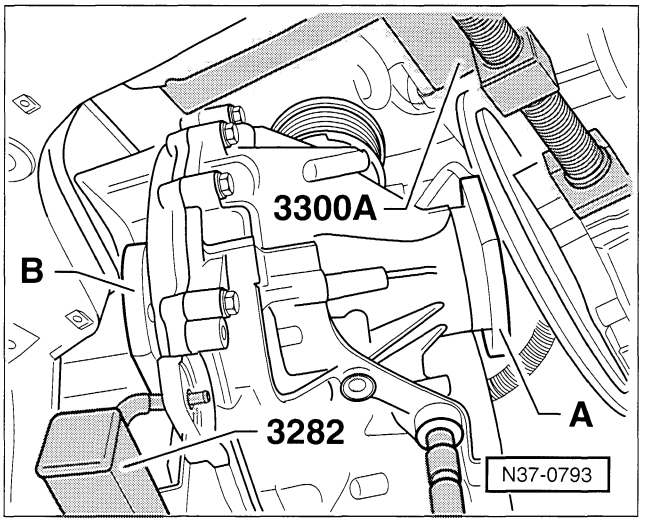
➢ Separate transmission from engine while pushing torque converter away from drive plate (**dashed arrow**) so that it stays within the transmission bell housing.

> ***WARNING —***
> *The torque converter should come off with the transmission. Secure the torque converter to the transmission to prevent damage.*

– Lower transmission slightly.

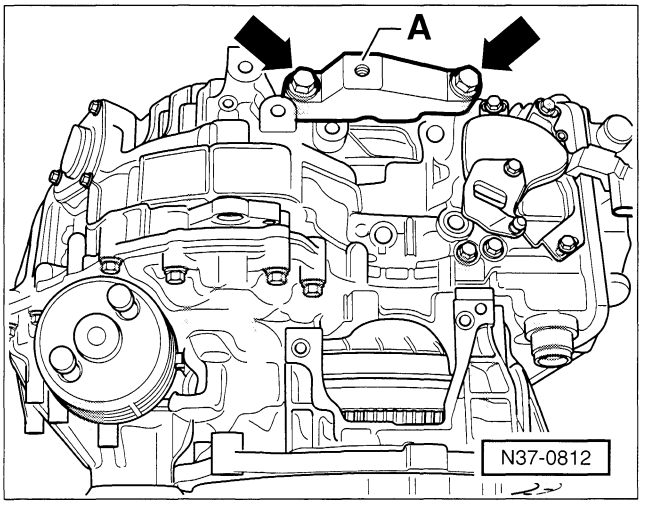
NOTE —
While lowering transmission, guide power steering hydraulic line past transmission.

– Swing transmission towards subframe.

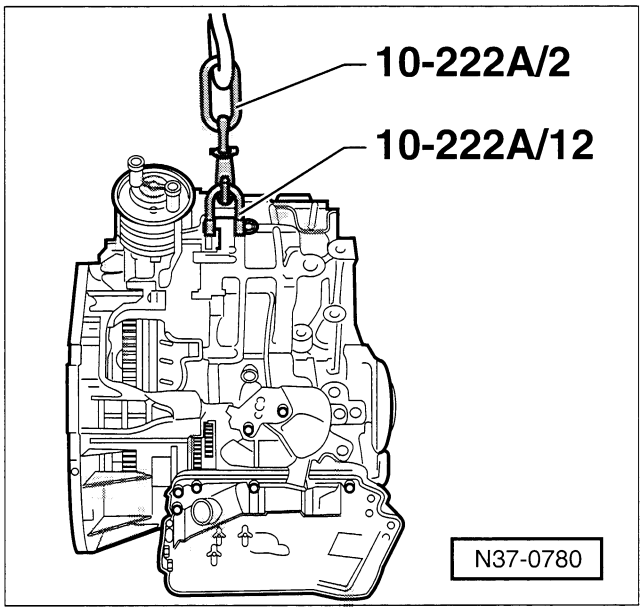


➢ Lower transmission carefully and guide right side drive flange shaft (**A**) in area of engine drive plate and left side drive flange (**B**) out past subframe.

NOTE —
- *While lowering transmission, use transmission support 3282 to change tilt angles.*
- *Secure torque converter to prevent it from falling out.*



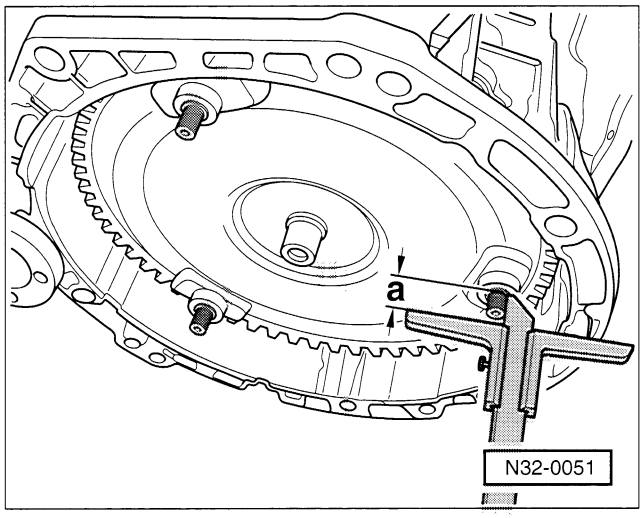
➢ If transmission is to be replaced, unbolt (**arrows**) original mount (**A**) and transfer to new unit.



Transmission, transporting (09A)

Due to size, bulk, and especially weight, the transmission is best moved by fitting the lifting hooks, 10-222A/2 and 10-222A/12. Use of this support in conjunction with a suitable shop crane will minimize the chance of damage to the transmission.

➢ Lift transmission with a suitable shop crane and transport to work area or shipping container to avoid personal injury and/or damage to transmission.



Transmission, installing (09A)

The transmission is installed in the reverse order of removal, noting the following:

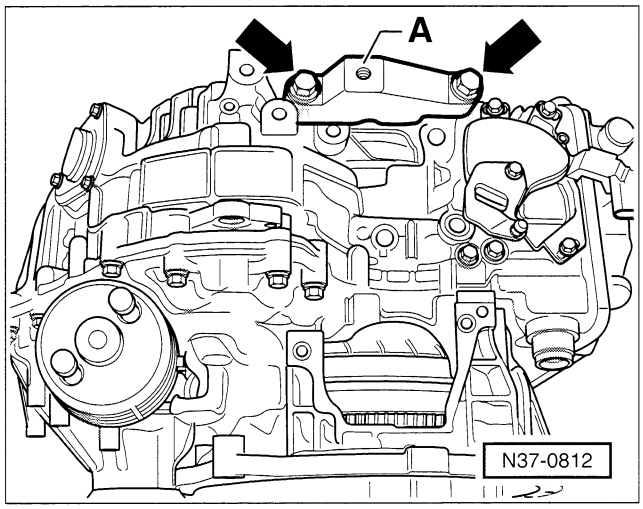
– Install torque converter.

➢ The torque converter is installed correctly when the distance (**a**) between the transmission housing flange and the machined contact surface for the securing studs is as specified.

- 21 mm (0.827 in) for 4-cylinder engines
- 17 mm (0.669 in) for 6-cylinder engines

– If distance (**a**) is not correct, torque converter is not properly installed. Slide converter out and reposition until correct distance is obtained.

NOTE —
When installing transmission into vehicle, be sure that torque converter does not move. If torque converter slips out, installation distance may change and transmission can not be installed.



➢ If transmission is to be replaced, unbolt (**arrows**) original mount (**A**) and transfer to new unit.

– Before installing transmission, be sure that the dowel sleeves are correctly located.

– When installing transmission, check that torque converter contact is properly positioned on drive plate.

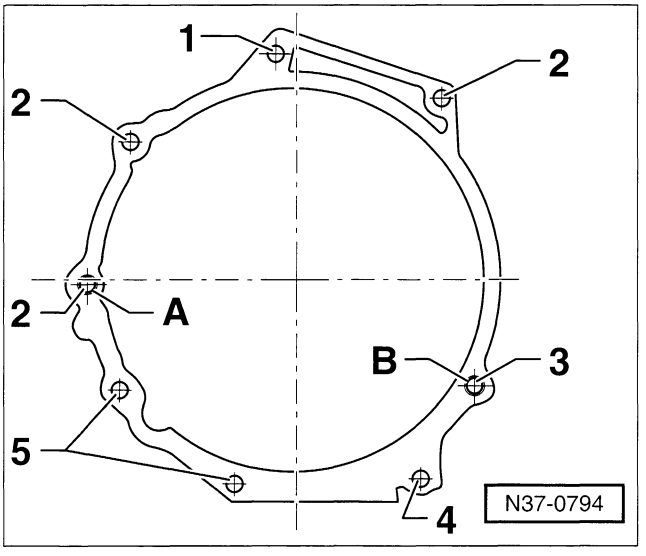
– Replace selector cable locking circlip.

– Adjust selector lever cable, see **Selector lever cable, checking and adjusting (09A)**.

- Check and top up ATF level.
- Connect scan tool VAG 1551/1552, VAS 5051/5052 or equivalent, or scan tool computer program and check diagnostic trouble code memory and initiate basic settings.
- It is usually advisable to have the front wheels professionally aligned once installation is complete.
- When installing transmission, ensure that mounts and bolts are installed without any pre-load, tension, or stress.

Use the following tightening torques when installing the automatic transmission. Note that some bolts are torque-to-yield, or stretch bolts and must be replaced as noted.

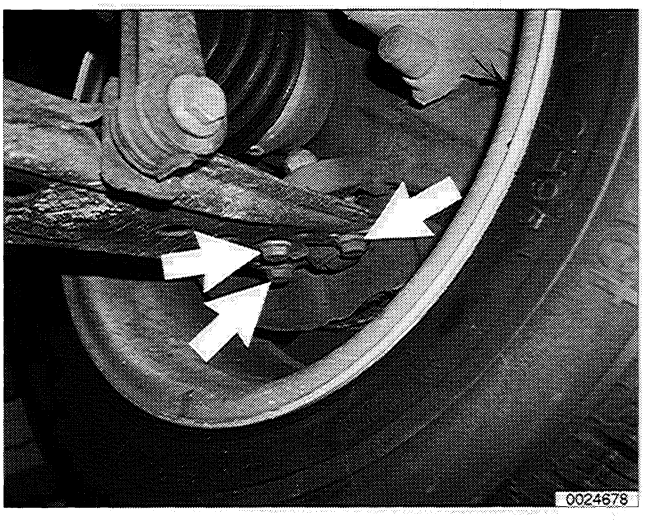
➤ Transmission-to-engine bolt specifications and tightening torques for 4-cylinder engines are listed below in.



Fastener	Size	Qty.	Tightening torque
1	M12 X 40	1	80 Nm (59 ft-lb)
2	M12 X 60	3	80 Nm (59 ft-lb)
3	M12 X 70	1	80 Nm (59 ft-lb)
4	M10 X 70	1	45 Nm (33 ft-lb)
5	M10 X 55	2	45 Nm (33 ft-lb)
A & B	Dowel sleeves	2	

Tightening torques

- Drive shaft to transmission drive flange (tighten diagonally)
  - Stage I . . . . . 10 Nm (7½ ft-lb)
  - Stage II (M8) . . . . . 40 Nm (30 ft-lb)
  - Stage II (M10) . . . . . 70 Nm (52 ft-lb)
- Torque converter to drive plate. . . . . 60 Nm (44 ft-lb)
- Transmission to engine
  - (M10) . . . . . 60 Nm (44 ft-lb)
  - (M12) . . . . . 80 Nm (59 ft-lb)
- Transmission to oil pan (M10) . . . . . 25 Nm (18 ft-lb)
- Connecting link to control arm . . . . . 45 Nm (33 ft-lb)
- Wheel bolts to wheel hub. . . . . 120 Nm (89 ft-lb)
- Power steering hydraulic line clamp nut to transmission, starter . . 25 Nm (18 ft-lb)
- Power steering hydraulic line clamp bolt to transmission . . . . . 22 Nm (16 ft-lb)
- Protective cover for drive axle boot to engine block. . . . . 35 Nm (26 ft-lb)

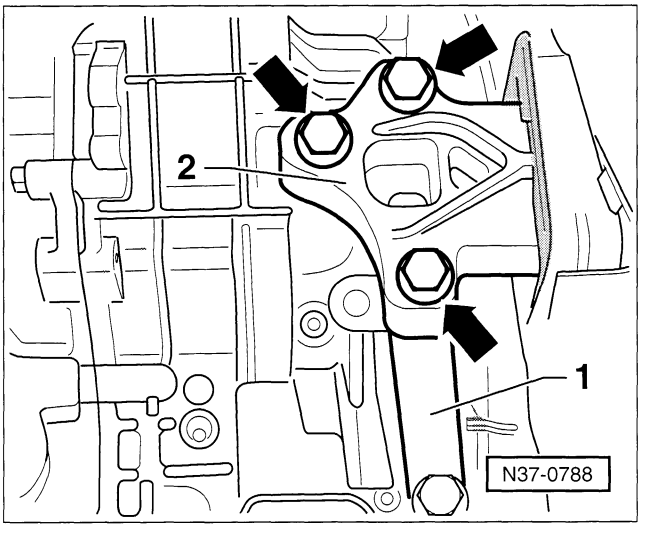


Replace bolts (**arrows**) for ball joint to control arm.

Tightening torque

Always replace bolts

- Ball joint to control arm . . . . . 20 Nm (15 ft-lb) plus ¼ turn (90°)

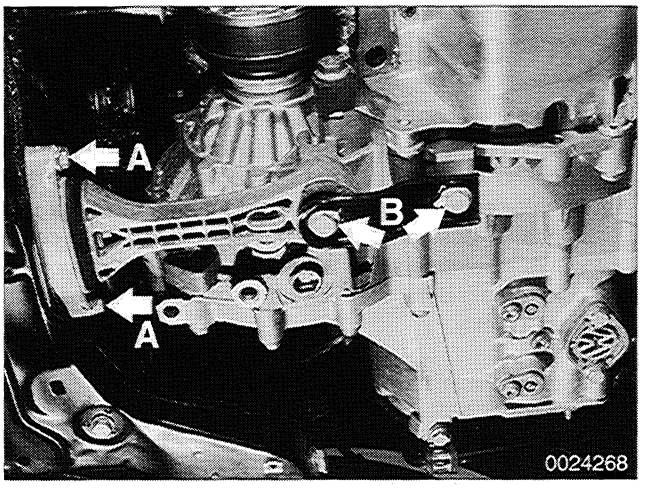


Replace bolts (**arrows**) for transmission mount (**1**, **2**).

Tightening torque

Always replace bolts

- Transmission mount (**arrows**) . . . . . 50 Nm (37 ft-lb) plus ¼ turn (90°)

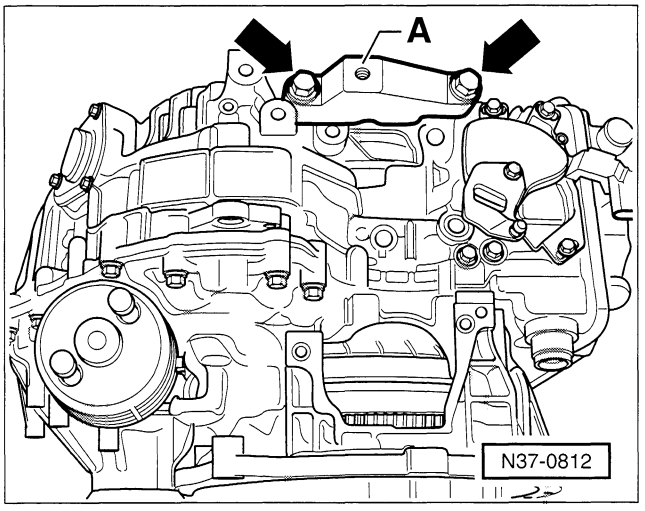


Replace bolts for pendulum mount to body and pendulum mount bracket (**A**) and support (**B**).

Tightening torque

Always replace bolts

- Pendulum mount to body (**A**) . . . . . 20 Nm (15 ft-lb) plus ¼ turn (90°)
- Pendulum mount bracket (**B**) . . . . . 40 Nm (30 ft-lb) plus ¼ turn (90°)

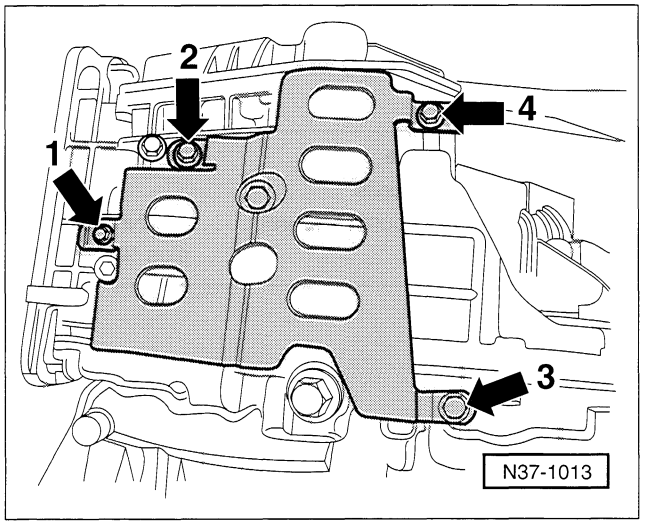


➢ Replace bolts (**arrows**) for transmission mount (**A**) to transmission.

Tightening torque

Always replace bolts

- Transmission mount (**A**) . . . . . 50 Nm (37 ft-lb) plus ¼ turn (90°)



➢ Torque bolts (**arrows**) for transmission shield in sequence (**1**,**2**,**3**,**4**).

Tightening torque

Torque in sequence

- Transmission shield . . . . . 22 Nm (16 ft-lb)

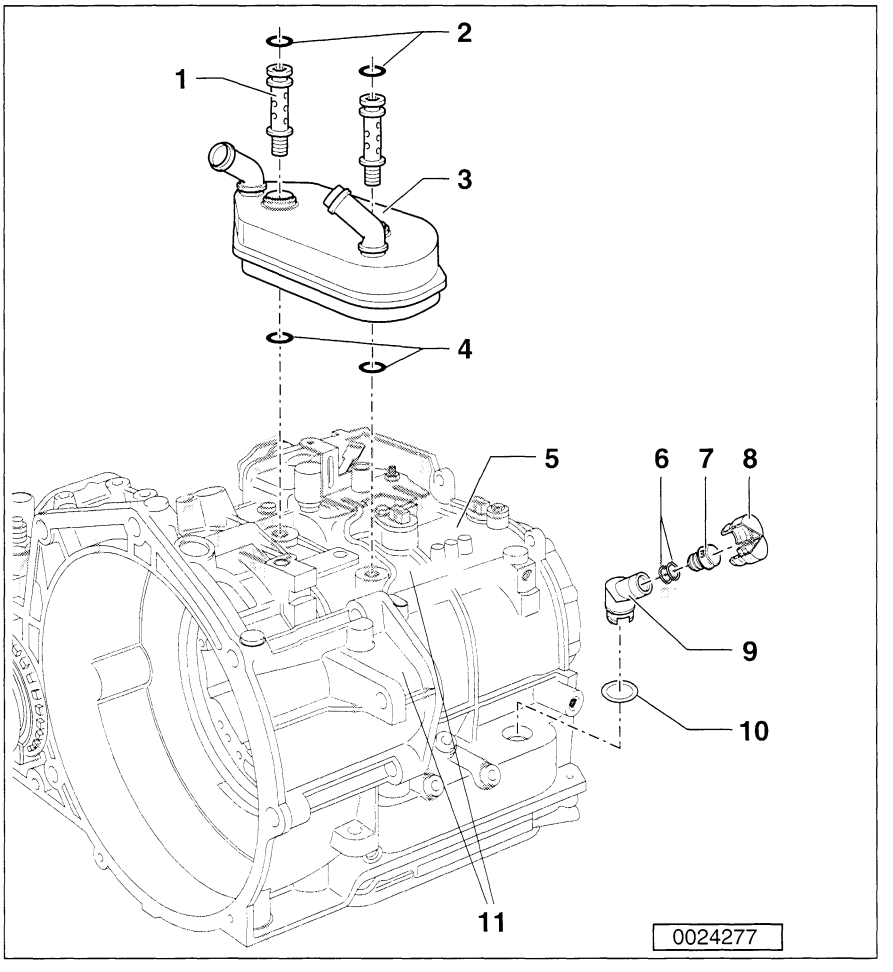
ATF COOLER

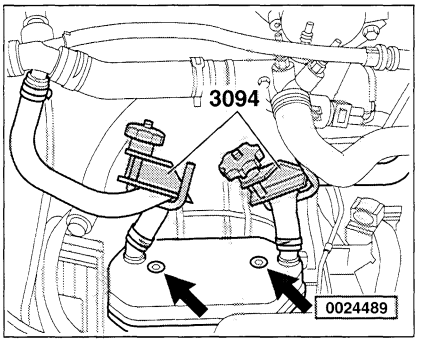
The 01M and 09A transmissions both use a cooler to control the temperature of the fluid. Hot, pressurized fluid is supplied to one section of the cooler. The heat is then transferred to the engine coolant through the other section and dissipated through the radiator. The cooler works in reverse when the engine and transmission are cold to help bring the ATF up to operating temperature more quickly.

If the vehicle has ATF in the cooling system, always check the ATF cooler. If the ATF shows evidence of engine coolant contamination, also check the cooler for internal leakage. Engine coolant contamination of the ATF will result in serious internal transmission problems, particularly with the friction materials.

ATF cooler (01M)

1. **Banjo bolts**
   - Hollow bolts
   - Tighten to 35 Nm (26 ft-lb)
2. **O-ring, upper**
   - Always replace
3. **ATF cooler**
   - See **Removing**
   - See **Installing**
4. **O-ring, lower**
   - Always replace
5. **Transmission housing**
6. **Seal**
   - Always replace
7. **Sealing/ level plug**
8. **Cap**
   - To secure ATF sealing/level plug after checking ATF level
   - Always replace
9. **ATF filler tube**
10. **O-ring**
    - Always replace
11. **Location of transmission code and production numbers**





Removing

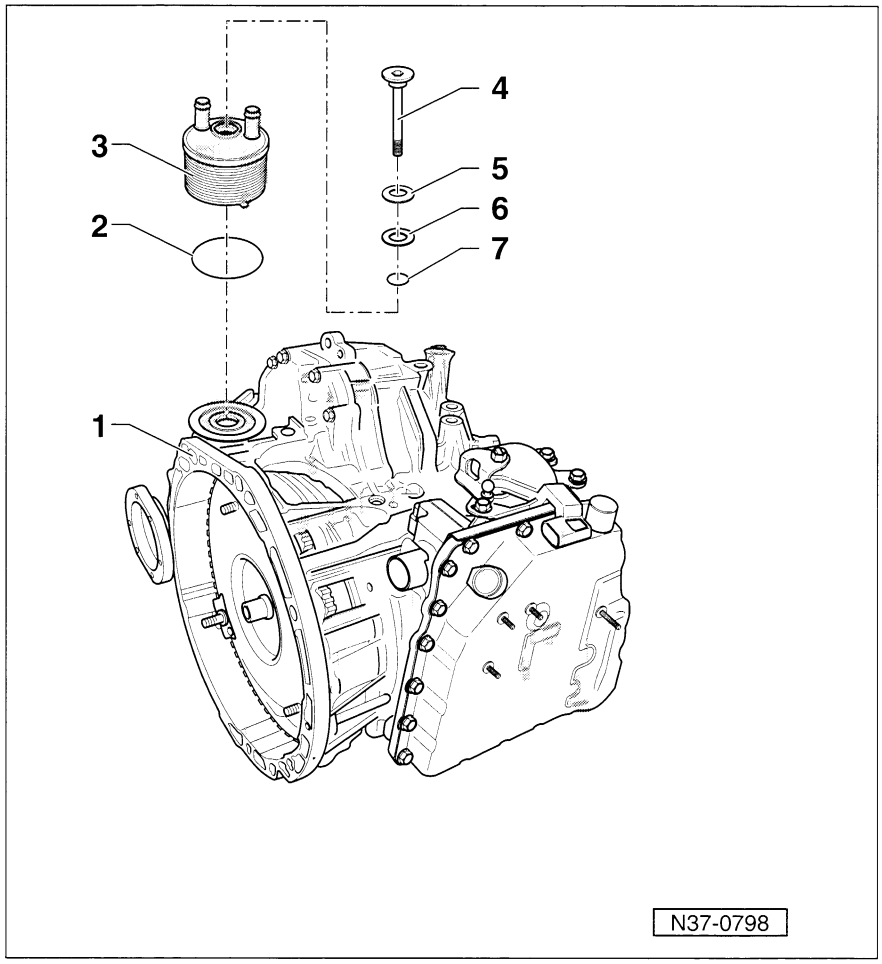
- Clamp-off ATF cooler hoses with special tool 3094 clamps or equivalent and detach at ATF cooler.
- Seal ATF cooler with clean plugs.
- Remove banjo bolts (**arrows**) and lift cooler out.

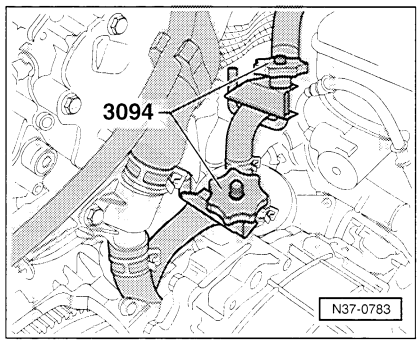
Installing

- Install in reverse order.
- Always replace O-rings.

ATF cooler (09A)

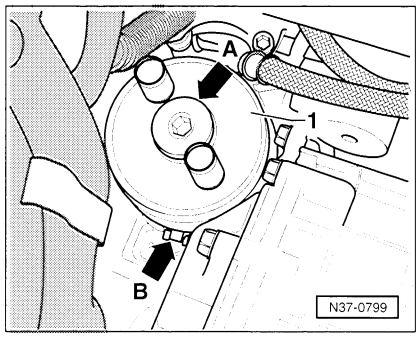
1. **Transmission housing**
2. **O-ring, large**
   - Always replace
3. **ATF cooler**
   - See **Removing**
   - See **Installing**
4. **Special bolt**
   - Tighten to 40 Nm (35 ft-lb)
5. **Dished washer**
   - When properly installed, outer circumference touches washer, item **6** below.
6. **Washer**
7. **O-Ring**
   - Always replace





Removing

- Remove air cleaner assembly.
- Clamp-off ATF cooler hoses with special tool 3094 clamps or equivanlent.
- Detach hoses at ATF cooler.
- Seal ATF cooler with clean plugs.
- Remove center special bolt and lift cooler out.



Installing

- Install in reverse order.
- Always replace O-rings.
- Install cooler (**1**) so that locating tab aligns with slot in transmission housing (**B**).
- Torque special bolt (**A**) to specification.

39 Differential and Final Drive

GENERAL 39-1

MANUAL TRANSMISSION 39-1
Differential and final drive assembly (02J) 39-2
Differential and final drive assembly (02M) 39-3
Drive flange oil seals, replacing (02J) 39-4
Drive flange oil seal, left side, replacing (02M) 39-6
Drive flange oil seal, right side, replacing (02M) 39-8

AUTOMATIC TRANSMISSION 39-9
Differential and final drive assembly (01M) 39-10
Differential and final drive assembly (09A) 39-11
Drive flange oil seals, replacing (01M) 39-12
Drive flange oil seal, left side, replacing (09A) 39-16
Drive flange oil seal, right side, replacing (09A) 39-18

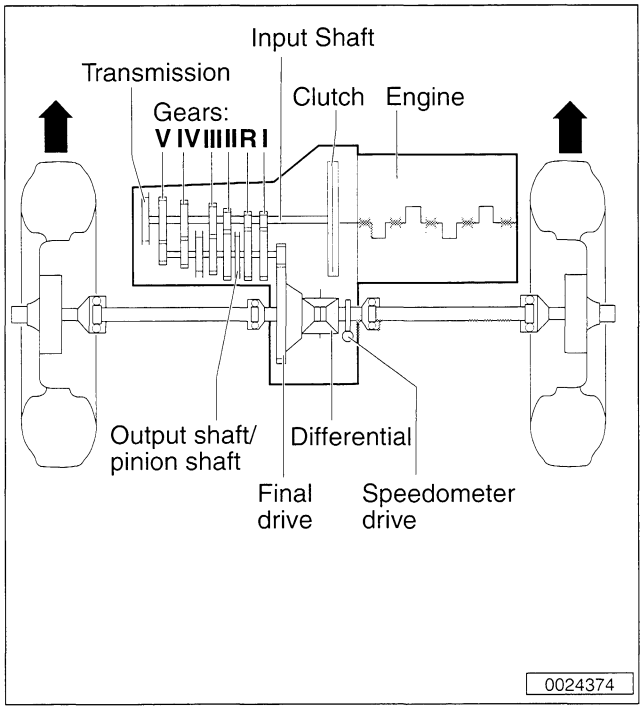
39

GENERAL

This repair group covers replacement of the drive flange oil seals in the final drive unit. Disassembly of the final drive unit is not covered in this section.

In some cases, the final drive for the automatic transmission is filled with gear oil. On cars with manual transmission, the final drive unit shares the same gear oil as the transmission. For information on checking, draining and filling the manual transmission and final drive oil, see **0 Maintenance**.

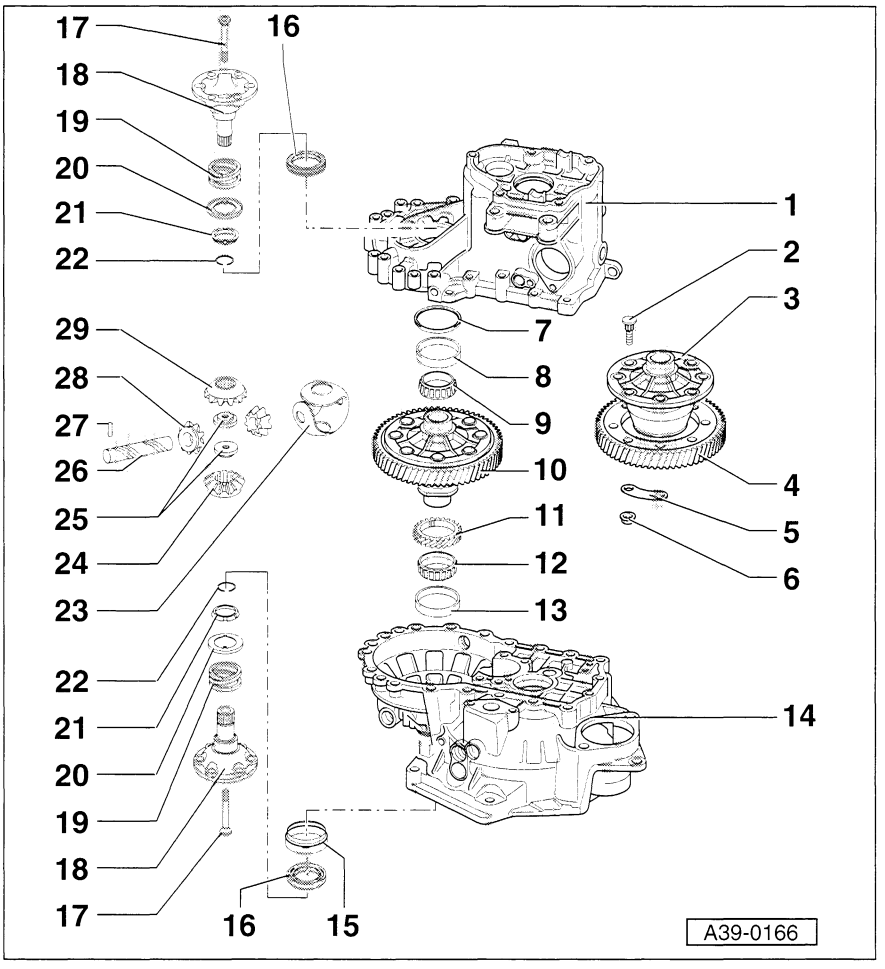
MANUAL TRANSMISSION



The layout of the 02J manual transmission and final drive is shown here in relation to the engine and the vehicle's direction of travel (**arrows**). The 02M transmission adds a sixth gear set, but the layout is similar.

Differential and final drive assembly (02J)

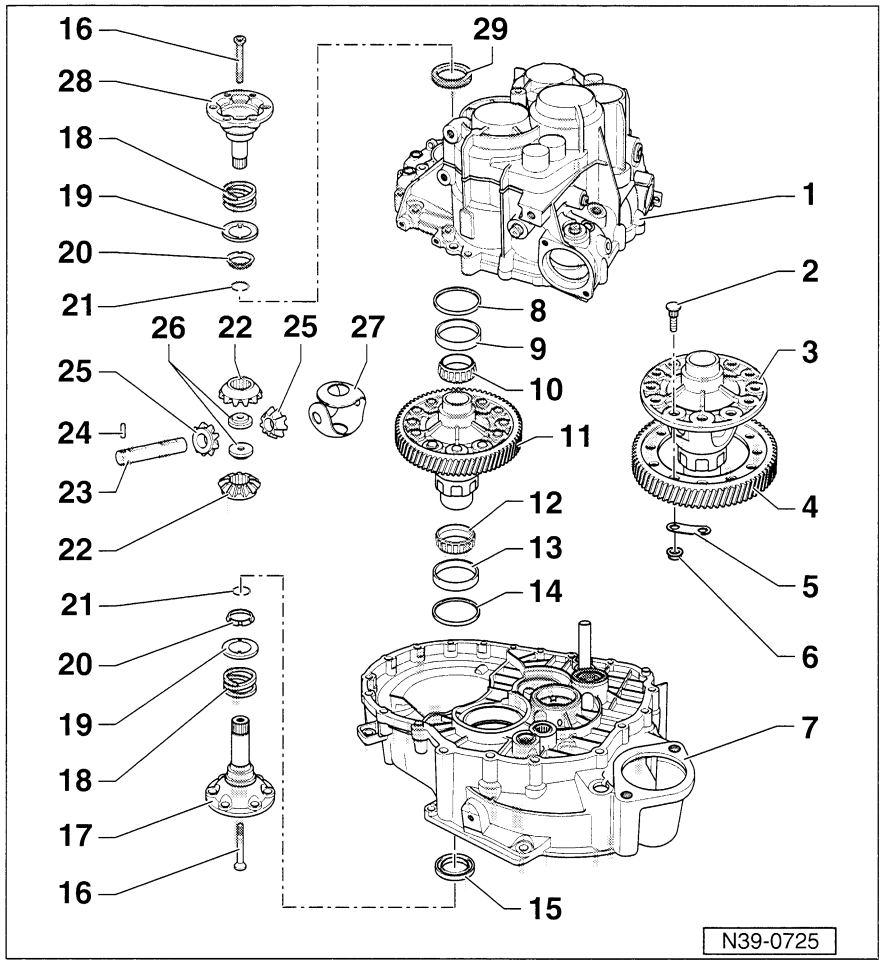
NOTE —
Many components shown here require transmission disassembly. Those procedures require special tools and skills that are outside the scope of this manual.



1. **Transmission housing**
2. **Bolt**
3. **Differential carrier**
4. **Final drive ring gear**
5. **Locking plate**
6. **Nut**
7. **Shim**
8. **Differential carrier bearing, tapered roller bearing outer race**
9. **Differential carrier bearing, tapered roller bearing inner race**
10. **Differential assembly**
11. **Speedometer drive gear**
12. **Differential carrier bearing, tapered roller bearing inner race**
13. **Differential carrier bearing, tapered roller bearing outer race**
14. **Transmission clutch housing**
15. **Sleeve**
16. **Drive flange oil seal**
    - See **Drive flange oil seals, replacing (02J)**.
17. **Bolt, socket head**
    - Attaches to nut plate 25
    - Tighten to 25 Nm (18 ft-lb)
18. **Drive flange**
19. **Spring**
    - Installed behind drive flanges
20. **Thrust washer**
    - Install with shoulder toward spring and tongues to tapered ring
21. **Tapered ring**
    - With grooves to secure/locate thrust washer
    - Install with taper facing differential housing
22. **Circlip**
    - Retains tapered ring, thrust washer, and spring when drive flange is removed.
23. **Thrust washer**
24. **Differential side gear**
25. **Nut plate**
    - Holds drive flange in position with bolt (item 17).
26. **Differential pinion bevel gear shaft**
27. **Roll pin**
28. **Differential small pinion bevel gear**
29. **Differential large side bevel gear**

Differential and final drive assembly (02M)

NOTE —
Many components shown here require transmission disassembly. Those procedures require special tools and skills that are outside the scope of this manual.

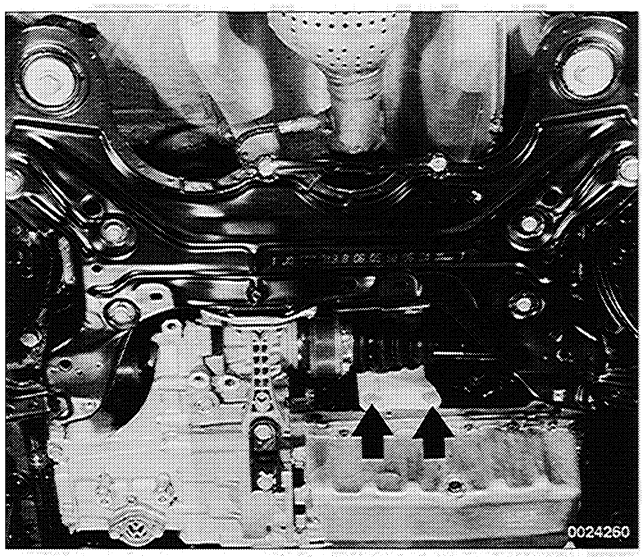


1. **Transmission housing**
2. **Bolt**
3. **Differential carrier**
4. **Final drive ring gear**
5. **Locking plate**
6. **Nut**
7. **Transmission clutch housing**
8. **Shim**
9. **Differential carrier bearing, tapered roller bearing outer race**
10. **Differential carrier bearing, tapered roller bearing inner race**
11. **Differential assembly**
12. **Differential carrier bearing, tapered roller bearing inner race**
13. **Differential carrier bearing, tapered roller bearing outer race**
14. **Shim**
15. **Drive flange oil seal, right side**
    - Right and left sides have different diameters.
    - See **Drive flange oil seals, replacing (02M)**.
16. **Bolt, socket head**
    - Attaches to nut plate (item 26)
    - Tighten to 25 Nm (18 ft-lb)
17. **Drive flange, left side**
    - Right and left sides are different do not interchange.
18. **Spring**
    - Installed behind drive flanges
19. **Thrust washer**
    - Install with shoulder toward spring and tongues to tapered ring
20. **Tapered ring**
    - With grooves to secure/locate thrust washer
    - Install with taper facing differential housing
21. **Circlip**
    - Retains tapered ring, thrust washer, and spring when drive flange is removed.
22. **Differential large side bevel gear**
23. **Differential pinion bevel gear shaft**
24. **Roll pin**
25. **Differential small pinion bevel gear**
26. **Nut plate**
    - Holds drive flange in position with bolt (item 16).
27. **Thrust washer**
28. **Drive flange, right side**
    - Right and left sides are different do not interchange.
29. **Drive flange oil seal, left side**
    - Right and left sides have different diameters.
    - See **Drive flange oil seals, replacing (02M).**

Drive flange oil seals, replacing (02J)

NOTE —

- *A slide hammer with a puller hook is needed to remove the drive flange oil seals. Factory special tool VW771 with attachments is shown in this section. Alternatively, a seal removal tool may be used.*
- *Several seal installation drifts are also necessary for installing the drive flange oil seals. Factory special tools 3106, and 3305 are shown in this section. If using different seal installers, take care to avoid damage to the seal when installing in these hard-to-reach and hard-to-see locations.*

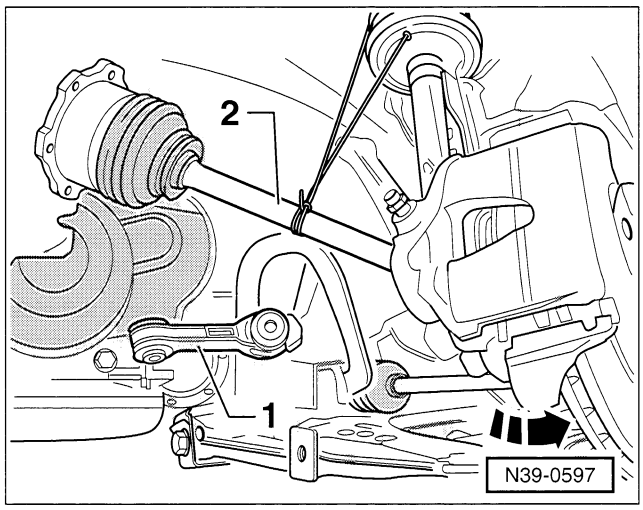


– Remove lower sound absorber panels as required to facilitate access.

– If replacing the left side drive flange seal, remove the left side drive axle. See **40 Front Suspension and Drive Axles**.

– If replacing the right side drive flange seal, turn the steering wheel completely to right (full-lock).

➤ Remove right inner drive axle boot shield (**arrows**) from engine, if installed.

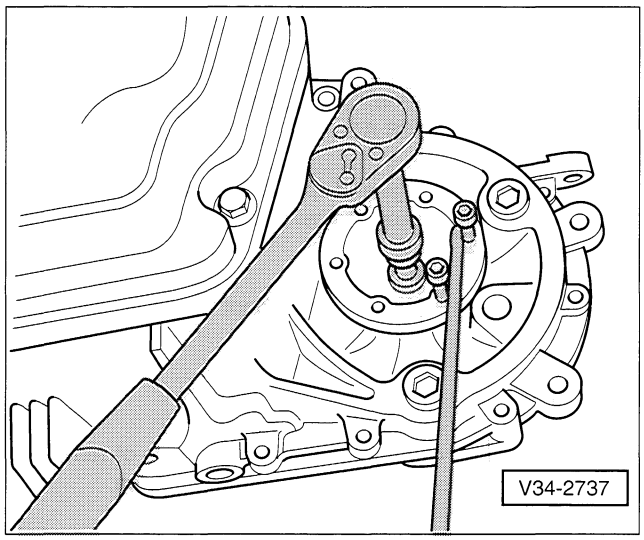


➤ Unbolt drive shaft(s) (**2**) at transmission drive flange(s) and secure (tie) up as high as possible.

NOTE —

When tying up axle shafts use care not to damage the paint on the body panels or the axles, or the axle boots.

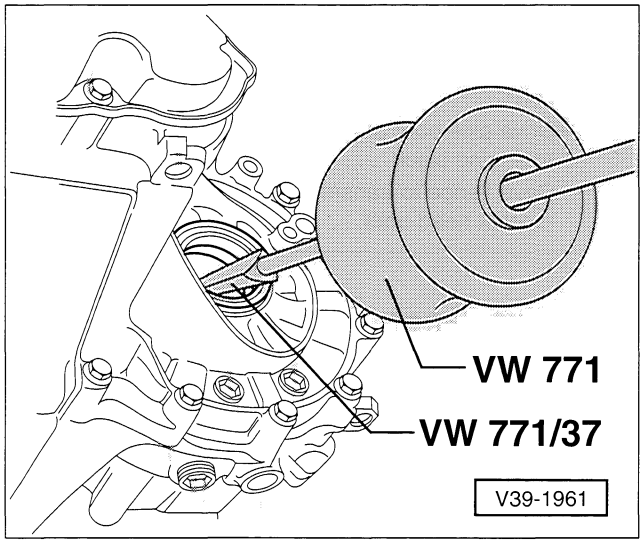
– Place drip tray underneath drive flange(s).



➢ Install two bolts into CV joint mounting holes of drive flange and counter-hold with a screwdriver. Remove socket head bolt from center of drive flange.

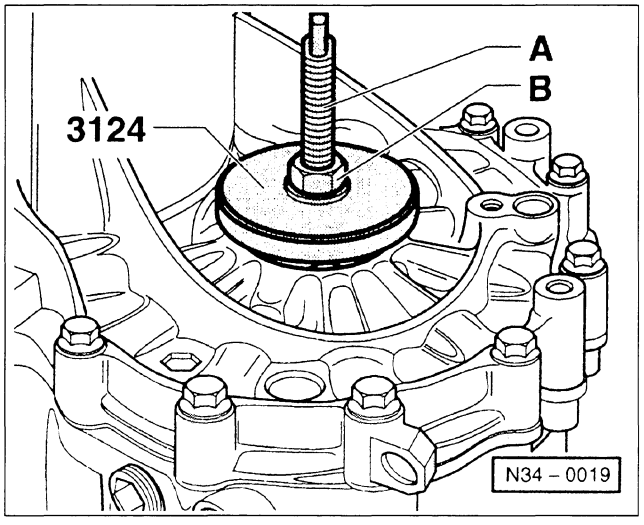
– Remove drive flange shaft with spring.

NOTE —
Thrust washer may come out with spring.



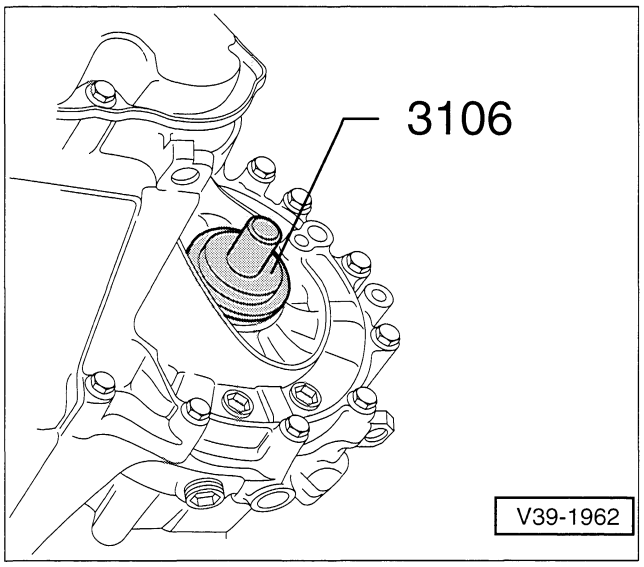
➢ Using the slide hammer and appropriate hook or seal removal tool, pull out drive flange oil seal using care to avoid damage to the sleeve.

NOTE —
- *Do not damage sleeve when removing oil seal.*
- *If sleeve is damaged, replace as shown.*



➢ If drive flange sleeve is damaged, pry out the old sleeve with a screwdriver and install new sleeve with thrust pad 3124, M12 threaded rod from 3066 (**A**), and an M12 nut (**B**) and washer. Press sleeve fully into recess.

NOTE —
Experience has shown that filling the inside space with grease where the spring is located prior to installation will help retain the spring in the correct position.



To install new seal, drive it fully into the recess with driver tool 3106. Do not tilt seal; drive it squarely into recess.

– Fill space between sealing lip and outer lip of oil seal with grease G052 128 A1.

– Install drive flange and spring. Torque socket head bolt to specification using the reverse of the technique used to remove it.

– Install right inner drive axle boot shield on engine if removed.

– Install drive shaft(s)

– Remainder of installation is the reverse of removal. Be sure to top up gear oil, see **0 Maintenance**.

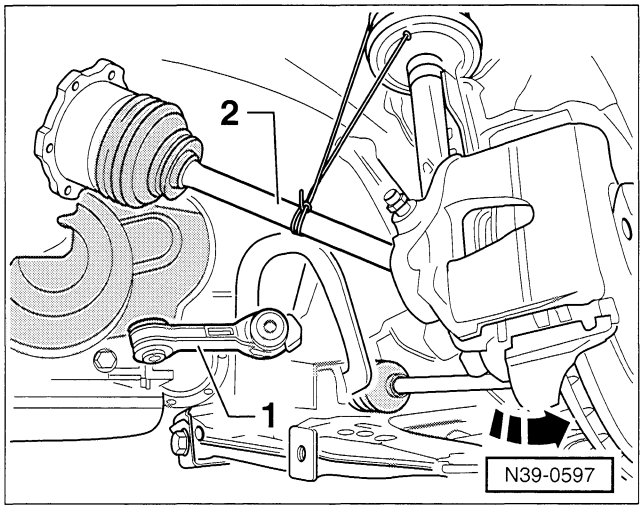
Tightening torques

- CV joint to drive flange on transmission, always replace, tighten diagonally
  M8 . . . . . 40 Nm (30 ft-lb)
  M10 . . . . . 70 Nm (52 ft-lb)
- Drive axle boot protective shield to engine block . . . . . 35 Nm (26 ft-lb)
- Drive flange to transmission nut plate (socket head bolt) . . . . . 25 Nm (18 ft-lb)

Drive flange oil seal, left side, replacing (02M)

NOTE —

- *A slide hammer with a puller hook is needed to remove the drive flange oil seals. Factory special tool VW771 with attachments is shown in this section. Alternatively, a seal removal tool may be used.*
- *A seal installation drift is also necessary for installing the drive flange oil seals. Factory special tool 3305 is shown in this section. If using different seal installers, take care to avoid damage to the seal when installing in these hard-to-reach and hard-to-see locations.*



– Remove left front wheel.

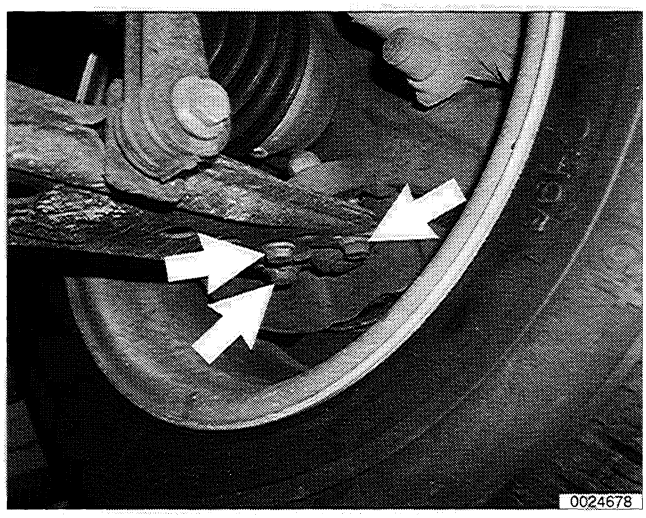
– Remove lower sound absorber panels as required to facilitate access.

– Turn the steering wheel completely to the left (full-lock).

Unbolt drive shaft (**2**) at transmission drive flange and secure (tie) up as high as possible.

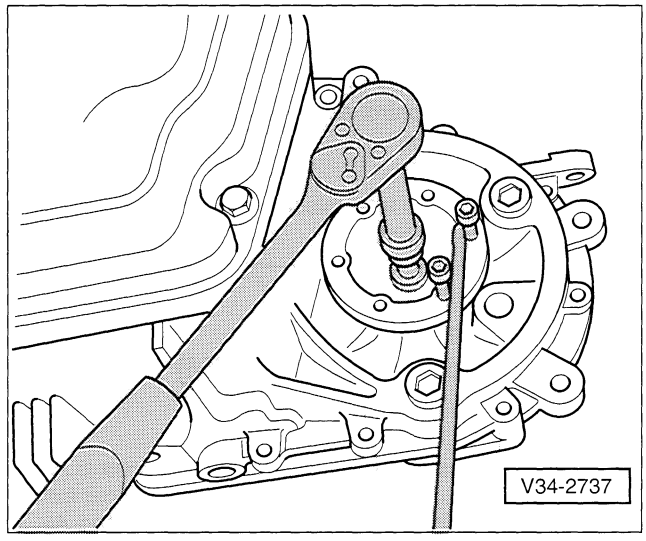
NOTE —

When tying up axle shafts use care not to damage the paint on the body panels or the axles, or the axle boots.



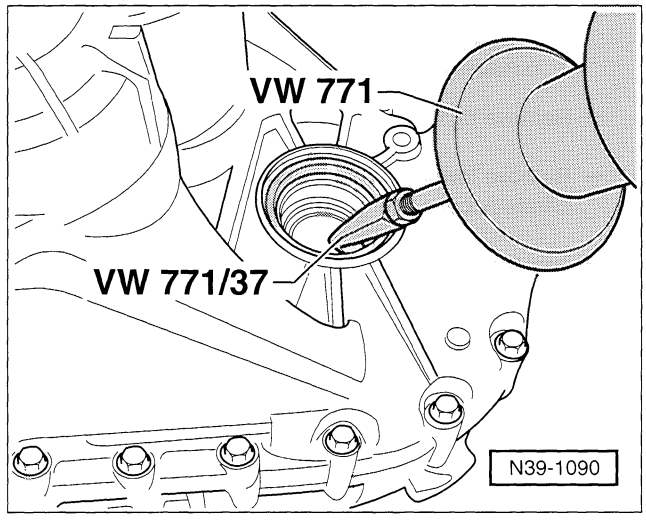
- Mark installation position of ball joint bolts (**arrows**) on left control arm and remove left control arm bolts.

– Place drip tray underneath drive flange.

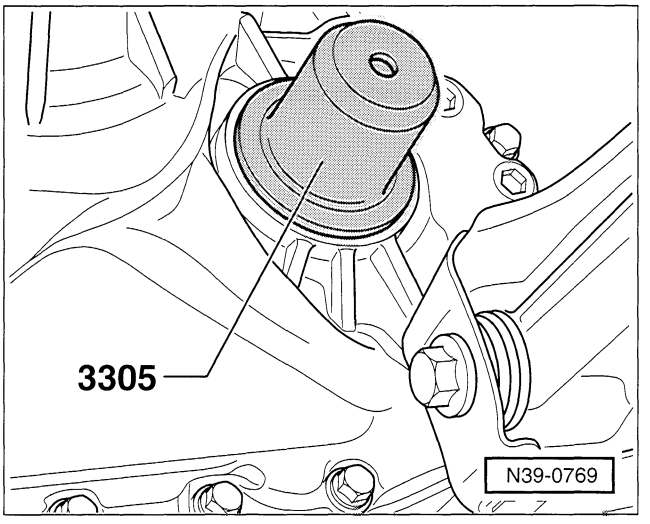


- Install two bolts into CV joint mounting holes of drive flange and counter-hold with a screwdriver. Remove socket head bolt from center of drive flange.

– Remove drive flange shaft with spring.



- Using the slide hammer and appropriate hook or seal removal tool, pull out drive flange oil seal.



➤ To install new seal, drive it fully into the recess with driver tool 3305. Do not tilt seal; drive it squarely into recess.

– Fill space between sealing lip and outer lip of oil seal with grease G052 128 A1.

– Install drive flange and spring. Torque socket head bolt to specification using the reverse of the technique used to remove it.

– Align previously made marks and connect ball joint to control arm with new bolts.

– Install drive shaft to drive flange.

– Remainder of installation is the reverse of removal. Be sure to top up gear oil, see **0 Maintenance**.

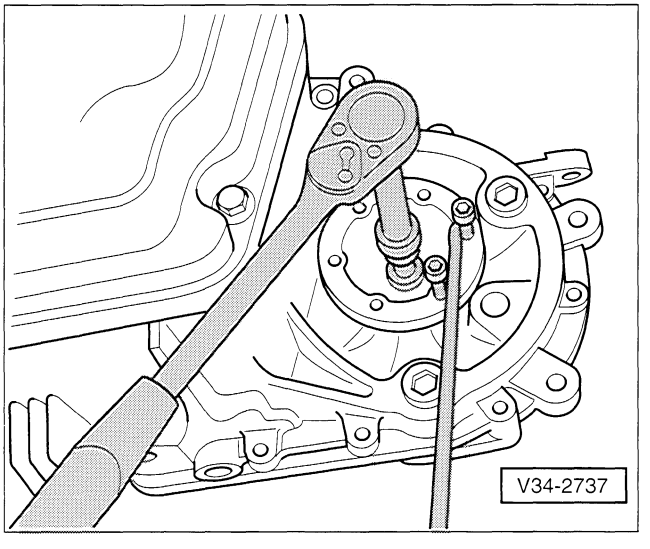
Tightening torques

- CV joint to drive flange on transmission, always replace, tighten diagonally
  M8 . . . . . 40 Nm (30 ft-lb)
  M10 . . . . . 70 Nm (52 ft-lb)
- Ball joint to control arm
  always replace . . . . . 20 Nm (15 ft-lb)
  plus ¼ turn (90°)
- Drive flange to transmission nut plate
  (socket head bolt) . . . . . 25 Nm (18 ft-lb)

Drive flange oil seal, right side, replacing (02M)

NOTE —

- *A slide hammer with a puller hook is needed to remove the drive flange oil seals. Factory special tool VW771 with attachments is shown in this section. Alternatively, a seal removal tool may be used.*
- *A seal installation drift is also necessary for installing the drive flange oil seals. Factory special tool 3158 is shown in this section. If using different seal installers, take care to avoid damage to the seal when installing in these hard-to-reach and hard-to-see locations.*



– Remove right front wheel.

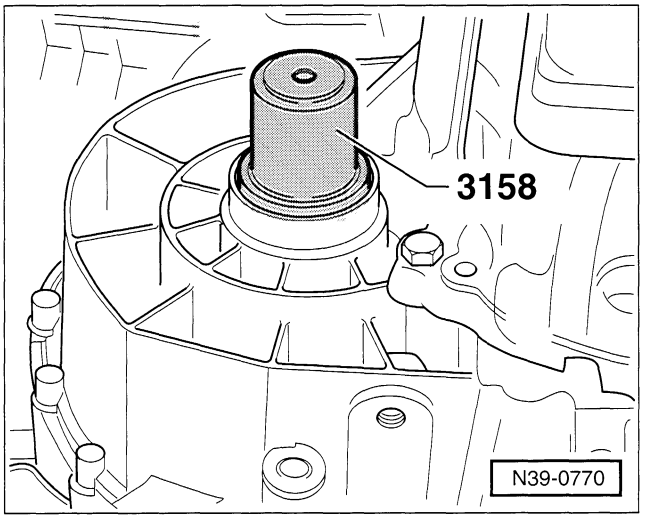
– Remove lower sound absorber panels as required to facilitate access.

– Turn the steering wheel completely to the right (full-lock).

– Unbolt drive shaft at transmission drive flange.

– Place drip tray underneath drive flange.

➤ Install two bolts into CV joint mounting holes of drive flange and counter-hold with a screwdriver. Remove socket head bolt from center of drive flange (left side shown).



– Remove drive flange shaft with spring.

– Using the slide hammer and appropriate hook or seal removal tool, pull out drive flange oil seal.

➢ To install new seal, drive it fully into the recess with driver tool 3158. Do not tilt seal; drive it squarely into recess.

– Fill space between sealing lip and outer lip of oil seal with grease G052 128 A1.

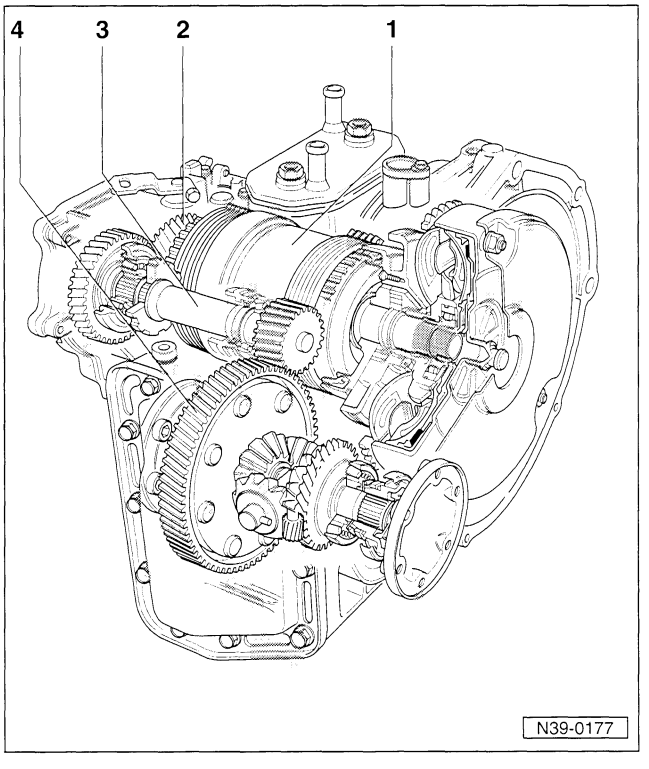
– Install drive flange and spring. Torque socket head bolt to specification using the reverse of the technique used to remove it.

– Install drive shaft to drive flange.

– Remainder of installation is the reverse of removal. Be sure to top up gear oil, see **0 Maintenance**.

Tightening torques

- CV joint to drive flange on transmission, always replace, tighten diagonally
  M8 . . . . . 40 Nm (30 ft-lb)
  M10 . . . . . 70 Nm (52 ft-lb)
- Drive flange to transmission nut plate (socket head bolt). . . . . 25 Nm (18 ft-lb)



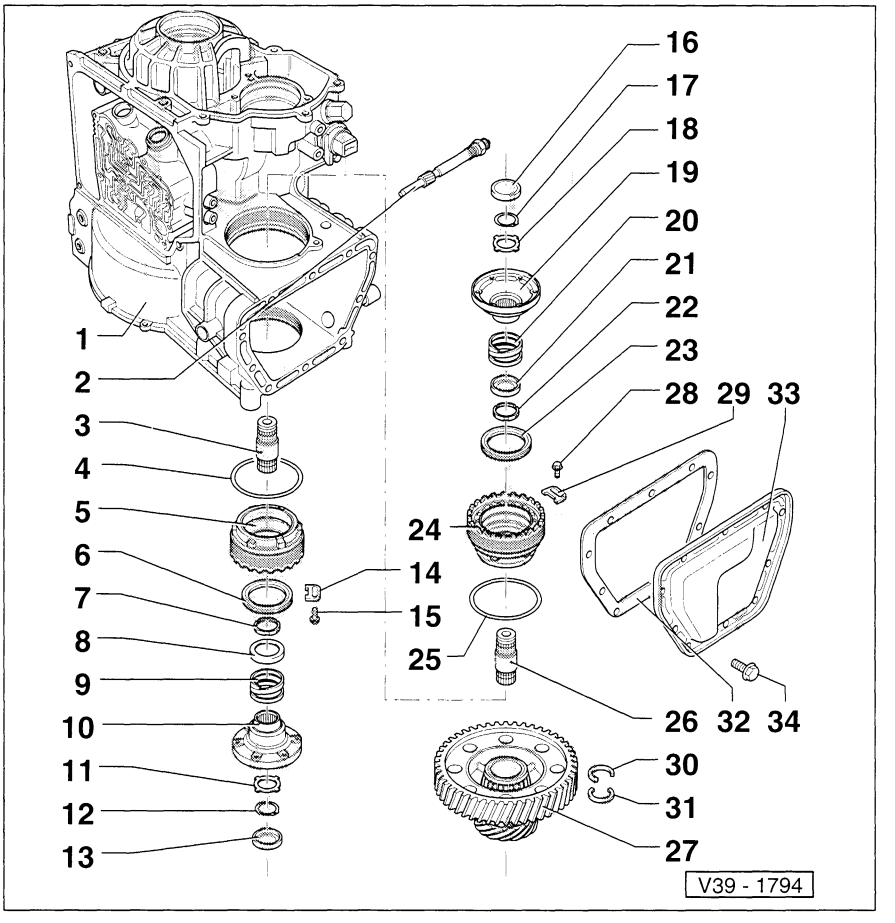
AUTOMATIC TRANSMISSION

➢ The general layout of the 01M automatic transmission and final drive is shown here from the engine (torque converter) side. The 09A transmission uses similar principle of operation, but is different in layout and components.

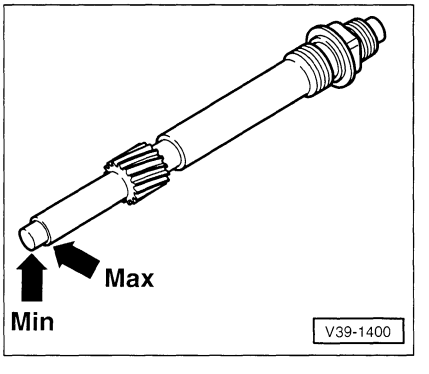
1. Planetary gearing
2. Input gear
3. Intermediate shaft with pinion gear
4. Ring gear and differential

Differential and final drive assembly (01M)

NOTE —
Many components shown here require transmission disassembly. Those procedures require special tools and skills that are outside the scope of this manual.



1. **Transmission housing**
2. **Speedometer drive**
   - Also used as dipstick for measuring lubricant level.
   - See **Final drive oil level checking**
3. **Output shaft**
4. **O-ring**
5. **Adjusting ring**
6. **Drive flange oil seal, right side**
   - See **Drive flange oil seals, replacing**
7. **Tapered ring**
   - Shoulder faces thrust washer
8. **Thrust washer**
   - Install over compression spring
9. **Compression spring**
   - Installed behind drive flanges
10. **Drive flange, right side**
11. **Dished washer**
12. **Circlip**
13. **Center cap**
14. **Adjusting ring lock**
15. **Screw**
16. **Center cap**
17. **Circlip**
18. **Dished washer**
19. **Drive flange, left side**
20. **Compression spring**
    - Installed behind drive flanges
21. **Thrust washer**
    - Install over compression spring
22. **Tapered ring**
    - Shoulder faces thrust washer
23. **Drive flange oil seal, left side**
    - See **Drive flange oil seals, replacing**
24. **Bearing support**
25. **O-ring**
26. **Output shaft**
27. **Differential assembly**
28. **Screw**
29. **Bearing support lock**
30. **Circlip**
31. **Circlip**
32. **Gasket/seal**
33. **Differential cover**
34. **Screw**
    - Install with AMV 185 101 A1 locking fluid
    - Tighten to 28 Nm (21 ft-lb)



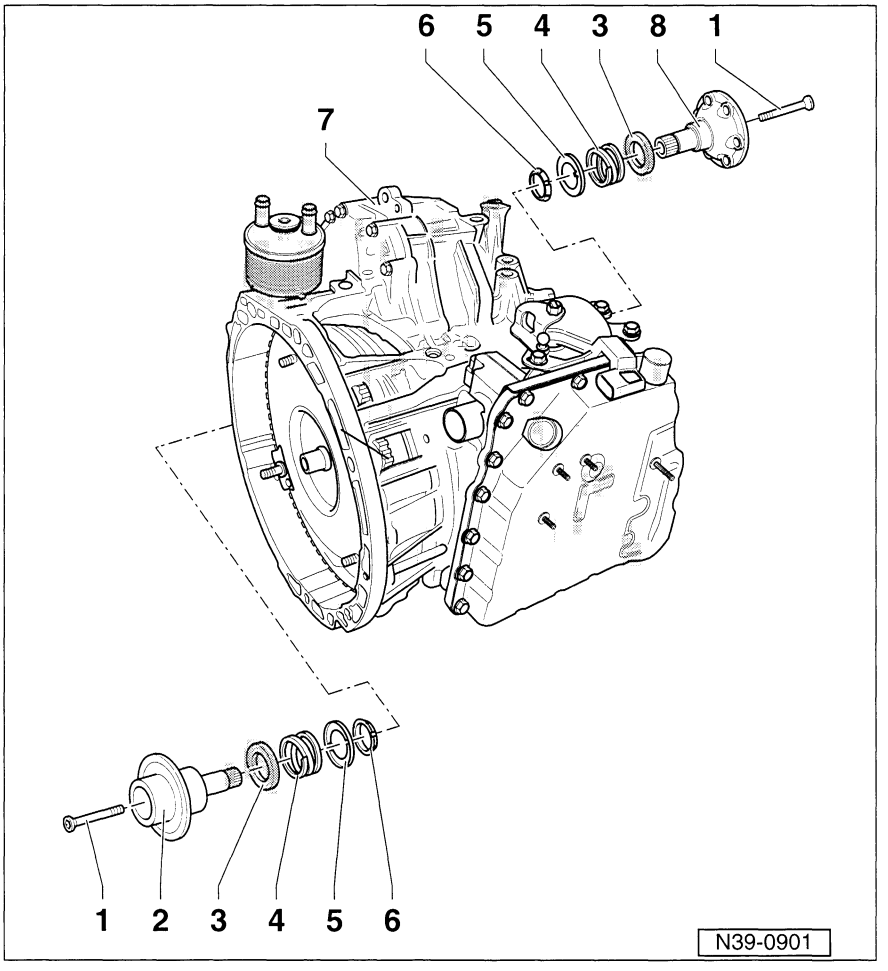
Final drive oil level checking

- No change interval is specified by Volkswagen. Check regularly as specified in **0 Maintenance**.
- Vehicle should be on a level surface when making the check.
- Remove harness connector and unscrew plastic speedometer drive to remove.
- Clean dipstick, re-insert and remove to check level.
- Add or top up level as needed.
- The difference between "**Min**" and "**Max**" marks on the speedometer drive gear is approx. 0.1 liter (3.4 fl. oz.).
- Reinstall speedometer drive gear.
- See **37 Automatic Transmission** for appropriate fluid type and quantity.

Differential and final drive assembly (09A)

NOTE —
Many components shown here require transmission disassembly. Those procedures require special tools and skills that are outside the scope of this manual. Some components may not be exactly as pictured.

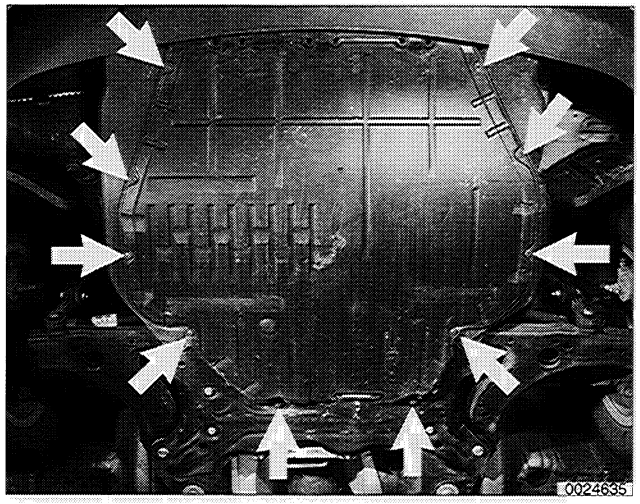
1. **Bolt, socket head**
   - Tighten to 25 Nm (18 ft-lb)
2. **Drive flange, right side**
3. **Drive flange oil seal, right side**
   - See **Drive flange oil seals, replacing**
4. **Compression spring**
   - Installed behind drive flanges
5. **Thrust washer**
   - Install over compression spring
6. **Tapered ring**
   - Shoulder faces thrust washer
7. **Transmission housing**
8. **Drive flange, left side**



Drive flange oil seals, replacing (01M)

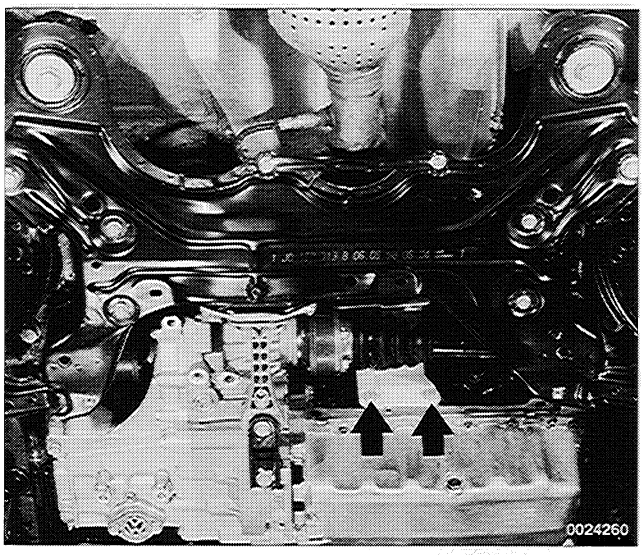
NOTE —

- *A slide hammer with a puller hook is needed to remove the drive flange oil seals. Factory special tool VW771 with attachments is shown in this section. Alternatively, a seal removal tool may be used.*
- *Several seal installation drifts are also necessary for installing the drive flange oil seals. Factory special tools 3106, and 3305 are shown in this section. If using different seal installers, take care to avoid damage to the seal when installing in these hard-to-reach and hard-to-see locations.*



Removing, right side

➢ Remove lower sound absorber panel fasteners (**arrows**) as required to facilitate access.



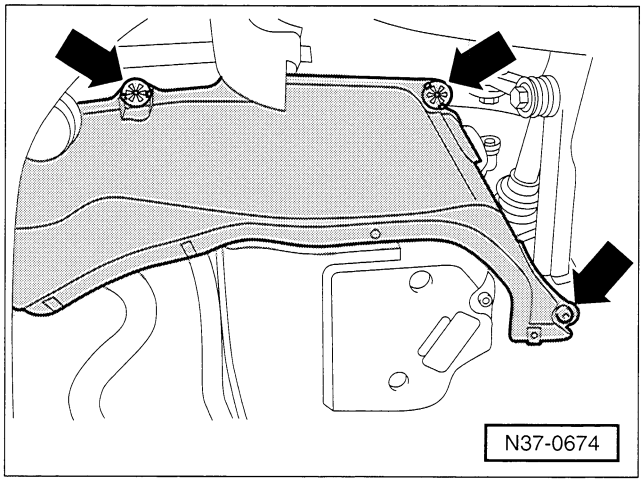
➢ Remove right inner drive axle boot shield (**arrows**) from engine, if installed.

– Unbolt right side drive shaft at transmission drive flange.

– Position drive shaft up and out of the way as far as possible.

NOTE —

*If drive shaft can not be positioned in such a way so as to gain sufficient clearance, it will be necessary to remove drive shaft. See **40 Front Suspension and Drive Axles**.*



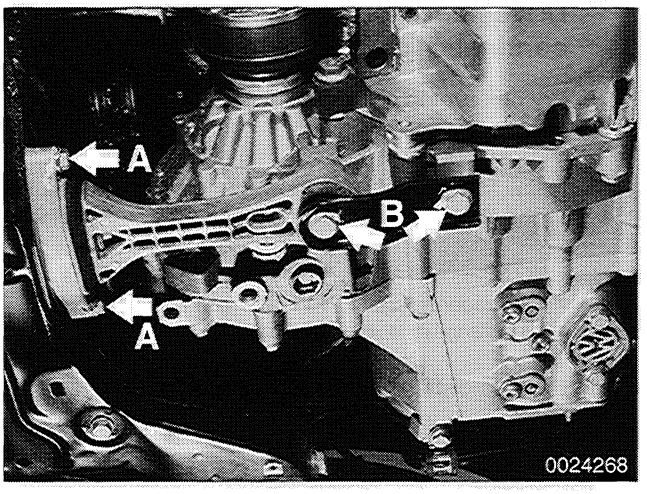
Removing, left side

– Loosen wheel bolts before raising vehicle.

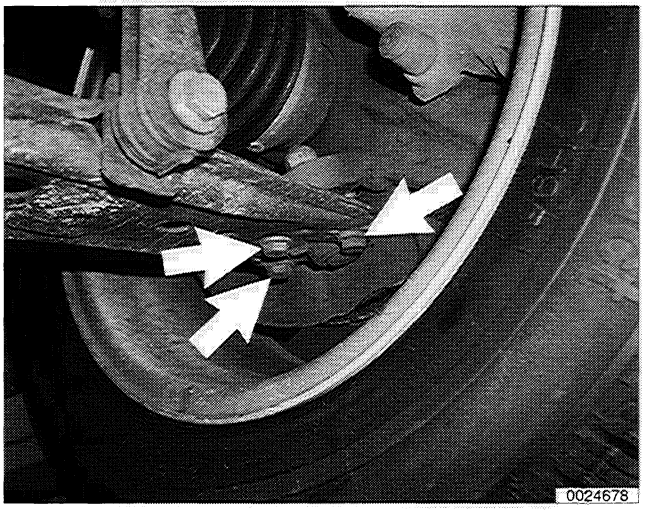
– Remove left front wheel.

➢ Remove left lower sound absorber panel fasteners (**arrows**) as required to facilitate access.

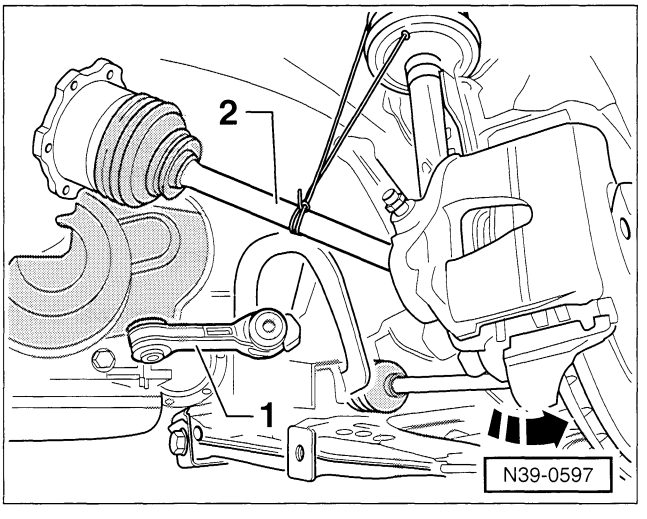
– Unbolt left side drive shaft at transmission drive flange.



➤ Remove pendulum support from subframe (**arrows A**).



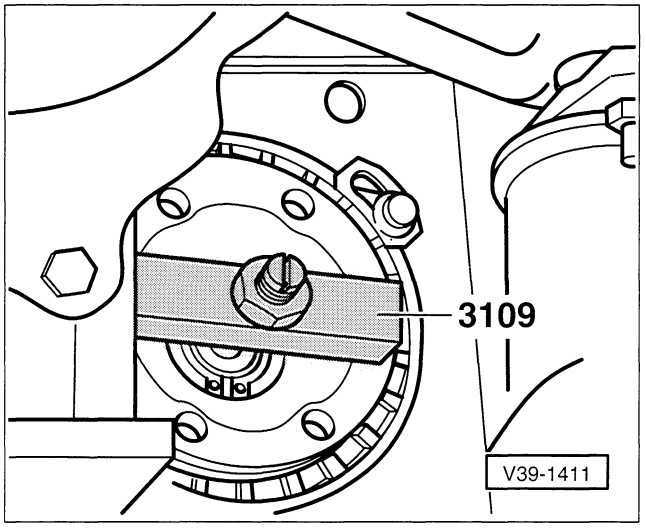
➤ Mark installation position of ball joint bolts (**arrows**) on left control arm and remove bolts.



➤ Unbolt left stabilizer connecting link (**1**) from control arm and turn connecting link upward. Swing wheel bearing housing outward and guide left drive shaft (**2**) out between subframe and transmission.

NOTE —
While guiding drive shaft out, it may be necessary to have an assistant push the engine/transmission assembly forward to allow sufficient clearance.

– Lift drive shaft and secure to suspension strut with wire as shown.



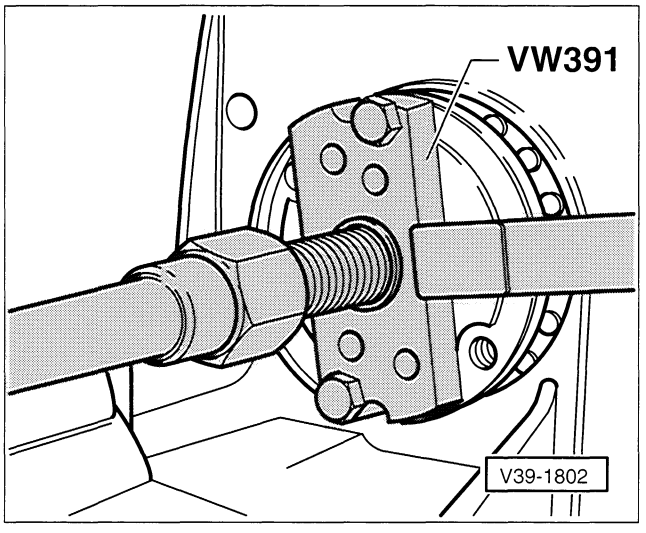
Drive flange oil seals, removing, continued for both sides

– Pry off cover in center of drive flange by piercing center of cover with screwdriver.

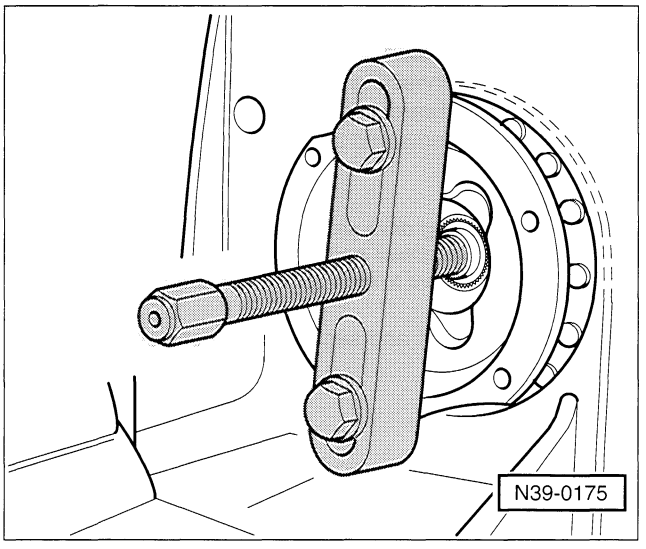
➢ Install fitting tool (3109 shown) and push drive flange in slightly to allow removal of circlip.

NOTE —
Volkswagen special tool VW 391 can also be used to press flange in to remove circlip.

– Remove dished washer, noting orientation.



➢ For CV joint drive axles, mount puller (VW391 shown) to drive flange with two 8x35mm bolts. Install a center spindle with nut through puller that will thread into output shaft (M10 thread). Turn spindle to press out drive flange.

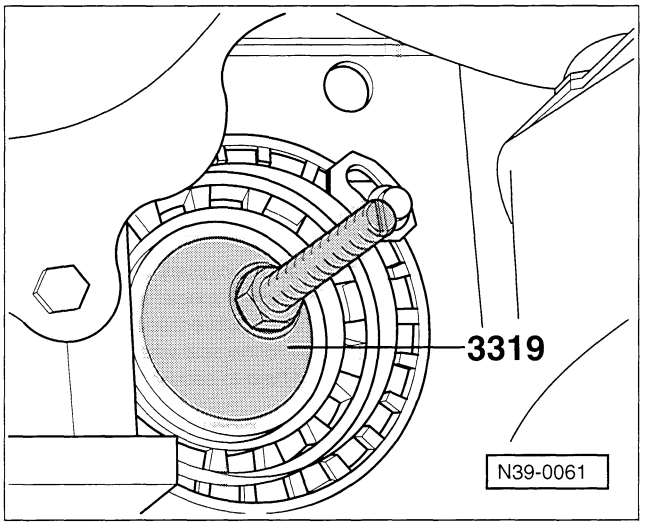


➢ For triple roller (tripod) drive axles, mount puller (Kukko 18-0 shown) to drive flange and pull it off.

NOTE —
For both versions, spring, thrust washer and tapered ring may drop out of transmission during drive flange removal. Be sure to note installation position during reassembly.

– Place drip tray underneath drive flange.

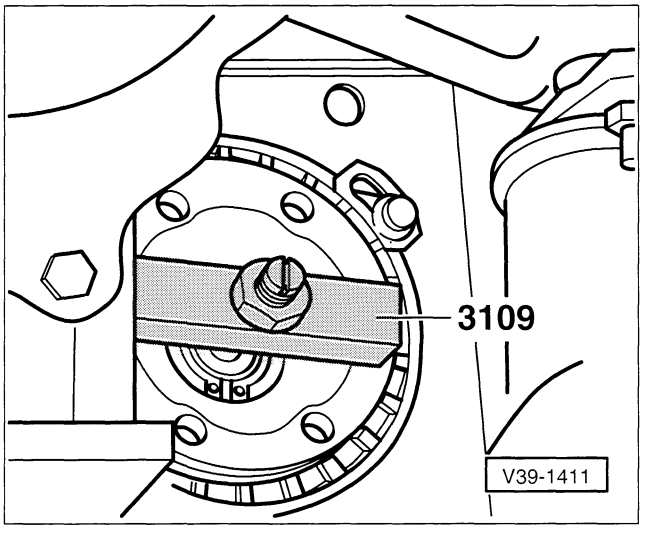
– Remove drive flange oil seal with seal removal tool (VW 681 or equivalent).



To install new seal, use seal installer 3319 with a length of M10 threaded rod approximately 80 mm in long and an M10 nut and washer. Press seal fully into the recess to the stop. Do not tilt seal; press it squarely into recess.

– Fill space between sealing lip and outer lip of oil seal with grease G052 128 A1.

– Install drive flange, dished washer, and circlip.



Install fitting tool (3109 shown) and push drive flange in slightly to allow installation of circlip. Install circlip.

NOTE —

- *Volkswagen special tool VW 391 can also be used to press flange in to install circlip.*
- *Place dished washer onto center spindle of puller with concave side facing in toward the differential.*

– Install new drive flange center cover.

– Install drive shaft to drive flange.

– Remainder of installation is the reverse of removal. Be sure to top up gear oil, see **0 Maintenance**.

Tightening torques

- CV joint to drive flange on transmission, always replace, tighten diagonally
  - M8 . . . . . 40 Nm (30 ft-lb)
  - M10 . . . . . 70 Nm (52 ft-lb)
- Ball joint to control arm always replace . . . . . 20 Nm (15 ft-lb) plus ¼ turn (90°)
- Connecting link to control arm . . . . . 25 Nm (18 ft-lb)
- Wheel bolt . . . . . 120 Nm (89 ft-lb)
- Pendulum mount to body always replace . . . . . 20 Nm (15 ft-lb) plus ¼ turn (90°)
- Pendulum mount bracket always replace . . . . . 40 Nm (30 ft-lb) plus ¼ turn (90°)

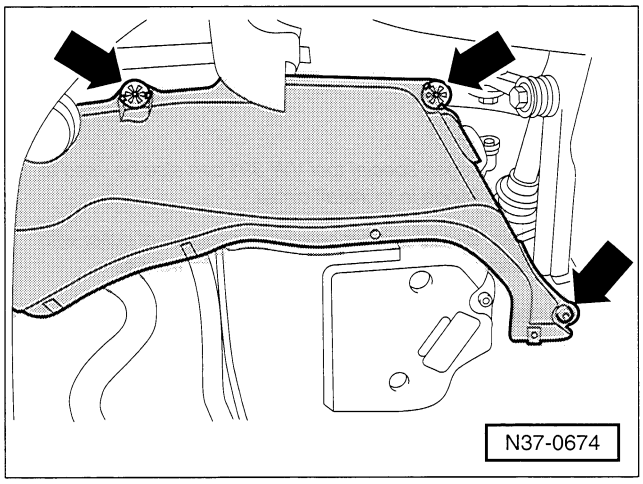
Drive flange oil seal, left side, replacing (09A)

NOTE —

- *A slide hammer with a puller hook is needed to remove the drive flange oil seals. Factory special tool VW771 with attachments is shown in this section. Alternatively, a seal removal tool may be used.*
- *A seal installation drift is also necessary for installing the drive flange oil seals. Factory special tool T10087 is shown in this section. If using different seal installers, take care to avoid damage to the seal when installing in these hard-to-reach and hard-to-see locations.*

– Loosen wheel bolts before raising vehicle.

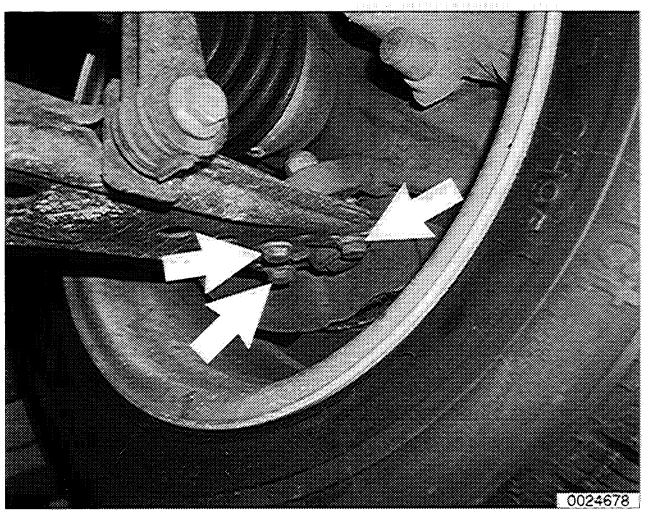
– Remove left front wheel.



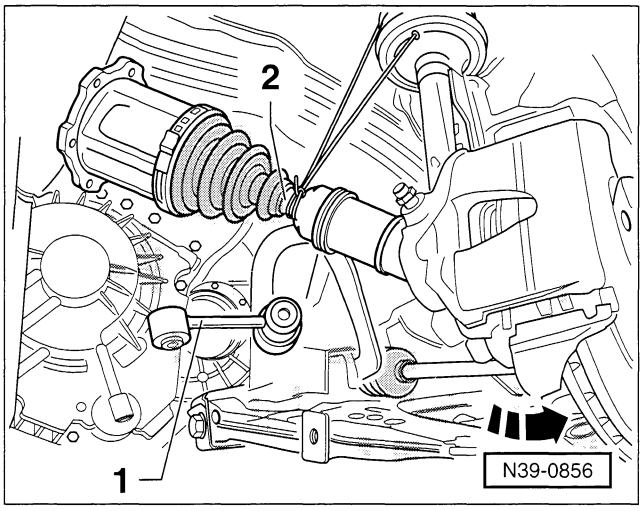
➢ Remove left lower sound absorber panel fasteners (**arrows**) as required to facilitate access.

– Turn the steering wheel completely to the left (full-lock).

– Unbolt drive shaft at transmission drive flange.



➢ Mark installation position of ball joint bolts on left control arm and remove bolts (**arrows**).

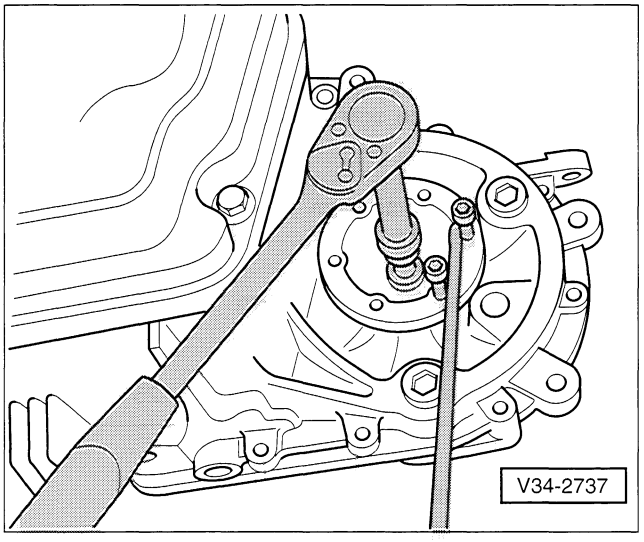


➢ Unbolt left stabilizer connecting link (**1**) from control arm and turn connecting link upward. Swing wheel bearing housing outward and guide left drive shaft (**2**) out between subframe and transmission.

NOTE —
While guiding drive shaft out, it may be necessary to have an assistant push the engine/transmission assembly forward to allow sufficient clearance.

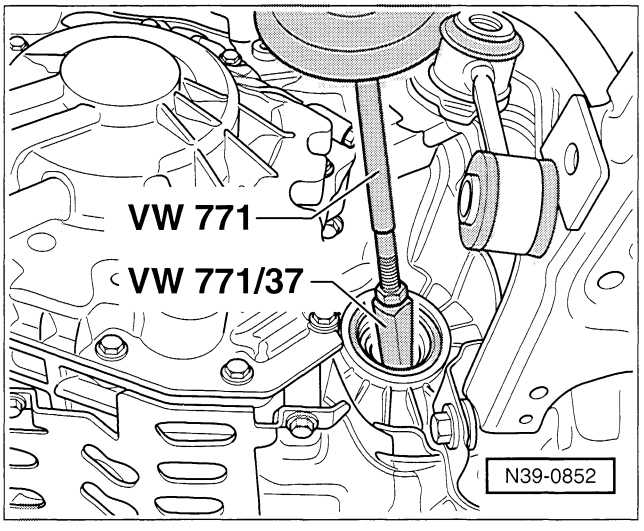
– Lift drive shaft and secure to suspension strut with wire as shown.

– Place drip tray underneath drive flange.

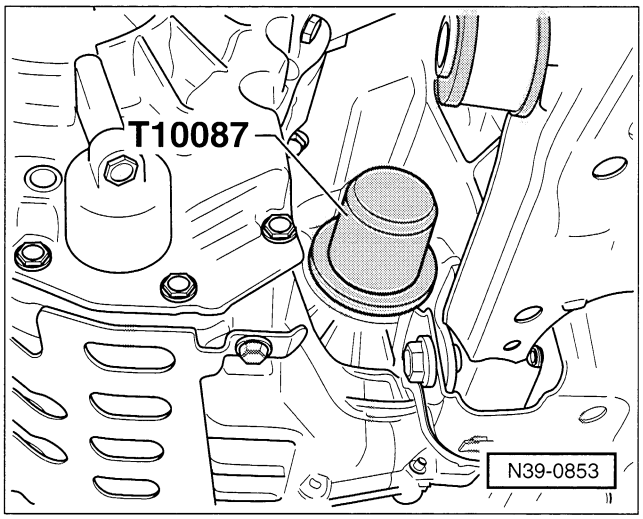


➢ Install two bolts into triple roller (tripod) joint mounting holes of drive flange and counter-hold with a screwdriver. Remove socket head bolt from center of drive flange (manual transmission shown).

– Remove drive flange shaft with spring.



➢ Using the slide hammer and appropriate hook or seal removal tool, pull out drive flange oil seal.



➢ To install new seal, drive it fully into the recess with driver tool T10087. Do not tilt seal; drive it squarely into recess.

– Fill space between sealing lip and outer lip of oil seal with grease G052 128 A1.

– Install drive flange and spring.

– Apply D 176 404 A2 locking fluid to threads of socket head bolt. Torque to specification using the reverse of the technique used to remove it.

– Align previously made marks and connect ball joint to control arm with new bolts.

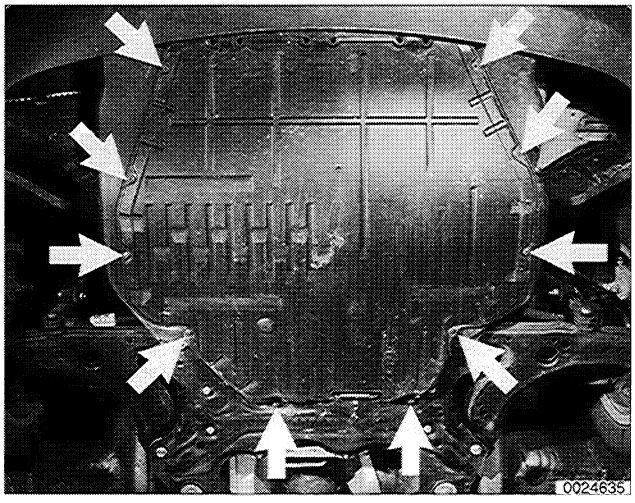
– Install drive shaft to drive flange.

– Remainder of installation is the reverse of removal. Be sure to top up gear oil, see **0 Maintenance**.

Tightening torques

- CV joint to drive flange on transmission, always replace, tighten diagonally
  M8 . . . . . 40 Nm (30 ft-lb)
  M10 . . . . . 70 Nm (52 ft-lb)
- Ball joint to control arm
  always replace . . . . . 20 Nm (15 ft-lb)
  plus ¼ turn (90°)
- Connecting link to control arm . . . . . 25 Nm (18 ft-lb)
- Wheel bolt . . . . . 120 Nm (89 ft-lb)
- Drive flange to transmission (socket head bolt). . . . . 25 Nm (18 ft-lb)

Drive flange oil seal, right side, replacing (09A)



NOTE —

- *A slide hammer with a puller hook is needed to remove the drive flange oil seals. Factory special tool VW771 with attachments is shown in this section. Alternatively, a seal removal tool may be used.*
- *A seal installation drift is also necessary for installing the drive flange oil seals. Factory special tool T10088 is shown in this section. If using different seal installers, take care to avoid damage to the seal when installing in these hard-to-reach and hard-to-see locations.*

➢ Remove lower sound absorber panel fasteners (**arrows**) as required to facilitate access.

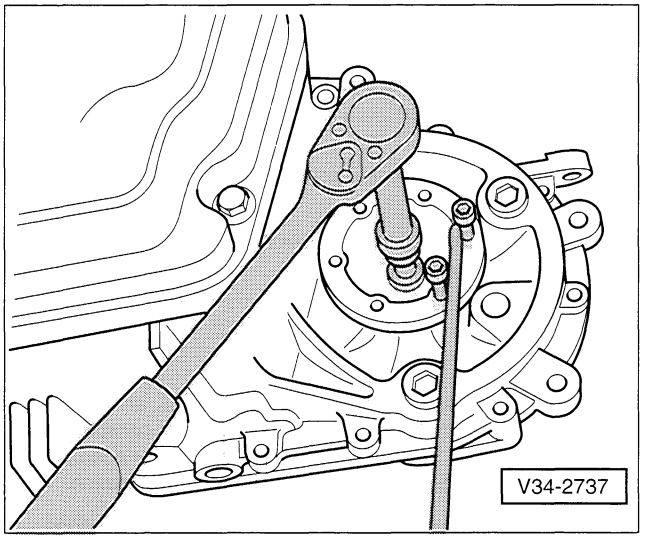
– Remove right side sound absorber panels.

– Turn the steering wheel completely to the right (full-lock).

– Unbolt right side drive shaft at transmission drive flange.

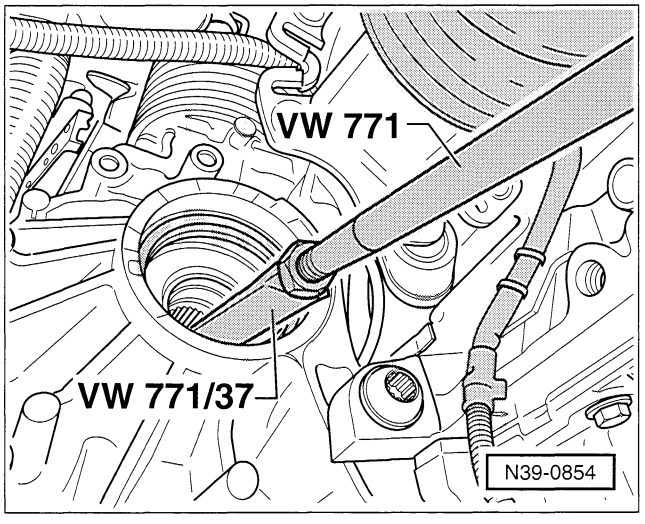
– Position drive shaft up and out of the way as far as possible and secure.

– Place drip tray underneath drive flange.

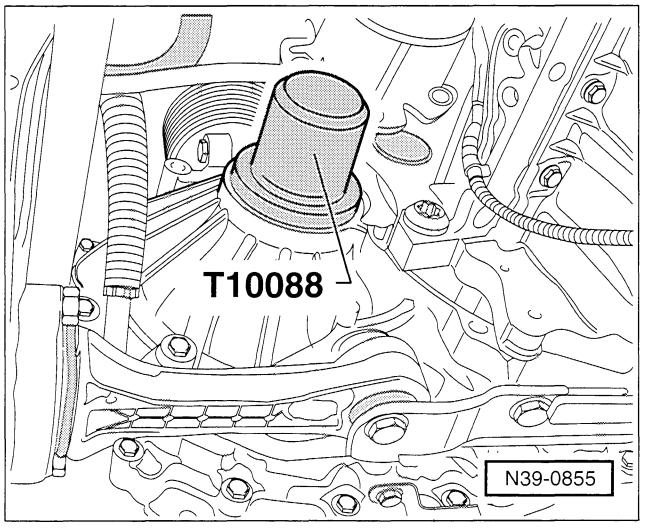


➢ Install two bolts into triple roller (tripod) joint mounting holes of drive flange and counter-hold with a screwdriver. Remove socket head bolt from center of drive flange (manual transmission shown).

– Remove drive flange shaft with spring.



➢ Using the slide hammer and appropriate hook or seal removal tool, pull out drive flange oil seal.



➢ To install new seal, drive it fully into the recess with driver tool T10088. Do not tilt seal; drive it squarely into recess.

– Fill space between sealing lip and outer lip of oil seal with grease G052 128 A1.

– Install drive flange and spring.

– Apply D 176 404 A2 locking fluid to threads of socket head bolt. Torque to specification using the reverse of the technique used to remove it.

– Install drive shaft to drive flange.

– Remainder of installation is the reverse of removal. Be sure to top up gear oil, see **0 Maintenance**.

Tightening torques

- CV joint to drive flange on transmission, always replace, tighten diagonally
  - M8 . . . . . 40 Nm (30 ft-lb)
  - M10 . . . . . 70 Nm (52 ft-lb)
- Ball joint to control arm always replace . . . . . 20 Nm (15 ft-lb) plus ¼ turn (90°)
- Connecting link to control arm . . . . . 25 Nm (18 ft-lb)
- Wheel bolt . . . . . 120 Nm (89 ft-lb)
- Drive flange to transmission (socket head bolt). . . . . 25 Nm (18 ft-lb)

NOTE —

- *Volkswagen part numbers for fluids, oils, and chemicals are given for reference only! Always consult with your local Volkswagen Parts Department or aftermarket Parts Specialist for the latest parts information.*
- *For appropriate fill capacities and fluid specifications, see **0 Maintenance**, **34 Manual Transmission**, and **37 Automatic Transmission**.*

40 Front Suspension and Drive Axles

GENERAL 40-1

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GENERAL

Special tools, equipment and procedures are required for most front suspension repair and component replacement. In addition, front wheel alignment is almost always disturbed when suspension components are removed or replaced.

This section covers repairs to the front suspension and related components. For rear suspension servicing and repair information, see **42 Rear Suspension**. For wheel alignment specifications, see **44 Wheels, Tires, Wheel Alignment**.

Also covered are the drive axle assemblies with Constant Velocity (CV) joints as installed in vehicles with manual transmissions, as well as drive axles with triple rotor joints installed in vehicles with automatic transmissions.

WARNING —

- *Do not re-use any fasteners that are worn or deformed in normal use. Most fasteners are designed to be used only once and become unreliable and may fail when used a second time. This includes, but is not limited to, nuts, bolts, washers, circlips cotter pins, self-locking nuts and bolts. For replacements, always use new parts.*
- *Do not reinstall bolts and nuts coated with undercoating wax, as correct tightening torque cannot be ensured. Always clean the threads of removed bolts and nuts that are to be re-used with a suitable solvent before installation. Ensure that new parts are clean.*
- *Do not use standard nuts and bolts in place of green colored parts. The green color denotes a special anti-corrosion process known as "dacromet" or "delta-tone". Torque specifications are given based on use of these parts only.*
- *Always replaced rusted or corroded bolts, nuts and washers even if not specifically indicated.*
- *DO NOT attempt to straighten or weld suspension struts, wheel bearing housings, control arms or any other wheel locating or load bearing components of the front suspension.*
- *If a vehicle has to be moved (rolled) after removing the drive axle, install an outer constant velocity joint into the wheel bearing/housing and tighten the nut to 50 Nm (37 ft-lb). Otherwise the wheel bearing will be damaged.*

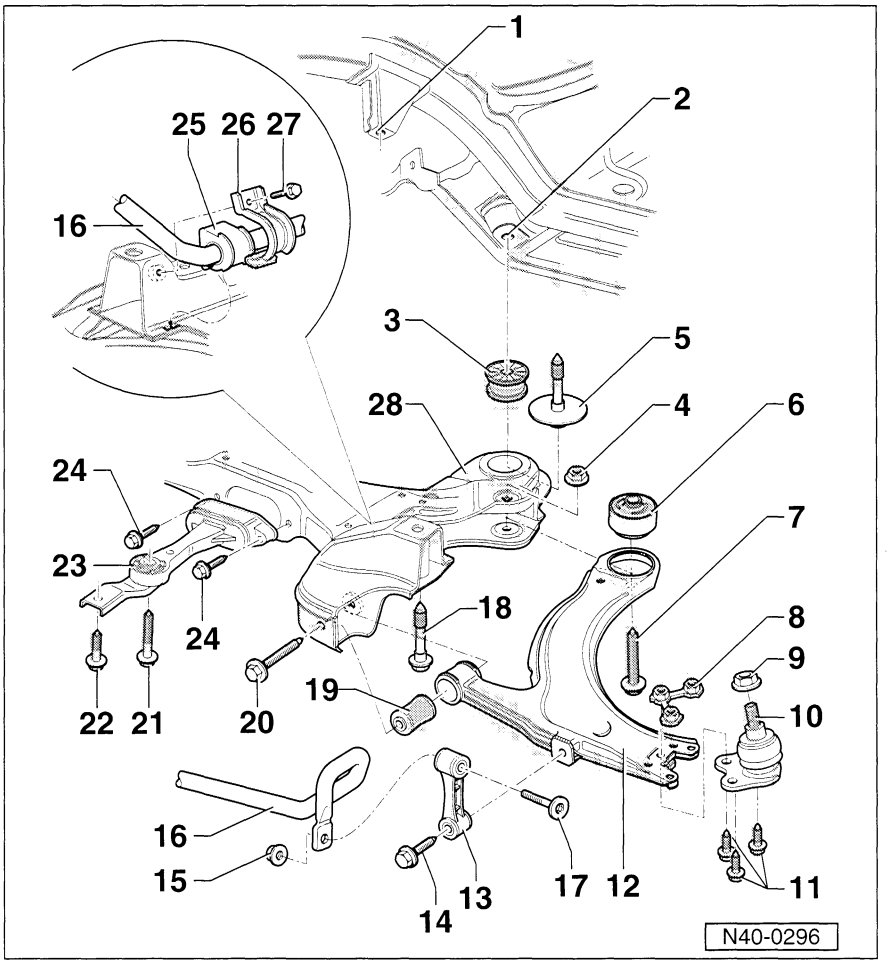
SUBFRAME AND CONTROL ARMS

The control arms and the subframe are mounted in replaceable rubber bushings that are subject to wear. The subframe supports the steering gear and the lower engine/transmission pendulum mount. Always understand and observe the warnings and cautions listed above before working on the suspension components shows the subframe, stabilizer bar and control arm assembly.

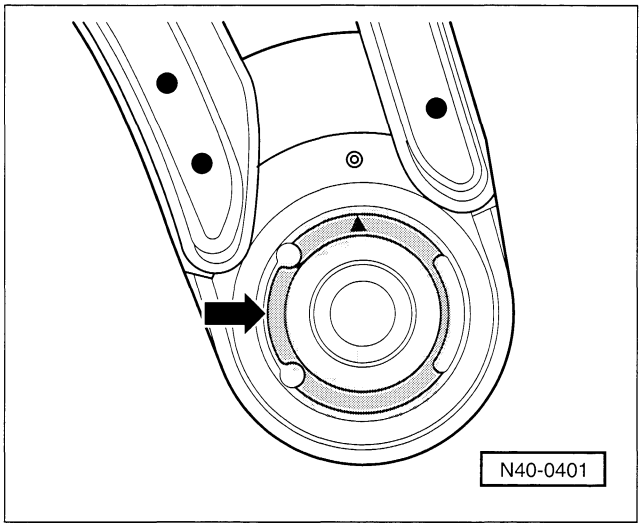
NOTE —

Special tools are identified by their VWAG number in this section. These tools are required for several hydraulic press operations described herein. Failure to use the correct special tool or it's equivalent may result in damage to bushings and/or seat areas during press operations.

Subframe, stabilizer bar, control arm assembly

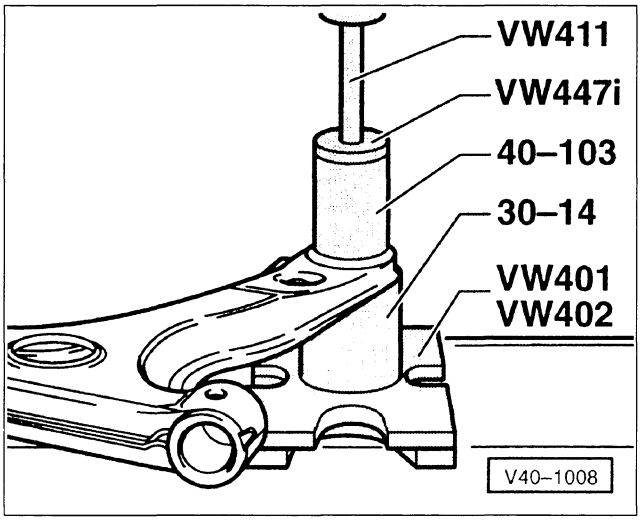


1. **Subframe retaining bracket (on body)**
   - Captive nut cannot be reworked.
   - Replace complete bracket if nut is damaged
2. **Welded nut (in body)**
   - Damaged welded nut threads can be repaired with HeliCoil® inserts
3. **Rear subframe bushing (bonded rubber)**
4. **Nut, self-locking**
   - Always replace
5. **Bolt, hex**
   - Always replace
   - Tighten to 100 Nm (74 ft-lb) + ¼ turn (90°)
6. **Rear control arm bushing, (bonded rubber)**
   - Installs properly in one position only, see **Rear control arm bushing, installed position**
   - Pressing out/in, see **Rear control arm bushing, pressing in/out**
7. **Bolt, hex**
   - Always replace
   - Tighten to 70 Nm (52 ft-lb) + ¼ turn (90°)
8. **Nut plate**
9. **Nut, self-locking**
   - Always replace
   - Tighten to 45 Nm (33 ft-lb)
10. **Ball joint**
    - Checking, see **Ball joint, checking axial play** and **Ball joint, checking radial play**
    - Replacing, see **Ball joint, removing and installing**
11. **Bolts, hex**
    - Always replace
    - Tighten to 20 Nm (15 ft-lb) + ¼ turn (90°)
12. **Control arm**
13. **Stabilizer connecting link**
14. **Bolt, hex**
    - Tighten to 15 Nm (11 ft-lb)
15. **Nut, self-locking**
    - Always replace
    - Tighten to 15Nm (11 ft-lb)
16. **Stabilizer bar**
    - Subframe must be lowered to remove and install
17. **Bolt, socket head hex**
18. **Bolt, hex**
    - Always replace
    - Tighten to 100 Nm (74 ft-lb) + ¼ turn (90°)
19. **Front control arm bushing (bonded rubber)**
    - Removing, see **Pressing out front control arm bushing**
    - Installing, see **Pressing in front control arm bushing**
20. **Bolt, hex**
    - Always replace
    - Tighten to 70 Nm (52 ft-lb) + ¼ turn (90°)
21. **Bolt, hex**
    - Tighten to 50 Nm (37 ft-lb)
22. **Bolt**
    - Tighten to 50 Nm (37 ft-lb)
23. **Pendulum support (mount)**
24. **Bolts, hex**
    - Tighten to 25 Nm (18 ft-lb)
25. **Stabilizer bar bushing**
26. **Stabilizer bar mounting bracket**
27. **Bolt, hex**
    - Tighten to 25 Nm (18 ft-lb)
28. **Subframe**
    - If damaged, do not repair threads in sub-frame for front control arm bolt



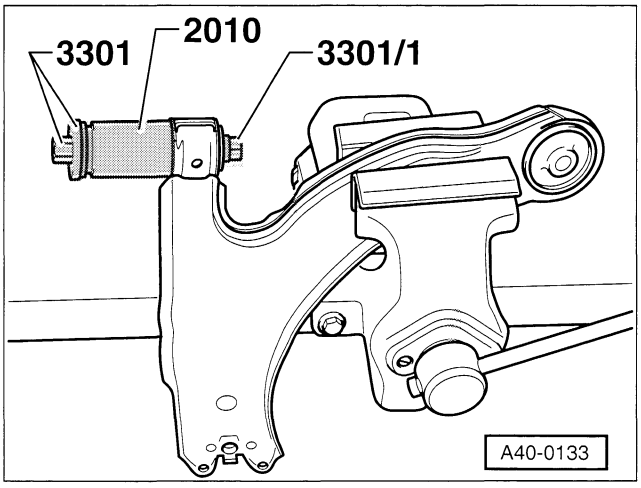
Rear control arm bushing, installed position

- One of the embossed triangular arrows points toward the index mark on the control arm.
- The cam (**arrow**) must point toward the outside of the vehicle



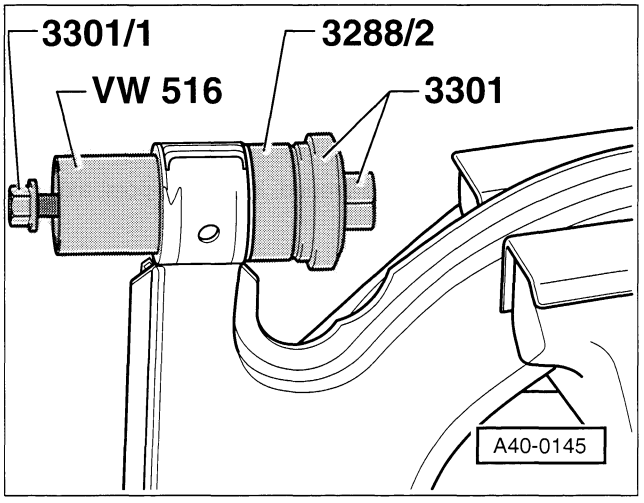
Rear control arm bushing, pressing in/out

- Press the bushing in or out using Volkswagen special tools or equivalent, as shown.
- Setup is the same for removal and installation.



Front control arm bushing, pressing out

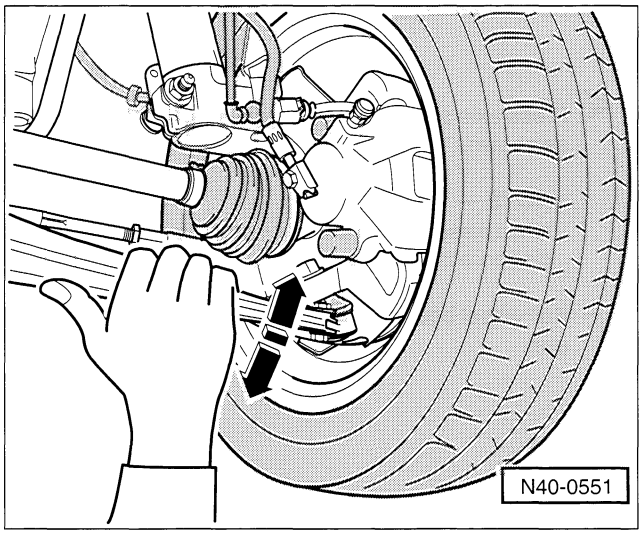
- Support control arm securely in vise and use special tool setup as shown.



Front control arm bushing, pressing out

- Support control arm securely in vise and use special tool setup as shown.
- Use assembly lubricant G 294 421 A1 or equivalent to press in bonded rubber bushing.

> ***WARNING —***
> *Do not use grease as an assembly lubricant!*

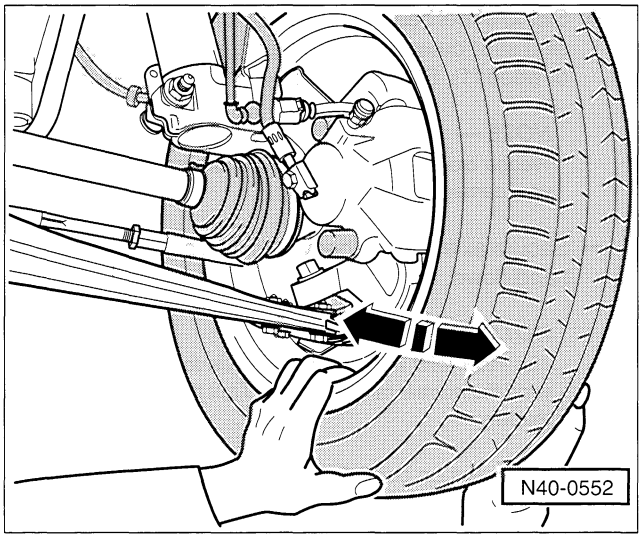


Ball joint, checking axial play

- Forcibly pull ball joint down and press up again (**arrows**) to check axial play.
- Observe ball joint performance as described below:

NOTE —

- *There must be no perceptible or visible "play" or movement when conducting both test procedures.*
- *When observing ball joint, do not confuse looseness in ball joint with wheel bearing "play" or looseness in other suspension components,*
- *Inspect rubber dust boot for damage; replace ball joint if necessary.*



Ball joint, checking radial play

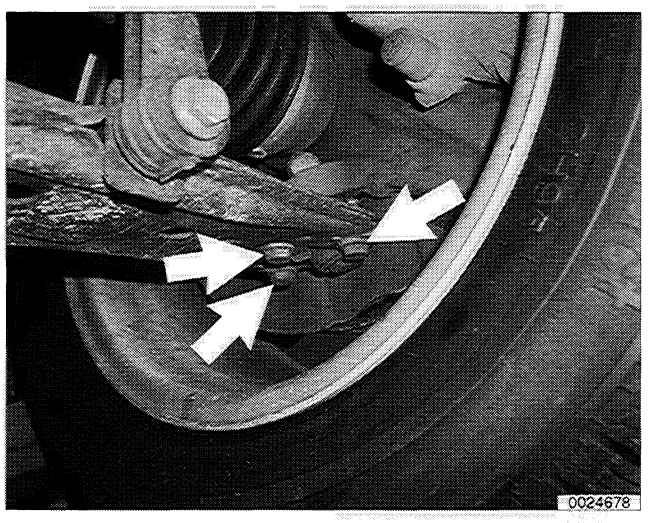
- Forcibly push lower section of wheel/tire in and out (**arrows**) to check radial play.
- Observe ball joint performance as described below:

NOTE —

- *There must be no perceptible or visible "play" or movement when conducting both test procedures.*
- *When observing ball joint, do not confuse looseness in ball joint with wheel bearing "play" or looseness in other suspension components,*
- *Inspect rubber dust boot for damage; replace ball joint if necessary.*

Ball joint, removing and installing

Replacement of the ball joint affects front wheel alignment. Be sure to have the front wheels aligned as the final step in the job.



– With vehicle on the ground, loosen 12-point axle nut or axle bolt.

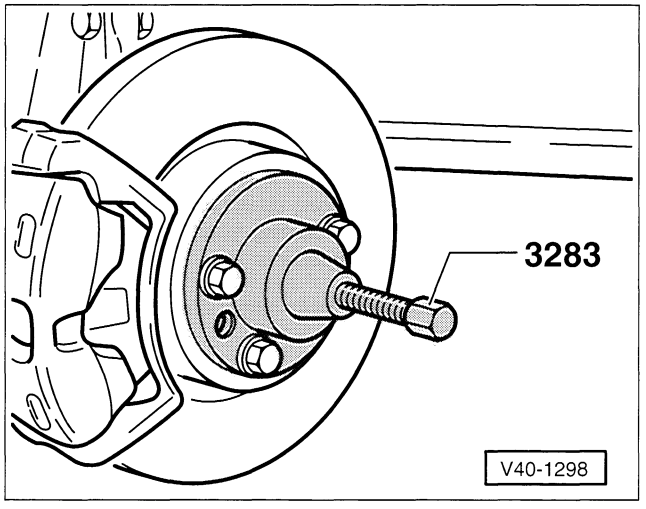
– Lift vehicle and support with appropriate jackstands to relieve load on front axles.

– Remove lower sound insulation panels (belly pans).

– Remove wheel.

◀ Mark the installed position of the ball joint in relation to the control arm and remove bolts (**arrows**).

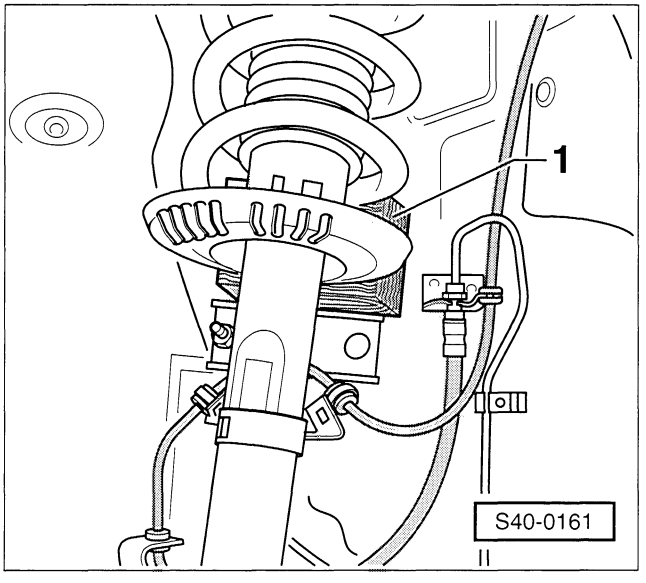
– Remove ball joint bolts.



◀ Press axle shaft out with special tool 3283, or equivalent as shown.

NOTE —
When pressing drive axle out make sure that sufficient clearance is available.

– Pull wheel bearing housing with ball joint out from control arm.



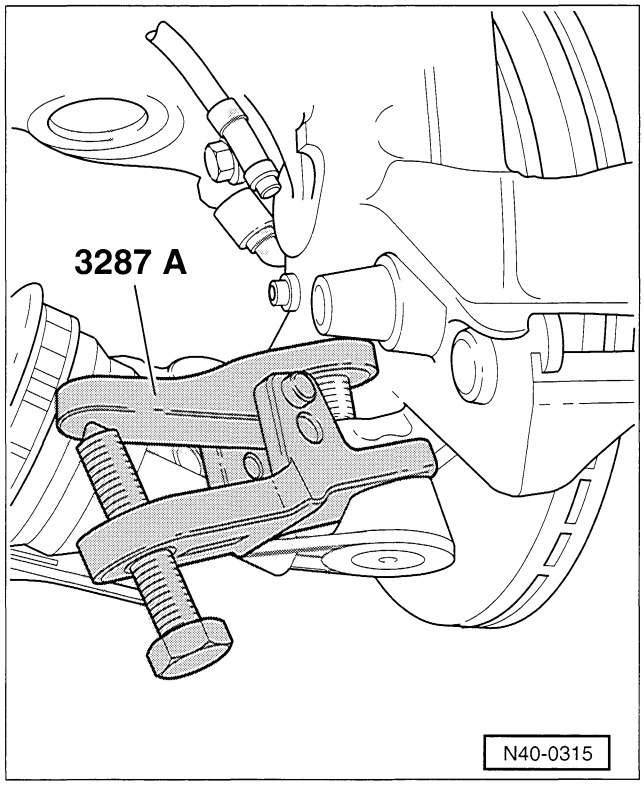
◀ Swing wheel bearing housing/rotor assembly and suspension strut outwards and support in position using a block of wood (**1**). Pull axle out of wheel bearing as required.

NOTE —
Wedge block of wood between strut and body to prevent damage to undercoating.

– Secure axle shaft to body with wire so that axle does not hang down.

NOTE —
The inner joint will be damaged due to movement beyond the normal range of travel if not tied up and out of the way.

– Loosen nut on ball joint, but do not remove it.

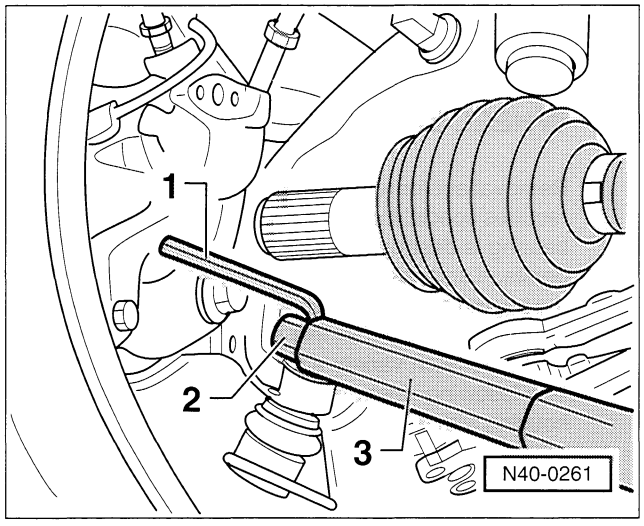


➤ Adjust 3287A ball joint press pivot pin and install press as shown.

– Pre-tension press slightly by turning bolt. Lightly tap on ball joint with a hammer. Re-adjust the pre-tension if needed. Tapping the ball joint with the pre-tensioned puller in place will release the tapered shaft of the ball joint from the wheel bearing housing.

> ***WARNING —***
> - *Leave ball joint nut threaded on few turns to protect ball joint threads and to keep ball joint from falling out unexpectedly.*
> - *Use care when tapping on the ball joint. Once the ball joint breaks free from the taper in the wheel bearing housing, the press will have a tendency to fall off.*

– Remove puller from ball joint (if still attached), remove nut from ball joint. Slide ball joint out of wheel bearing housing.



– Install ball joint into wheel bearing housing with a new self locking nut.

➤ Tighten self locking nut with an 18 mm open end or box wrench insert (**2**) in torque wrench (**3**) and counter hold with a Torx® T40 (**1**) in the ball joint shaft.

Tightening torques

- Ball joint to control arm
  (always replace) . . . . . 20 Nm (15 ft-lb)
  plus ¼ turn (90°)
- 12-point nut for drive axle to wheel hub
  (always replace) . . . . . 200 Nm (148 ft-lb)
  loosen ½ turn (180°)
  turn wheel ½ turn (180°)
  then tighten to 50 Nm (37 ft-lb)
  plus 1/6 turn (60°)
- Hex bolt for drive axle to wheel hub
  (always replace) . . . . . 250 Nm (184 ft-lb)
  plus ¼ turn (90°)
  loosen ½ turn (180°)
  turn wheel ½ turn (180°)
  then tighten to 250 Nm (184 ft-lb)
  plus ¼ turn (90°)
- Ball joint to wheel bearing housing. . 45 Nm (33 ft-lb)

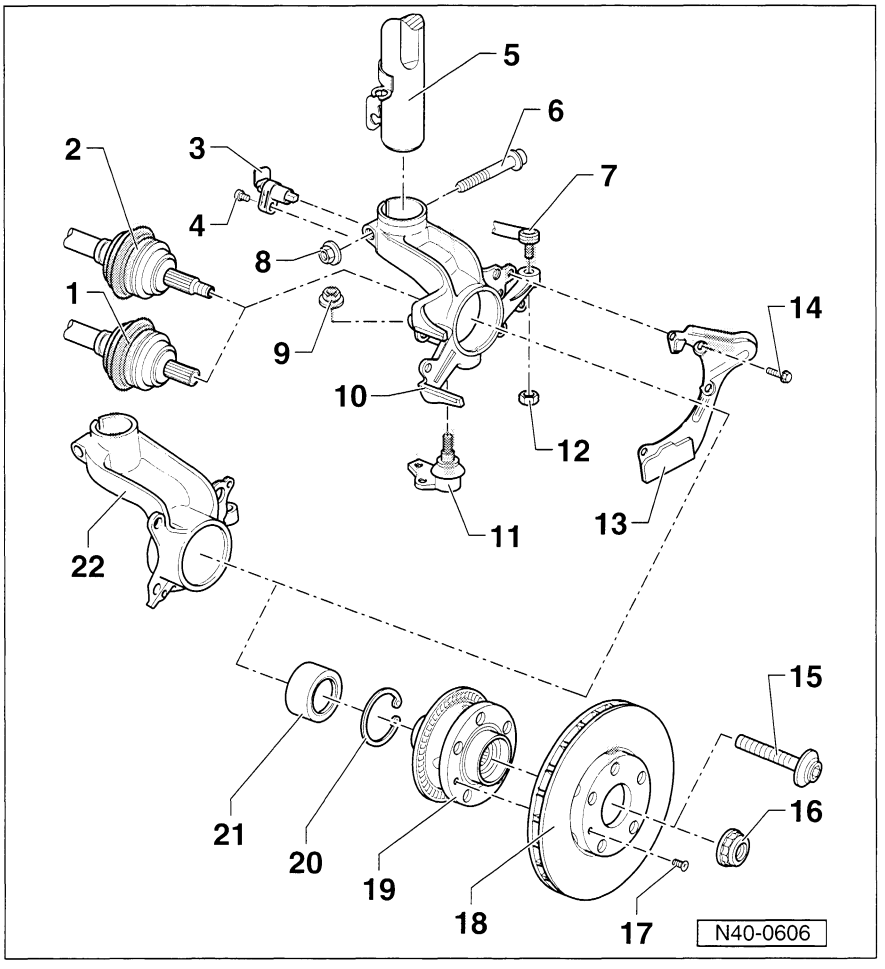
– Remaining installation is the reverse of removal noting the following:
  - Make sure the matching marks made earlier for the ball joint on the control arm are exactly aligned before tightening new bolts.
  - Use a new 12-point nut or bolt for securing the drive axle to the wheel hub. See tightening procedures given later under **Front wheel bearing housing assembly**.
  - Check and adjust front wheel alignment.

WHEEL BEARINGS

Removal and/or replacement of the front wheel bearings requires special tools and equipment. Note that the wheel bearing is destroyed any time it is removed. Always understand and observe the warnings and cautions listed at the beginning of this section. Also be aware that most of the fasteners used in this section are of the torque-to-yield or stretch variety and must be replace if removed. The following illustration shows the front wheel bearing housing with related components.

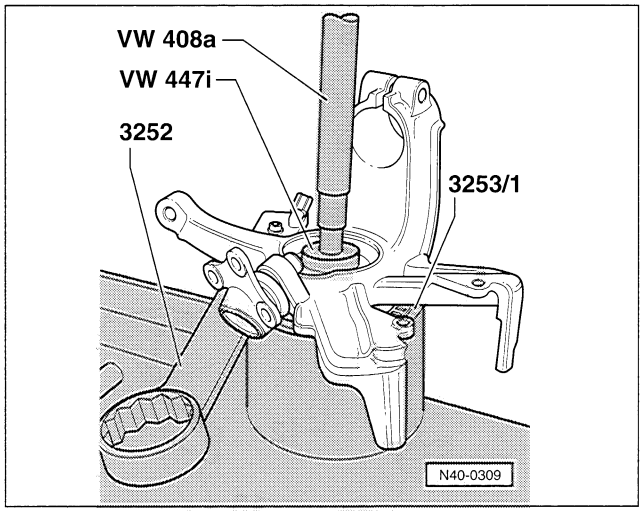
> ***WARNING —***
> *Loosen and tighten axle nuts only when weight of vehicle is on the wheels. The leverage (torque) required for this operation is sufficient to topple the vehicle to the ground if supported on a lift or jack stands.*

Front wheel bearing housing assembly



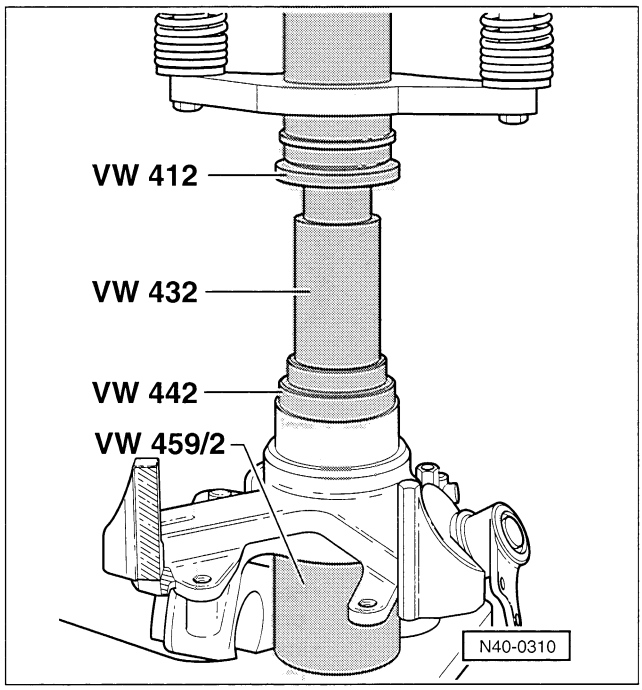
1. **Axle shaft**
   - For vehicles with hex bolt
   - See: **Drive axle/constant velocity joint, pressing out of hub**
2. **Axle shaft**
   - For vehicles with self locking 12-point nut
   - See: **Drive axle/constant velocity joint, pressing out of hub**
3. **ABS wheel speed sensor**
4. **Bolt, hex socket head**
   - Tighten to 10 Nm (89 in-lb)
5. **Suspension strut**
6. **Bolt, hex**
   - Always replace
   - The "wrench end" of the bolt should be towards the rear of the vehicle.
7. **Tie rod end**
8. **Nut, self-locking**
   - Always replace
   - Tighten to 60 Nm (44 ft-lb) + ¼ turn (90°)
   - Turning angle tolerance 90°–120°
   - Never less than 90°!
9. **Nut, self locking**
   - Always replace
   - Tighten to 45 Nm (33 ft-lb)
10. **Wheel bearing housing**
    - Installed on vehicles with 1.9 L TDI and 2.0 L gasoline engines
11. **Ball joint**
12. **Nut, self locking**
    - Always replace
    - Tighten to 45 Nm (33 ft-lb)
13. **Splash guard**
14. **Bolt, hex**
    - Tighten to 10 Nm (7 ft-lb)
15. **Bolt, hex axle**
    - For axle shaft, item 1
    - Always replace
    - See: **Axle bolt tightening**
    - Only installed on certain high performance models
16. **Nut, self locking 12-point axle**
    - For axle shaft, item 2
    - Always replace
    - See: **Axle nut tightening** or **Axle nut tightening (alternate procedure)**
17. **Screw, Phillips®**
    - Tighten to 4 Nm (35 in-lb)
18. **Ventilated brake disc (rotor)**
19. **Wheel hub with ABS wheel speed sensor rotor**
    - Rotor welded to wheel hub
    - Removal, see **Wheel hub, pressing out of wheel bearing**
    - Installation, see **Wheel, hub pressing into wheel bearing**
    - Removal of old bearing remnants, see: **Inner wheel bearing races, pulling off**
20. **Circlip**
    - Ensure clip is correctly seated
21. **Wheel bearing**
    - Always replace (bearing is destroyed during removal).
    - Removal, see **Wheel bearing, pressing out**
    - Installation, see **Wheel bearing, pressing in**
22. **Wheel bearing housing**
    - Installed on vehicles with 2.8 L and 1.8 L gasoline engines.
    - Do not allow the caliper to hang by the brake hose. The unsupported weight can stretch and damage the hose. Suspend the brake caliper using a piece of wire or similar

* **Wheel (lug) bolts** (not shown)
- Tighten to 120 Nm (87 ft-lb)



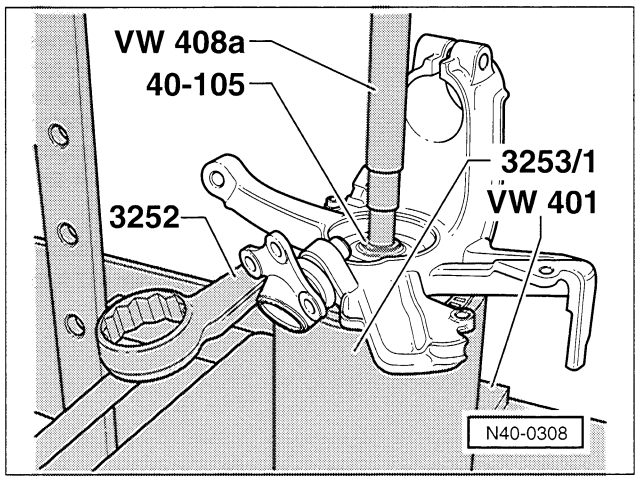
Wheel bearing, pressing out

- Press wheel bearing out using a hydraulic press with the Volkswagen special tools shown or their equivalents.
- Ensure that circlip is removed before pressing operations.



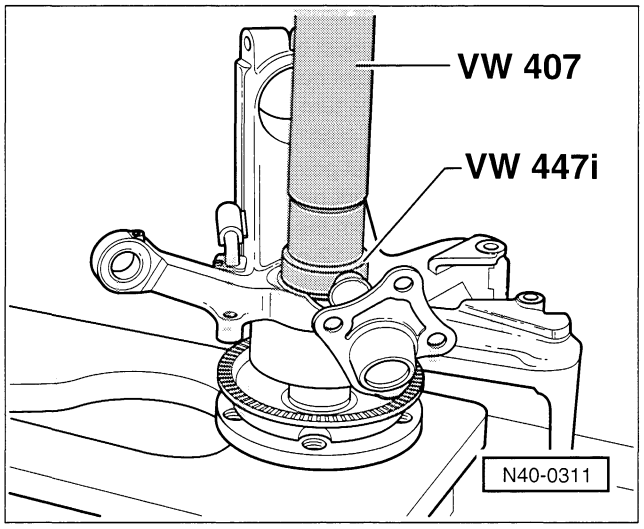
Wheel bearing, pressing in

- Press wheel bearing in using a hydraulic press with the Volkswagen special tools shown or their equivalents.
- Lubricate inner surface of bearing carrier completely with $MoSo_2$ (moly) lubricant supplied in kit (N 052 723 00) or AOS 115 000 01 $MoSo_2$ lubricant.
- Install circlip with open end facing the road.
- Ensure that circlip is properly seated in groove after pressing operations.



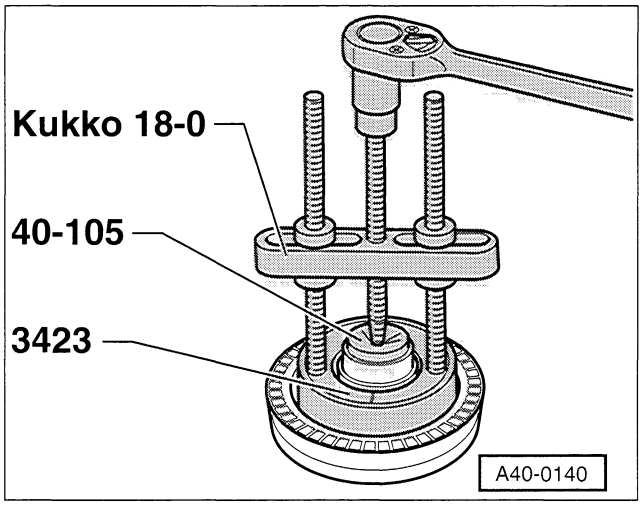
Wheel hub, pressing out of wheel bearing

- Press wheel hub out of wheel bearing using a hydraulic press with the Volkswagen special tools shown or their equivalents.
- Inner wheel bearing race(s) will usually stay attached to hub and will require removal before hub is reused.



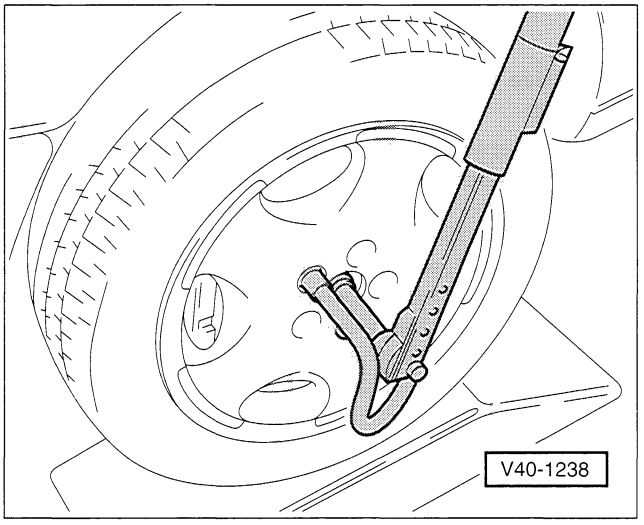
Wheel hub, pressing into wheel bearing

- Press wheel hub into wheel bearing using a hydraulic press with the Volkswagen special tools shown or their equivalents.
- Press inner wheel bearing race(s) off before hub is re-used.



Inner wheel bearing races, pulling off

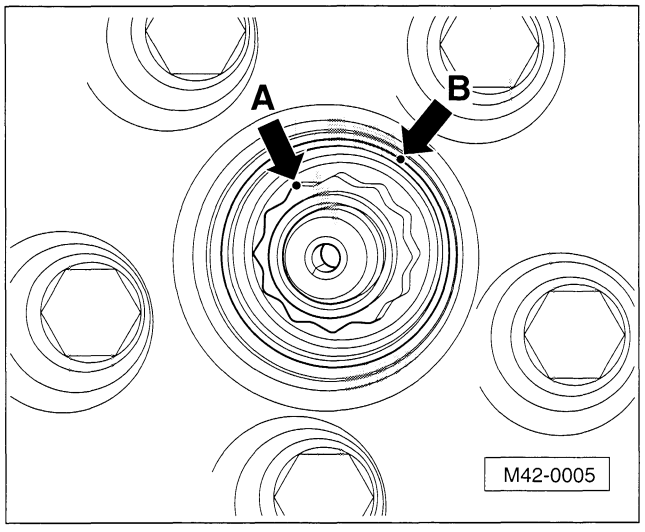
- Pull remaining inner wheel bearing race(s) off of hub using a Kukko puller with the Volkswagen special tools shown or their equivalents.
- Puller must grip between inner race and hub.



Axle nut tightening (12-point hex nut)

- Weight of vehicle must be on its wheels.
- Tighten new 12-point nut to 200 Nm (148 ft-lb) and immediately loosen ½ turn (180°)
- Turn wheel ½ turn (180°) (roll vehicle), then tighten to 50 Nm (37 ft-lb) plus 1/6 turn (60°)

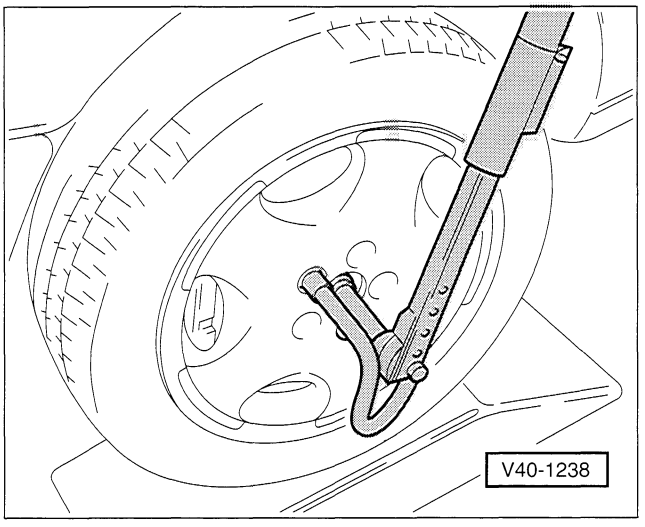
> ***WARNING —***
> *Loosen and tighten axle nuts only when weight of vehicle is on the wheels. The leverage (torque) required for this operation is sufficient to topple the vehicle to the ground if supported on a lift or jack stands.*



Axle nut tightening (alternate procedure)

- Weight of vehicle must be on its wheels.
- Tighten new 12-point nut to 200 Nm (148 ft-lb) and immediately loosen ½ turn (180°)
- Turn wheel ½ turn (180°) (roll vehicle)
- Make a mark on nut point with line (**arrow A**).
- Make a second mark on the wheel hub (**arrow B**) two nut points away from the first. (The distance between each nut point on a 12-point nut is 30°)
- Tighten the axle nut until both marks line up.

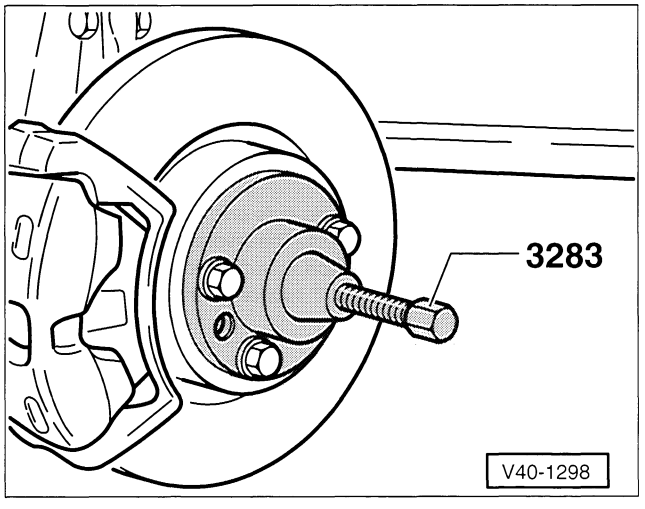
> ***WARNING —***
> *Loosen and tighten axle nuts only when weight of vehicle is on the wheels. The leverage (torque) required for this operation is sufficient to topple the vehicle to the ground if supported on a lift or jack stands.*



Axle bolt tightening (6-point hex bolt)

- Weight of vehicle must be on its wheels.
- Tighten new bolt to 250 Nm (184 ft-lb) plus ¼ turn (90°) and immediately loosen ½ turn (180°)
- Turn wheel ½ turn (180°) (roll vehicle), then tighten to 250 Nm (184 ft-lb) plus ¼ turn (90°)

> ***WARNING —***
> *Loosen and tighten axle nuts only when weight of vehicle is on the wheels. The leverage (torque) required for this operation is sufficient to topple the vehicle to the ground if supported on a lift or jack stands.*



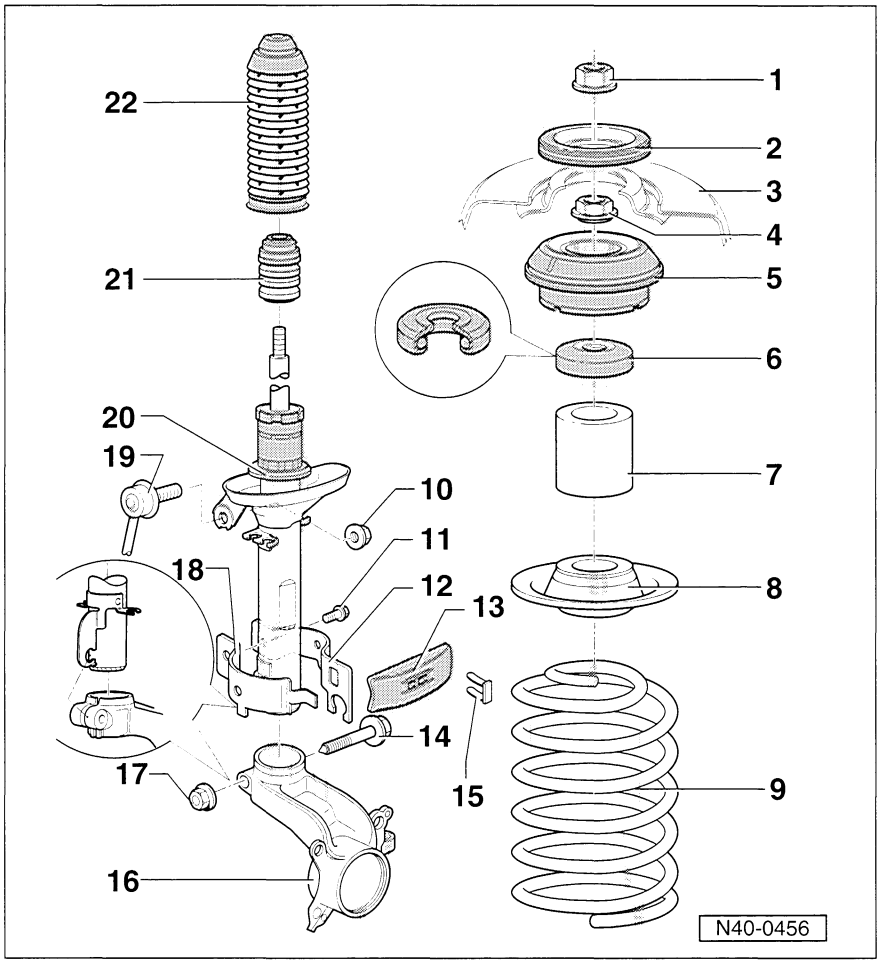
Drive axle/constant velocity joint, pressing out of hub

- Press end of axle out using Volkswagen special tools or equivalent, as shown. Use 3 lug bolts to secure 3283 to hub.
- Be sure there is sufficient clearance before pressing.
- Do not allow drive axle to hang from inner CV joint or triple rotor joint to avoid damaging bearing. Tie up axle to stabilizer bar or another suspension component.
- Do not flex the inner CV joint or triple rotor joint more than 25° from its original angle.

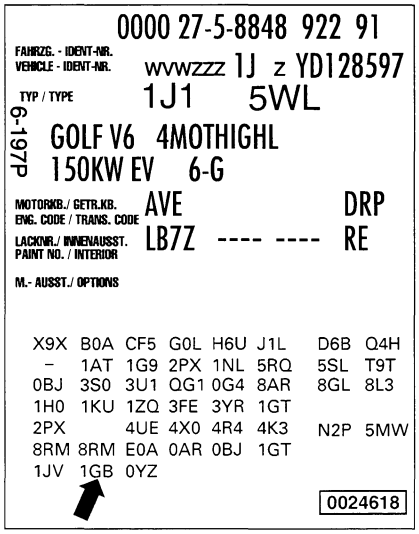
SUSPENSION STRUTS

Removal and/or replacement of the front suspension struts requires special tools and equipment. Note that the strut is a sealed unit integral with the shock absorber. Always understand and observe the warnings and cautions listed at the beginning of this section. This section shows the front strut with related components

Front suspension strut assembly



1. **Nut, outer self locking**
   - Always replace
   - Tighten to 60 Nm (44 ft-lb)
2. **Stop plate**
3. **Suspension strut turret**
   - Welded to inner wheel housing
4. **Nut, inner hex**
   - Tighten to 60 Nm (44 ft-lb)
5. **Suspension strut mount, upper**
6. **Axial ball bearing**
7. **Bushing**
   - Only on vehicles with heavy duty suspension (1GB)
   - Suspension identification code, if relevant, can be found on vehicle data label in luggage compartment or owner's manual
   - Suspension identification, see: **44 Wheels-Tires, Wheel Alignment**
8. **Spring plate**
9. **Coil spring**
   - Note color coded marking for identification
   - Outer surface of spring must not be damaged
   - See: **Coil springs, removing, installing, and identifying**
10. **Nut, self locking**
    - Always replace
    - Tighten to 50 Nm (37 ft-lb) + ¼ turn (90°)
11. **Bolt, hex**
    - Tighten to 10 Nm (7 ft-lb)
12. **Bracket**
13. **Heat shield**
14. **Bolt, hex**
    - Always replace
15. **Clip**
    - Secures brake hose to bracket
16. **Wheel bearing housing**
    - Version depends on brake system type
17. **Nut, self locking**
    - Always replace
    - Tighten to 60 Nm (44 ft-lb) + ¼ turn (90°)
    - Turning angle tolerance 90°–120°
    - Never less than 90°!
18. **Clamp**
    - Secures bracket (item 12).
19. **Connecting link**
    - Usage depends on vehicle equipment
20. **Shock absorber (strut)**
    - See: **Front suspension struts, removing and installing**
21. **Bump stop (buffer)**
22. **Protection boot (sleeve)**



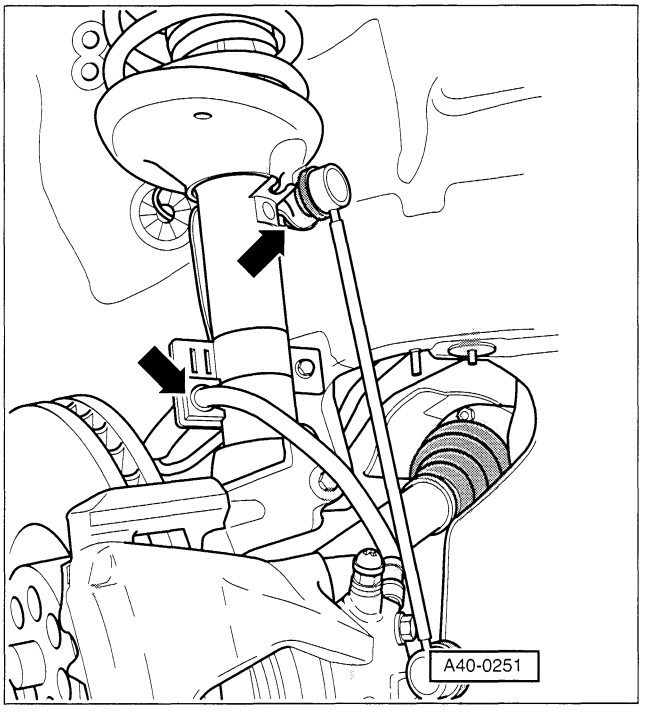
Suspension identification

- Heavy duty suspension referenced on vehicle data stickers is **1GB** (**arrow**)

Front suspension struts, removing and installing

WARNING —

- *Suspension strut springs are compressed and under pressure when installed on struts.*
- *DO NOT attempt to disassemble or repair suspension without proper tools and experience. Serious injury will result from using improper tools or procedures.*
- *Suspension strut is removed and installed as an assembly. DO NOT disassemble or attempt repair while assembly is still installed in vehicle.*
- *Front wheel alignment may be altered during suspension strut repairs. Wheel alignment should be checked and adjusted any time repairs are made to the suspension strut area.*



– Raise vehicle and properly support.

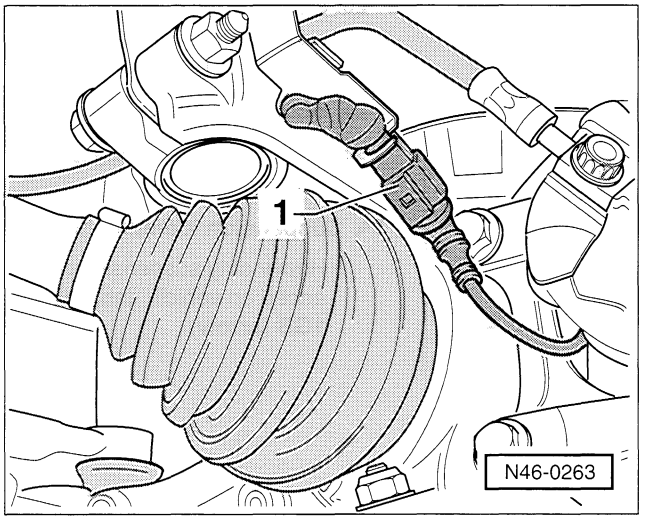
WARNING —

- *Be sure to use jack stands designed for the purpose.*
- *Jack stands should be on a level hard surface.*
- *If a vehicle lift/hoist is used, be sure vehicle is lifted according to manufacturer's instructions.*

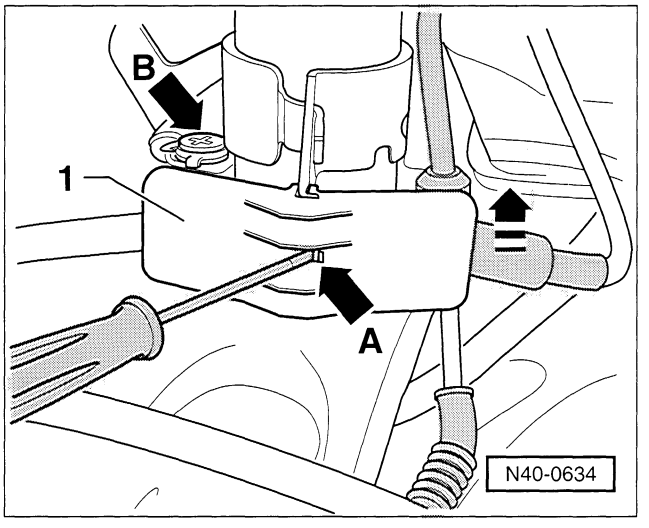
– Remove wheel.

➤ Depending on equipment level:

- Remove nuts from left and right upper connecting link (**upper arrow**).
- Remove clip from brake hose (**lower arrow**).
- Release ABS wheel speed sensor from strut.

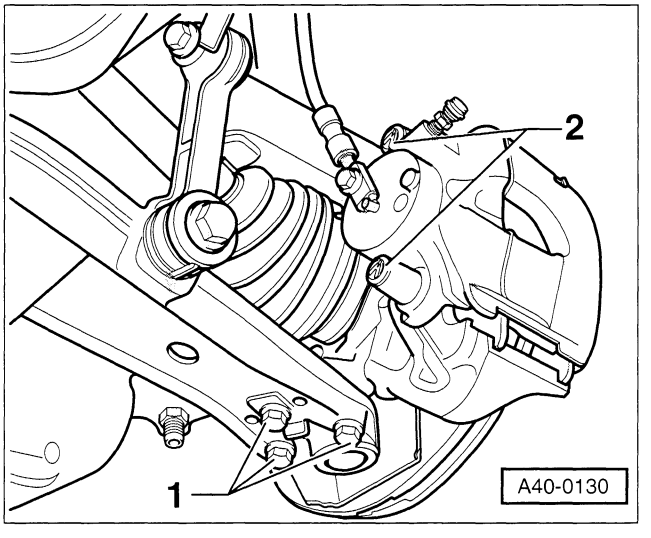


➤ Disconnect brake pad wear indicator connector (**1**) if equipped.



➤ Remove heat shield (**1**). Push lip (**arrow A**) with a screwdriver while at the same time pushing heat shield up (**dashed arrow**).

– Remove bolt for brake pad wear indicator support (**B**) if equipped.



➤ Remove caliper guide pins (**2**) and remove caliper from wheel bearing housing. Suspend caliper securely up and out of the way with wire. Do not loosen ball joint bolts (**1**).

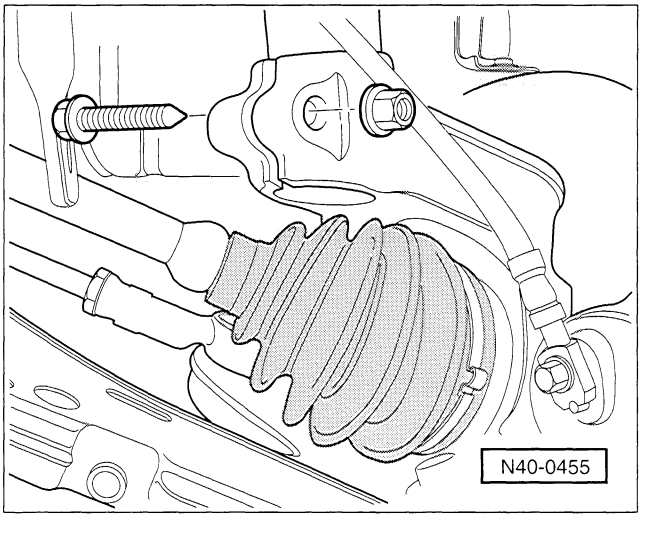
NOTE —

- *Suspend the brake caliper using a piece of wire or heavy duty tie wrap.*
- *Do not allow the caliper to hang by the brake hose. The unsupported weight can stretch and damage the hose.*

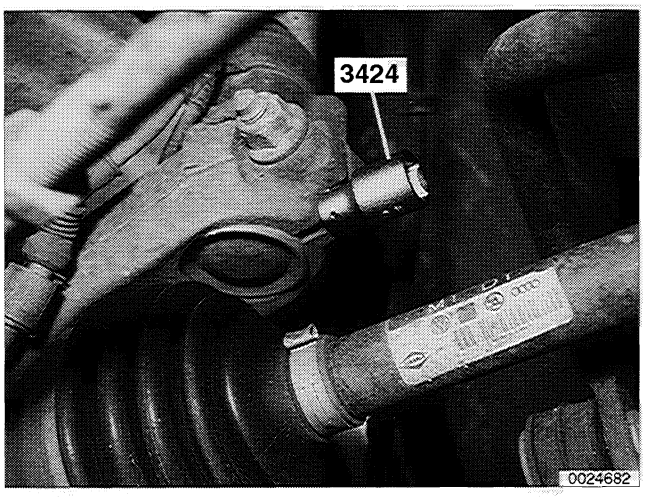
– On the right side only, remove lower sound absorber panel(s) and disconnect axle from the transmission drive flange. Tie up drive axle to prevent damage.

NOTE —

- *To improve access to the right side transmission drive flange, it may be necessary to remove the heat shield from the engine block.*
- *Disconnecting right side drive axle allows the suspension to hang sufficiently to allow access to the strut.*
- *If clearance is still insufficient, disconnect stabilizer link from lower control arm.*



➤ Remove bolt and nut from wheel bearing housing at suspension strut connection.

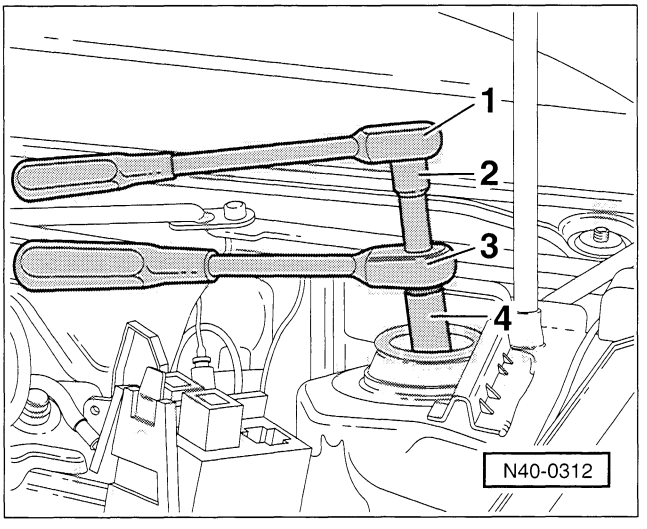


➤ Insert special tool 3424 into lower part of gap in wheel bearing housing as shown and turn ¼ turn in either direction with a ½ inch drive ratchet to spread housing apart.

NOTE —
A socket-drive screwdriver bit may be used with care to pry the strut clamp apart if special tool 3424 is not available.

– Push brake disc (rotor) in direction of suspension strut by hand to prevent shock absorber tube from canting in wheel bearing housing opening.

– Pull wheel bearing housing down and clear of shock absorber.



➤ Remove outer nut and stop plate for upper shock absorber mount using Volkswagen special tools shown or equivalent.

1 - Ratchet handle or driver
2 - T10001/8 hex key (7 mm)
3 - T10001/11 driver handle
4 - T10001/5 special socket (21 mm)

NOTE —
A special offset box wrench or special 21 mm socket (such as VW tool 3186) can be used to turn the outer strut nut while holding the strut shaft with a 7 mm hex wrench, as an alternative to the listed VW special tools.

– Carefully remove suspension strut from below.

– Before re-installing strut assembly, remove any dirt from mating areas.

NOTE —
If necessary, use a lubricant that will evaporate quickly such as WD-40 to clean components. Do not use grease.

– Install top mounting nut of strut using special tools, or equivalent, as shown for disassembly.

– Raise the control arm with a threaded support stand or floor jack until bolt hole in wheel bearing housing aligns with pinch bolt locating tab on the bottom of the strut.

– Install new self-locking lower strut mounting nut and bolt.

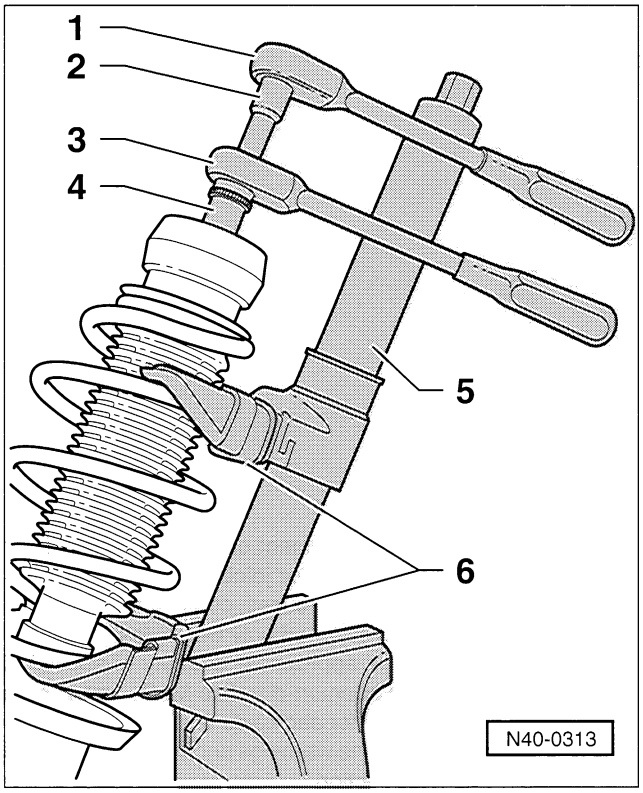
– Remaining installation is the reverse of removal.

Tightening torques

- Outer nut on top of strut (always replace) . . . . . 60 Nm (44 ft-lb)
- Lower strut mounting bolt and nut (always replace) . . . . . 60 Nm (44 ft-lb) +¼ turn (90°)
- Coupling rod to strut . . . . . 50 Nm +¼ turn (90°)
- Hex nut for wheel bearing housing . . 60 Nm (44 ft-lb) +¼ turn (90°)
- CV joint to drive flange on transmission always replace, tighten diagonally
  M8 . . . . . 40 Nm (30 ft-lb)
  M10 . . . . . 70 Nm (52 ft-lb)
- Drive axle boot protective shield to engine block . . . . . 35 Nm (26 ft-lb)
- Brake caliper guide pins . . . . . 28 Nm (21 ft-lb)

Coil spring, removing, installing, identifying

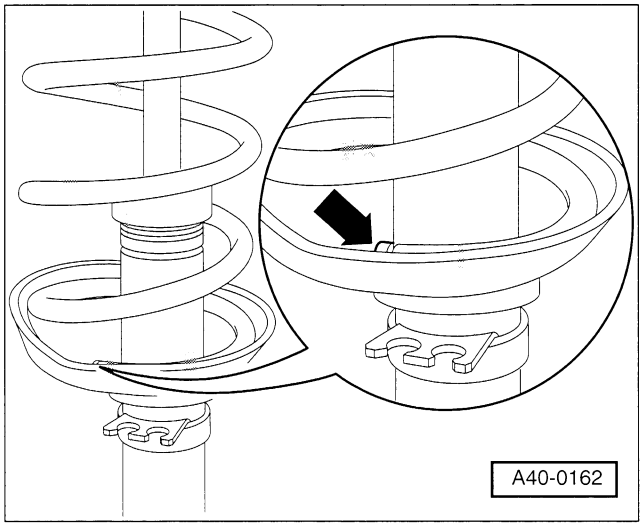
This procedure cannot be performed with strut installed in vehicle. Remove complete front suspension as detailed earlier in this section before proceeding.



➢ With the strut removed, use VAG1752 spring compressor, or equivalent, and appropriate adapters to compress coil spring until upper spring seat is free and remove inner nut with the setup shown.

1 - Ratchet handle or driver
2 - T10001/8 hex key (7 mm)
3 - T10001/11 driver handle
4 - T10001/5 special socket (21 mm)
5 - VAG 1752/1 spring compressor
6 - VAG 1752/4 adapter

> ***WARNING —***
> *Do not remove inner nut from top of strut assembly without a spring compressor.*

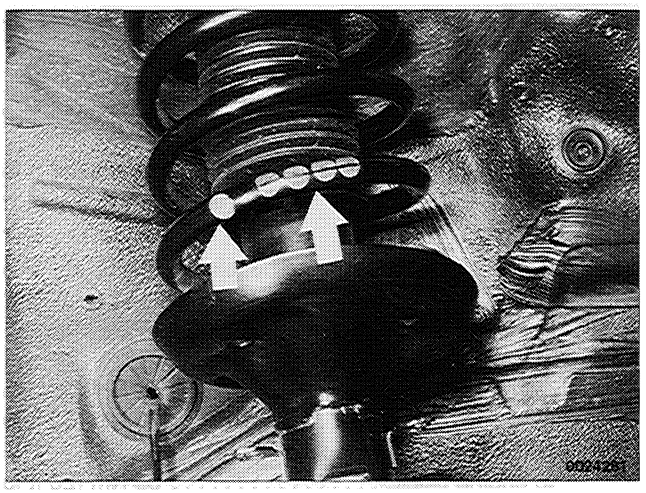


NOTE —
A special offset box wrench or special 21 mm socket (such as VW tool 3186) can be used to turn the outer strut nut while holding the strut shaft with a 7 mm hex wrench, as an alternative to the listed VW special tools.

– Remove components of suspension strut keeping parts in order as they are removed.

– Inspect removed components for wear and damage. Pay particular attention to the upper suspension strut mounts, bump stops and protection boots.

➢ When re-installing coil spring, fit end of coil (**arrow**) against stop in lower spring seat on strut. When de-compressing spring, ensure that end of coil remains in proper position.

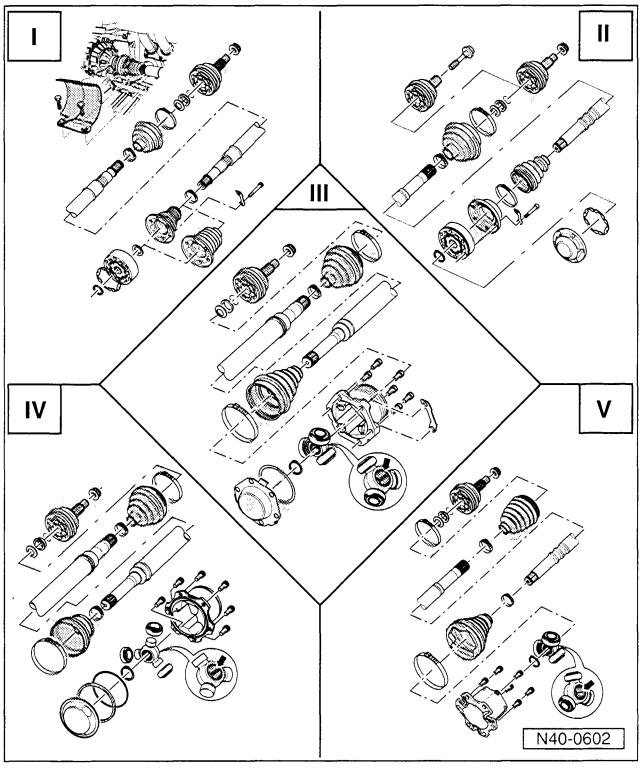


If coil springs are to be replaced, note identifying paint marks on coils (**arrows**) for proper matching, particularly if only one spring is replaced. Example shows 1 violet mark and 4 yellow marks.

– Installation is the reverse of disassembly.

Tightening torque

- Inner suspension strut nut . . . . . 60 Nm (44 ft-lb)
- Outer suspension strut nut (always replace) . . . . . 60 Nm (44 ft-lb)



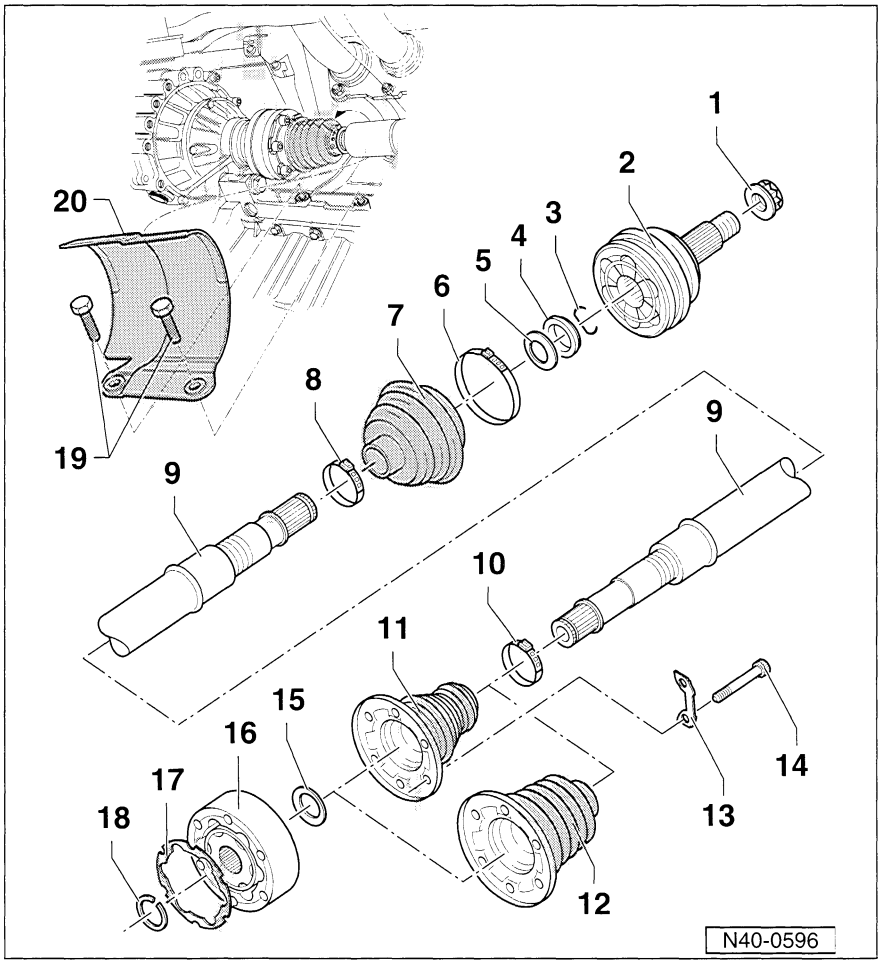
DRIVE AXLES

Removal and/or replacement of the front axle with constant velocity or triple rotor joints requires special tools and equipment. In many cases, constant velocity and triple rotor joints are supplied only with axles. Lubricate all axle joints with the appropriate quantity of special high temperature molybdenum-disulfide MoS_2 "moly" grease as listed in the table for each axle version. Always understand and observe the warnings and cautions listed at the beginning of this section.

Axle versions are divided into 5 different types; two with inner and outer constant velocity (CV) joints, and three with outer constant velocity and inner triple roller (tripod, tripot) joints. Each axle has a section identified by Volkswagen Factory designation.

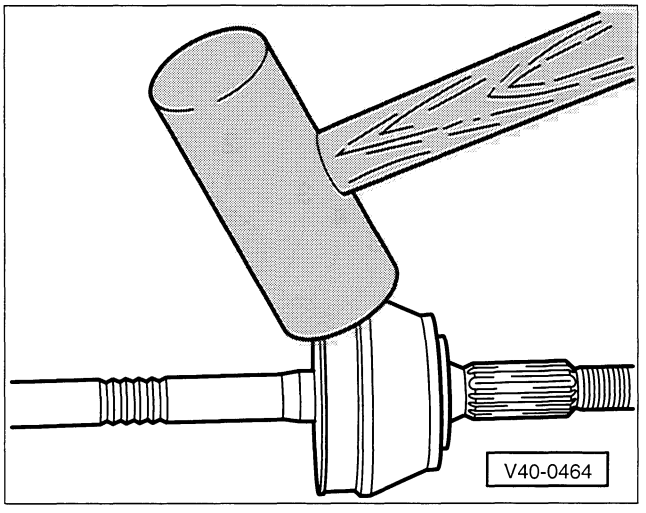
I Drive axles with constant velocity joints, version I
II Drive axles with constant velocity joints, version II
III Drive axles with outer CV joints and inner triple roller joints, version AAR-2000
IV Drive axles with outer CV joints and inner triple roller joints, version AAR-2900
V Drive axles with outer CV joints and inner triple roller joints, version AAR-3300i

Drive axles with constant velocity joints (version I)



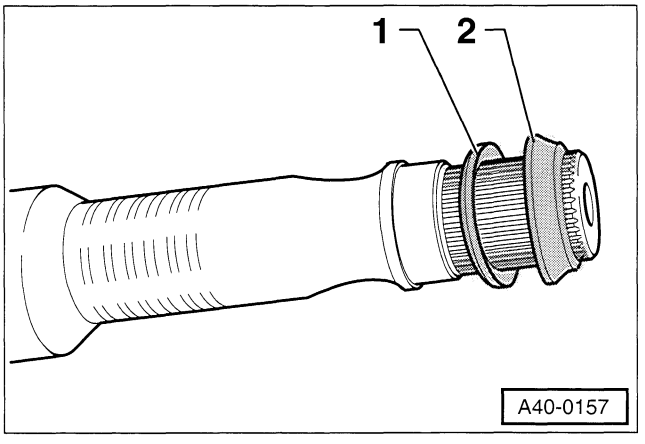
1. **Axle nut, self locking 12-point**
   - Always replace
   - Any paint residue and/or corrosion on threads of outer joint must be removed before nut is installed
   - For tightening procedure see: **Axle nut tightening** or **Axle nut tightening (alternate procedure)** given earlier
2. **Outer CV joint**
   - Only replace complete unit
   - Removing and installing, see **Outer CV joint removing and installing**
3. **Circlip**
   - Always replace
   - Install in groove in joint hub
4. **Thrust washer**
   - Installation position, see **Thrust washer and spring washer, outer, installed position**
5. **Spring washer**
   - Installation position, see **Thrust washer and spring washer, outer, installed position**
6. **Clamp**
   - Always replace
   - See: **CV joint boot clamps, tightening**
7. **CV joint boot, outer**
   - Check for tears and chafing
   - Material: Hytrel (Polyelastomer)
8. **Clamp**
   - Always replace
   - See: **CV joint boot clamps, tightening**
9. **Axle shaft (right side shown)**
10. **Clamp**
    - Always replace
    - See: **CV joint boot clamps, tightening**
11. **CV joint boot, inner (version 1)**
    - Material: Hytrel (Polyelastomer)
    - No vent hole
    - Check for tears and chafing
    - Drive off CV joint using drift
    - Apply VW sealant D 454 300 A2 to sealing surface before installing
    - For installation on left axle, see **CV joint boot, left inner, installed position**
    - For installation on right axle, see **CV joint boot, right inner, installed position**
12. **CV joint boot, inner (version 2)**
    - Material: rubber
    - With vent hole
    - Check for tears and chafing
    - Drive off CV joint using drift
    - Apply VW sealant D 454 300 A2 to sealing surface before installing
    - For installation on left axle, see **CV joint boot, left inner, installed position**
    - For installation on right axle, see **CV joint boot, right inner, installed position**
13. **Lock plate**
14. **Bolt, multi-point socket head**
    - Always replace
    - Pre-tighten diagonally to 10 Nm (7½ ft-lb)
    - Tighten to 40 Nm (30 ft-lb)
15. **Spring washer**
    - Installation position, see **Spring washer, inner, installed position**
16. **Inner CV joint**
    - Only replace complete unit
    - Install with chamfer on inner diameter of hub facing stop on axle shaft
    - Removing, see: **Inner CV joint, pressing off**
    - Installing, see: **Inner CV joint, pressing on**
17. **Gasket (self adhesive)**
    - Always replace
    - Adhesive surface on CV joint must be free of oil and grease
    - Remove protective foil and stick gasket onto CV joint
18. **Circlip**
    - Always replace.
19. **Bolt, hex**
    - Tighten to 35 Nm (26 ft-lb)
20. **Heat shield (on engine block)**

* **High temperature grease (not shown)**
- See: **CV joint grease quantity and type**



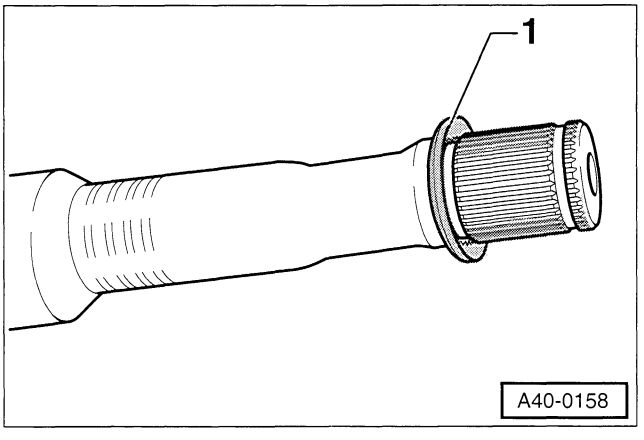
Outer CV joint, removing and installing

- Removing and installing: drive off/onto axle with plastic, brass, or aluminum hammer or mallet at outer circumference.



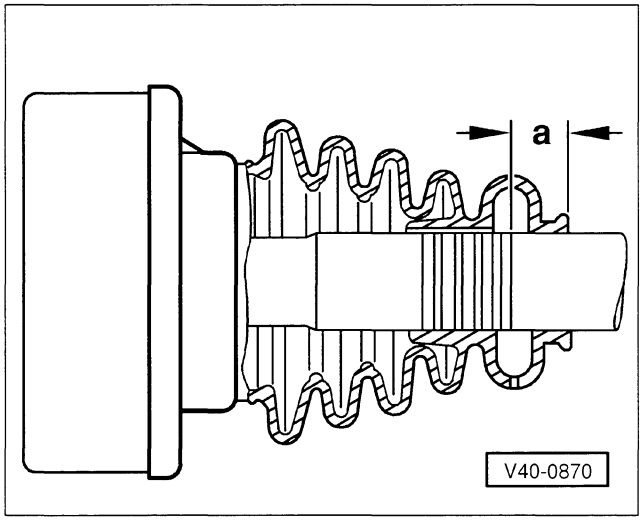
Thrust washer and spring washer, outer, installed position

1 - Spring washer
2 - Thrust washer



Spring washer, inner, installed position

1 - Spring washer

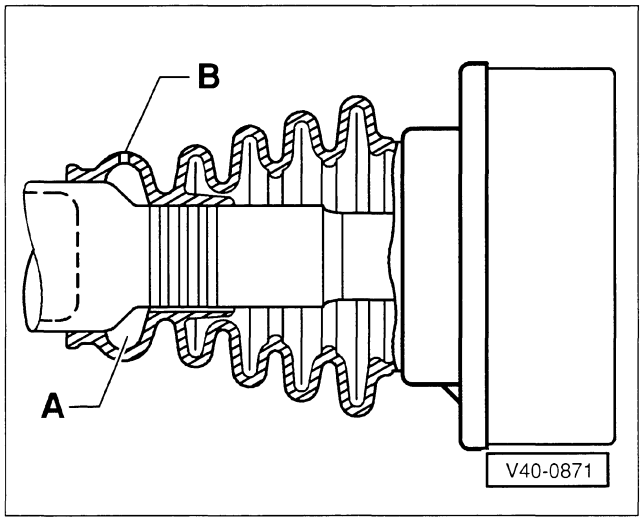


CV joint boot, left inner, installed position

- Position boot on axle to dimension **a**.
- Dimension a = 17 mm (± 11/16 inch).

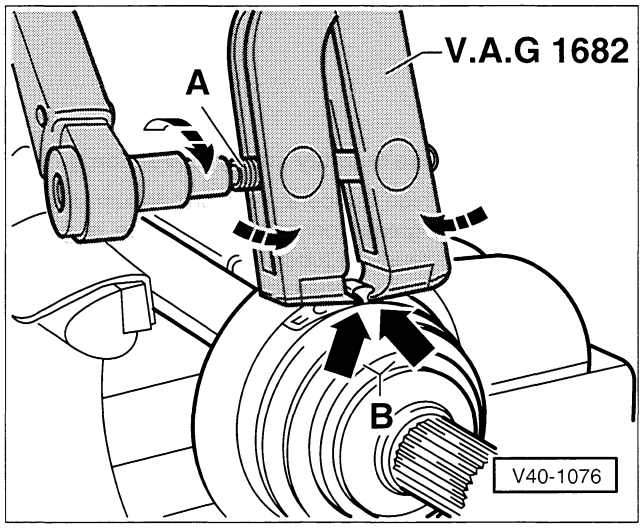
NOTE —

Note edge location of boot before assembly with paint or tape mark. Do not mark by scratching axle.



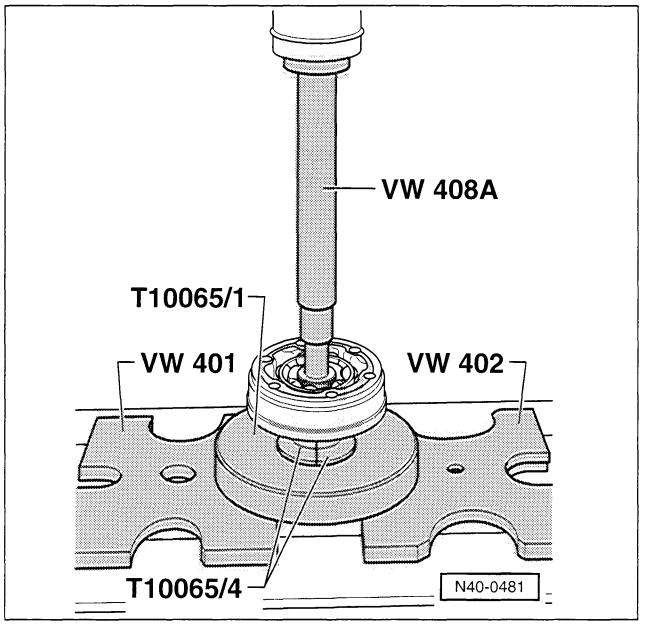
CV joint boot, right inner, installed position

- Position boot to allow for vent chamber (**A**).
- Vent hole (**B**) must open into vent chamber (**A**) and not be blocked by axle tube.



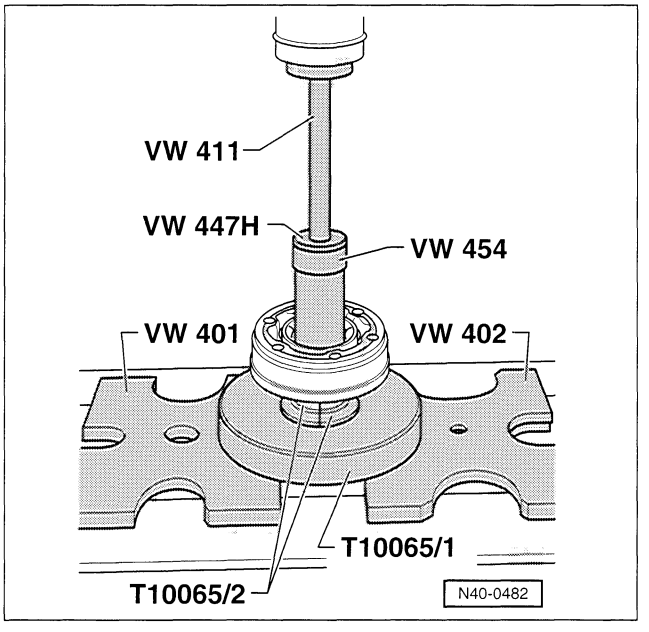
CV joint boot clamps, tightening

- Due to hardness of materials, it may be necessary to use a heavy duty clamping tool such as the VAG 1682 to properly secure all clamps.
- Tighten shaft (**arrow A**) until a torque value of 25 Nm (18 ft-lb) is obtained.
- Ensure that jaws of tool (**dashed arrows**) are properly seated in corners of clamp (**B**).



Inner CV joint, pressing off

- Use a hydraulic press set up with the special tools shown or their equivalents.
- Support ball hub and press off of axle
- Drive off outer rim of CV joint boot with a drift.



Inner CV joint, pressing on

- Use a hydraulic press set up with the special tools shown or their equivalents.
- Chamfer on inner diameter of ball hub (splines) must face the contact shoulder of the axle shaft.
- Press CV joint fully until contact with the stop.
- Replace circlip.

Outer joint diameter	Total grease	Proportions	
		Joint	Boot
mm/in.	grams/ounces	grams/ounces	grams/ounces
81 (3.2)	80 (2.8)	40 (1.4)	40 (1.4)
90 (3.5)	120 (4.2)	80 (2.8)	40 (1.4)
Inner joint diameter			
94 (3.7)	90 (3.2)	40 (1.4)	50 (1.8)
100 (3.9)	120 (4.2)	50 (1.8)	70 (2.5)

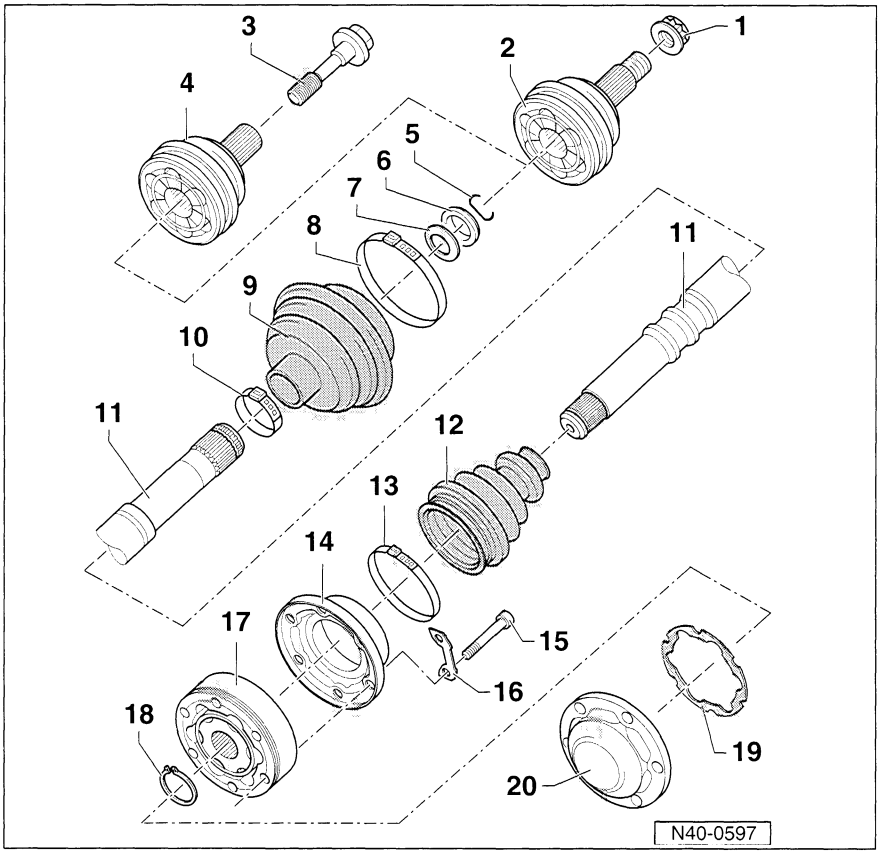
CV joint grease quantity and type (version I)

Use special high temperature molybdenum disulphide MoS_2 (moly) grease only. Special grease is generally packaged in reusable tubes of 90, 120, and 140 grams each. Pack the appropriate quantity into the boot and the joint according to the CV joint diameter listed in the table.

- Model years 1999-2001:
  G 000 603 (90 grams)
  G 000 633 (120 grams)
  G 000 605 (140 grams)
- Model years 2002-2004
  G 052 133 A2 (90 grams)
  G 052 133 A3 (120 grams)
  G 000 605 (140 grams)

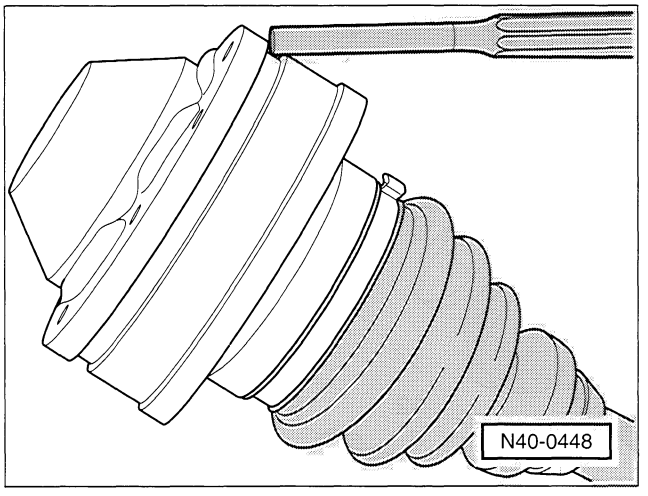
Drive axles with constant velocity joints (version II)

1. **Axle nut, self locking 12-point**
   - Always replace
   - Any paint residue and/or corrosion on threads of outer joint must be removed before nut is installed
   - For tightening procedure see: **Axle nut tightening** or **Axle nut tightening (alternate procedure)** given earlier
2. **Outer CV joint**
   - Only replace complete unit
   - Removing and installing, see **Outer CV joint removing and installing** given earlier (version 1)
3. **Axle bolt, special hex head**
   - Always replace
   - Any paint residue and/or corrosion on threads of outer joint must be removed before nut is installed
   - For tightening procedure see: **Axle nut tightening** or **Axle nut tightening (alternate procedure)** given earlier
4. **Outer CV joint**
   - Installation on some high performance models
   - Only replace complete unit
   - Removing and installing, see **Outer CV joint removing and installing** given earlier (version 1)
5. **Circlip**
   - Always replace
   - Install in groove in joint hub
6. **Thrust washer**
   - Installation position, see **Thrust washer and spring washer, outer, installed position** given earlier (version 1)
7. **Spring washer**
   - Installation position, see **Thrust washer and spring washer, outer, installed position given** earlier (version 1)
8. **Clamp**
   - Always replace
   - See: **CV joint boot clamps, tightening** given earlier (version 1)
9. **CV joint boot, outer**
   - Check for tears and chafing
   - Material: Hytrel (Polyelastomer)
10. **Clamp**
    - Always replace
    - See: **CV joint boot clamps, tightening given** earlier (version 1)



11. **Axle shaft**
12. **CV joint boot, inner**
    - Material: rubber
    - With vent hole
    - Check for tears and chafing
    - For installation on left axle, see **CV joint boot, left inner, installed position** given earlier (version 1)
    - For installation on right axle, see **CV joint boot, right inner, installed position** given earlier (version 1)
13. **Clamp**
    - Always replace
14. **Cover**
    - Drive off CV joint using drift
    - Apply VW sealant D 454 300 A2 to sealing surface before installing
    - Adhesive surface on CV joint must be free of oil and grease
15. **Bolt, multi-point socket head**
    - Always replace
    - Pre-tighten diagonally to 10 Nm (7½ ft-lb)
    - Tighten to 70 Nm (52 ft-lb)
16. **Lock plate**
17. **Inner CV joint**
    - Only replace complete unit
    - Install with chamfer on inner diameter of hub facing stop on axle shaft
    - Removing, see: **Inner CV joint, pressing off** given earlier (version 1)
    - Installing, see: **Inner CV joint, pressing on** given earlier (version 1)
18. **Circlip**
    - Always replace.
19. **Gasket (self adhesive)**
    - Always replace
    - Adhesive surface on CV joint must be free of oil and grease
    - Remove protective foil and stick gasket onto CV joint
20. **Cover**
    - Drive off using drift, see: **Cover, inner CV joint, driving off**.
    - Apply VW sealant D 454 300 A2 to sealing surface before installing
    - Adhesive surface must be free of oil and grease

* **High temperature grease (not shown)**
- See: **CV joint grease quantity and type**



Cover, inner CV joint, driving off

- Drive off with a drift as shown. Break free by tapping lightly at several points.

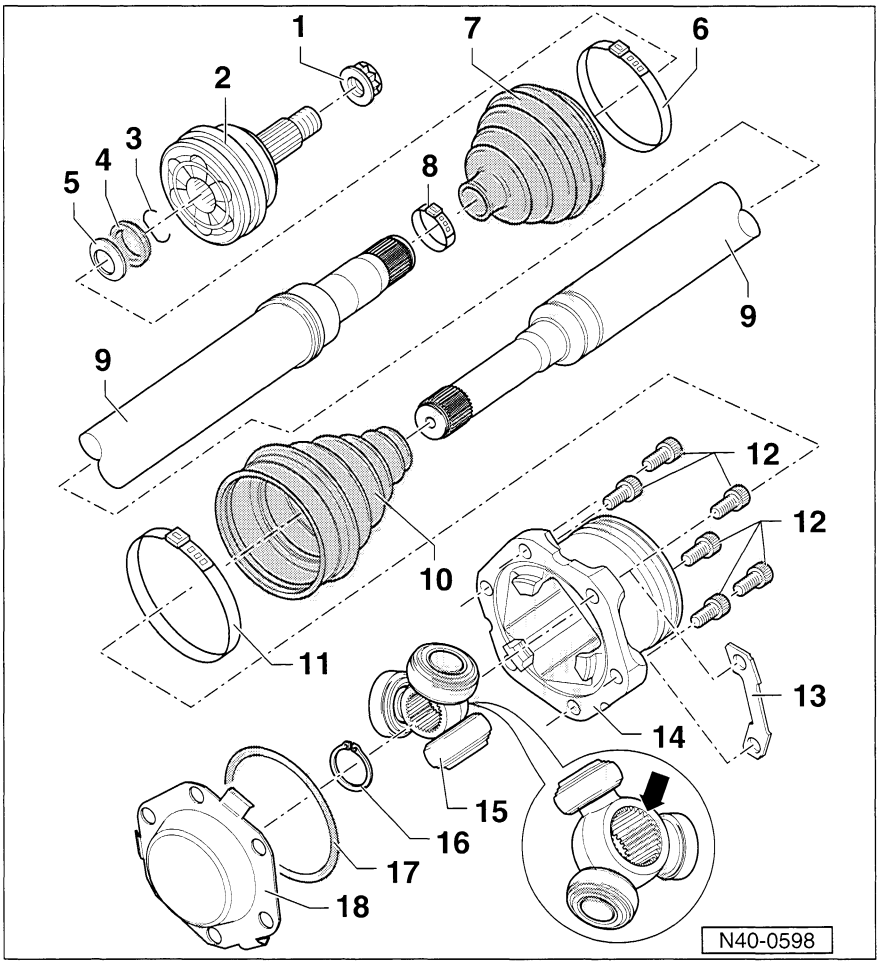
Outer joint diameter	Total grease	Proportions	
		Joint	Boot
mm/in.	grams/ounces	grams/ounces	grams/ounces
98 (3.86)	120 (4.2)	80 (2.8)	40 (1.4)
Inner joint diameter			
108 (4.25)	120 (4.2)	60 (2.1)	60 (2.1)

CV joint grease quantity and type (version II)

Use special high temperature molybdenum disulphide MoS_2 (moly) grease only. Special grease is generally packaged in reusable tubes of 90, 120, and 140 grams each. Pack the appropriate quantity into the boot and the joint according to the CV joint diameter listed in the table.

- Model years 1999-2001:
  G 000 603 (90 grams)
  G 000 633 (120 grams)
  G 000 605 (140 grams)
- Model years 2002-2004
  G 052 133 A2 (90 grams)
  G 052 133 A3 (120 grams)
  G 000 605 (140 grams)

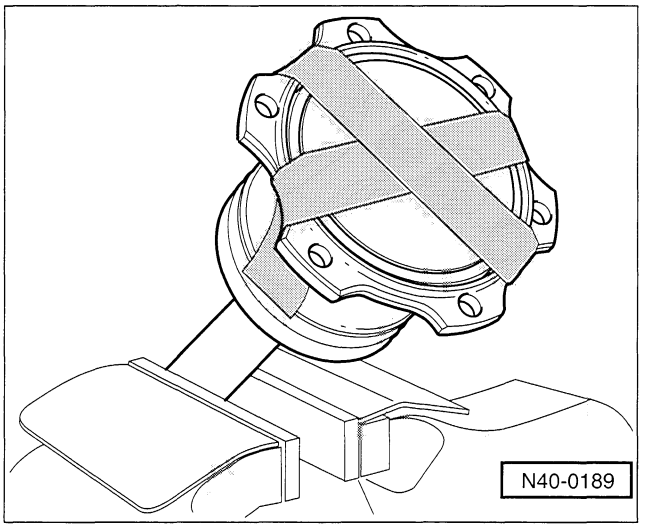
Drive axles with outer CV joints and inner triple roller joints (version AAR-2000)



1. **Axle nut, self locking 12-point**
   - Always replace
   - Any paint residue and/or corrosion on threads of outer joint must be removed before nut is installed
   - For tightening procedure see: **Axle nut tightening** or **Axle nut tightening (alternate procedure)** given earlier (version 1).
2. **Outer CV joint**
   - Only replace complete unit
   - Removing and installing, see **Outer CV joint removing and installing** given earlier (version 1).
3. **Circlip**
   - Always replace
   - Install in shaft groove
4. **Thrust washer**
   - Installation position, see **Thrust washer and spring washer, outer, installed position** given earlier (version 1).
5. **Spring washer**
   - Installation position, see **Thrust washer and spring washer, outer, installed position** given earlier (version 1).
6. **Clamp**
   - Always replace
   - See: **CV joint boot clamps, tightening** given earlier (version 1).
7. **CV joint boot, outer**
   - Check for tears and chafing
8. **Clamp**
   - Always replace
   - See: **CV joint boot clamps, tightening** given earlier (version 1).
9. **Axle shaft**
10. **Triple roller joint boot**
    - Check for tears and chafing
11. **Clamp**
    - For triple rotor star, left side.
    - Always replace
    - See: **CV joint boot clamps, tightening** given earlier (version 1).
12. **Bolt, multi-point socket head**
    - Always replace
    - Pre-tighten diagonally to 10 Nm (7½ ft-lb)
    - Tighten to 70 Nm (52 ft-lb)
13. **Lock plate**
    - Only installed on 108 mm diameter (4.252 in.) triple roller joints
14. **Triple roller joint outer housing**
    - For transport or during installation see: **Outer housing, inner triple roller joint, securing.**
    - See: **Triple roller joint, disassembling and assembling (AAR-2000).**
15. **Triple roller star (center hub) with rollers**
    - Chamfer (inset **arrow**) points toward axle shaft splines.
16. **Circlip**
    - Always replace
    - Install in shaft groove
17. **O-ring**
    - Always replace
18. **Cover**
    - Always replace

* **High temperature grease (not shown)**
- See: **CV joint/triple roller grease quantity and type**

Outer joint diameter	Total grease	Proportions	
		Joint	Boot
mm/in.	grams/ounces	grams/ounces	grams/ounces
90 (3.5)	100 (3.5)	50 (1.8)	50 (1.8)
Inner joint diameter			
100 (3.9)	110 (3.9)	55 (1.9)	55 (1.9)
108 (4.25)	110 (3.9)	55 (1.9)	55 (1.9)



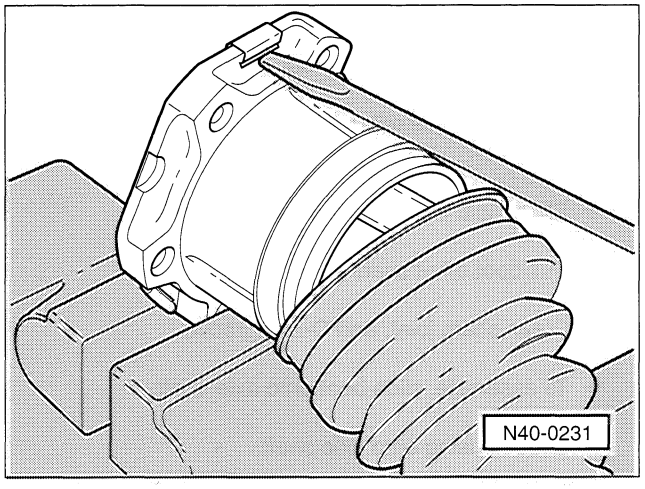
CV joint/triple roller grease quantity and type (AAR-2000)

Use special high temperature molybdenum disulphide MoS_2 (moly) grease only. Special grease is generally packaged in reusable tubes of 90, 120, and 140 grams each. Pack the appropriate quantity into the boot and the joint according to the CV joint diameter listed in the table.

- Model years 1999-2001:
  G 000 603 (90 grams)
  G 000 633 (120 grams)
  G 000 605 (140 grams)
- Model years 2002-2004
  G 052 133 A2 (90 grams)
  G 052 133 A3 (120 grams)
  G 000 605 (140 grams)

Outer housing, inner triple roller joint, securing

- Secure triple rotor joint with adhesive tape as shown to prevent housing from accidently sliding down axle shaft.
- Remove tape just prior to bolting securely to drive flange

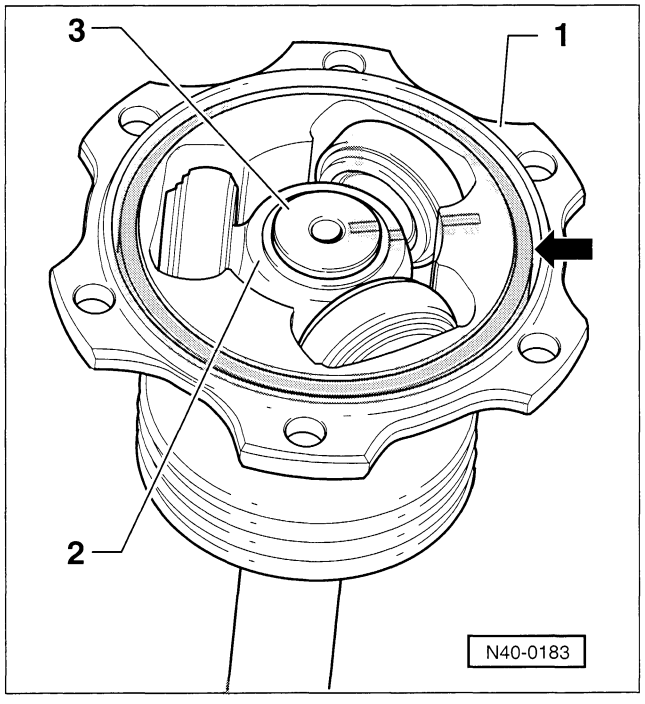


Triple roller joint, disassembling and assembling (version AAR-2000)

– Remove axle from vehicle.

– Release clamp on boot and slide boot off of joint.

➤ Release tab on cover with a screwdriver and pry cover off of joint.

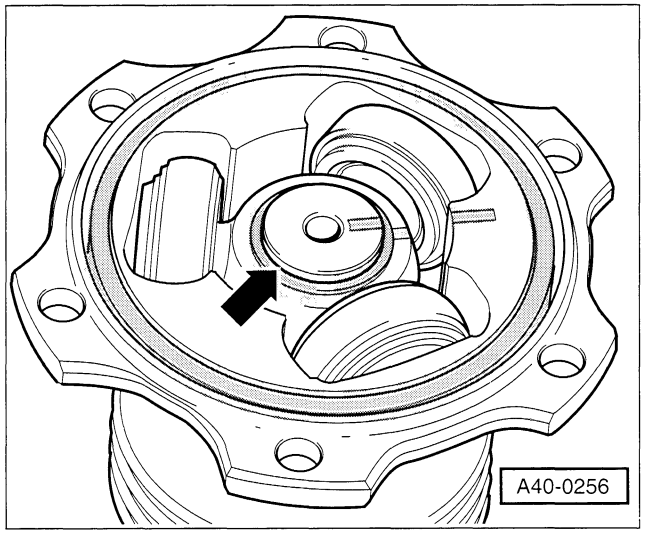


➤ Mark the installed position of the indicated parts so that they can be re-assembled later in the same positions relative to each other. Making index marks minimizes the chance of vibration and noise due to mis-matching.

1 - Triple rotor housing
2 - Triple rotor star (hub)
3 - Axle shaft

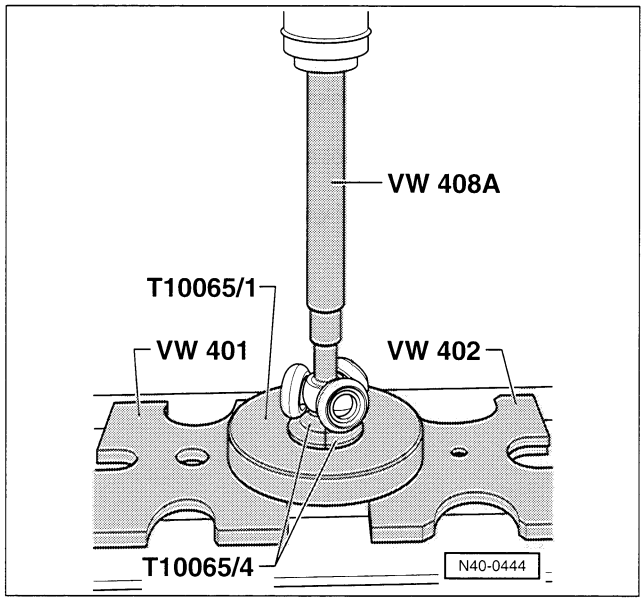
NOTE —
A waterproof felt tipped pen (such as a Sharpie®) is suitable for making these index markings.

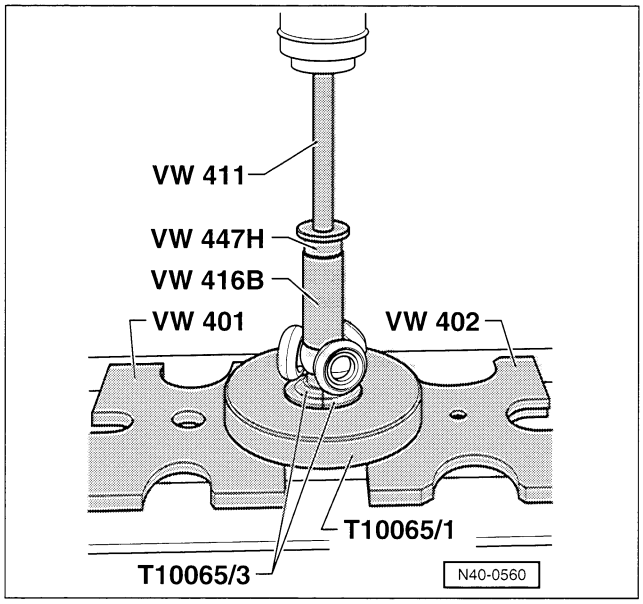
– Remove O-ring (**arrow**) from groove.

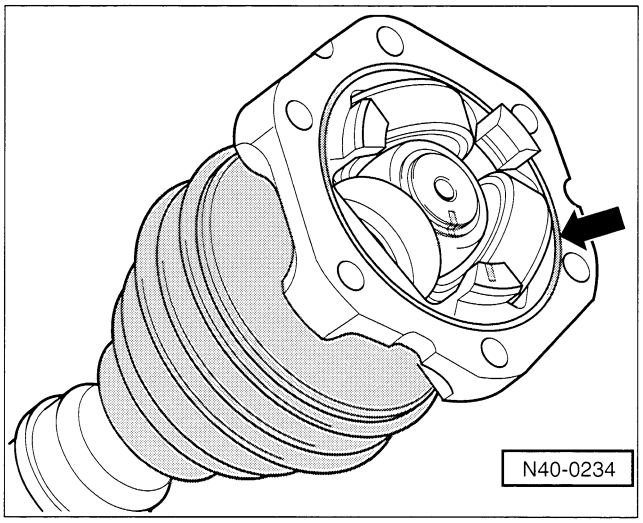


➤ Remove circlip (**arrow**).

– Slide triple rotor housing down axle shaft.







Use a hydraulic press set up with the special tools shown or their equivalents. Hold the axle, support the triple rotor star, and press the axle out.

- Place the triple roller star with rollers in place on a clean surface.
- Slide triple rotor housing off of axle shaft.
- Pull boot off of shaft.
- Clean shaft, joint, and O-ring groove.
- To assemble, slide boot onto axle shaft.
- Slide housing onto axle shaft.
- Install the triple rotor star onto the axle with the chamfered inner splines facing the axle and the previously made index markings in alignment.

NOTE —

- *The chamfered inner splined hub of the star must face the axle.*
- *Confirm that the star is aligned to the axle according to the index marks made during disassembly.*

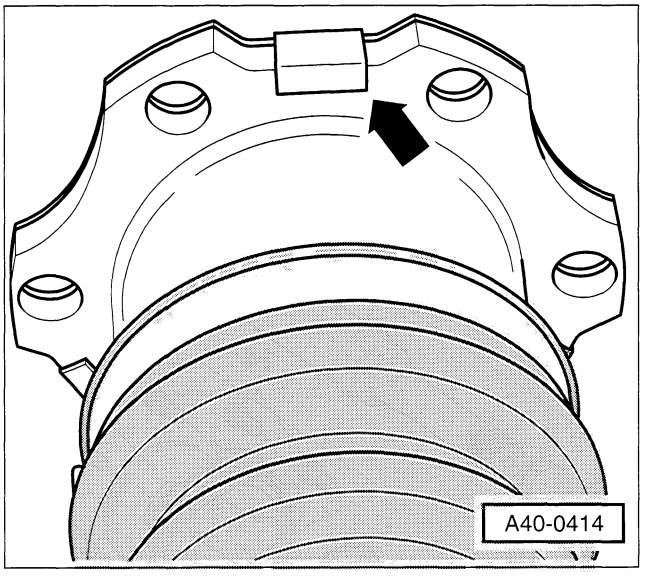
Use a hydraulic press set up with the special tools shown or their equivalents. Support the axle, press the triple rotor star fully until contact with the stop.

NOTE —

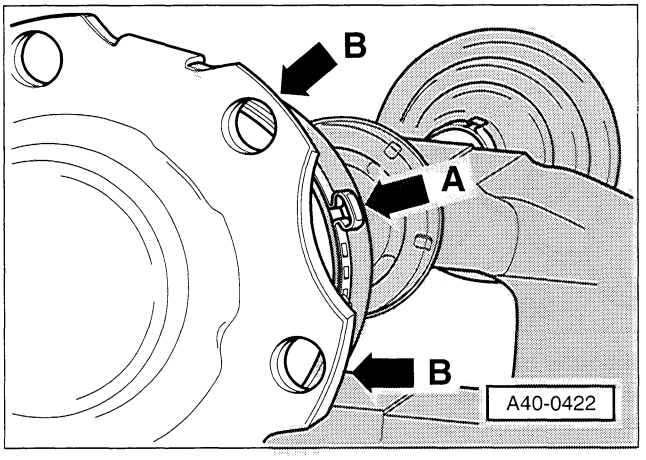
Do not use more than 3 metric tons (3.3 short tons) of force to press star onto axle.

- Install new circlip and confirm that it is correctly seated.
- Slide triple rotor housing up the axle shaft over the rollers taking care to align the previously made index markings.
- Lubricate triple roller joint with one half of the MoS_2 grease from the repair kit. Work lubricant into the joint and rollers.
- Work the remaining half of the MoS_2 grease into the back of the triple roller joint and housing.
- Slide protective boot up the axle shaft and seat in groove in the outer housing, but do not install clamp at this time.
- Mount axle shaft in a vise with soft jaws taking care to protect paint on axle from damage.

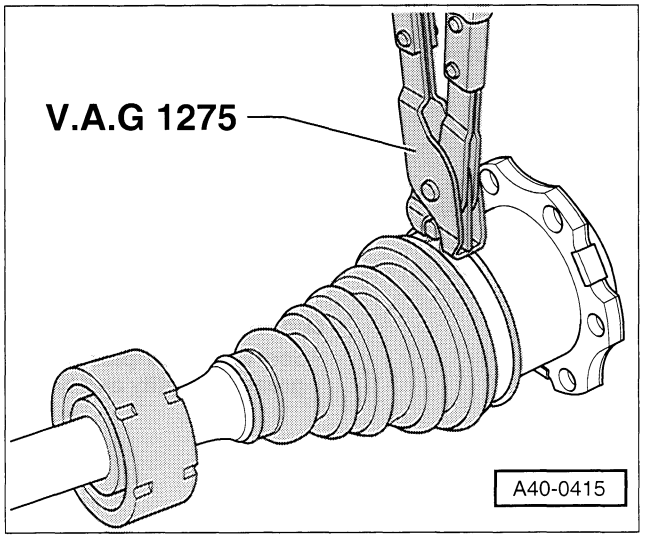
Install new O-ring (**arrow**) into groove in outer housing.



- Install new cover to outer joint housing. Position the plate tabs in the cut-outs in the outer housing (**arrow**).

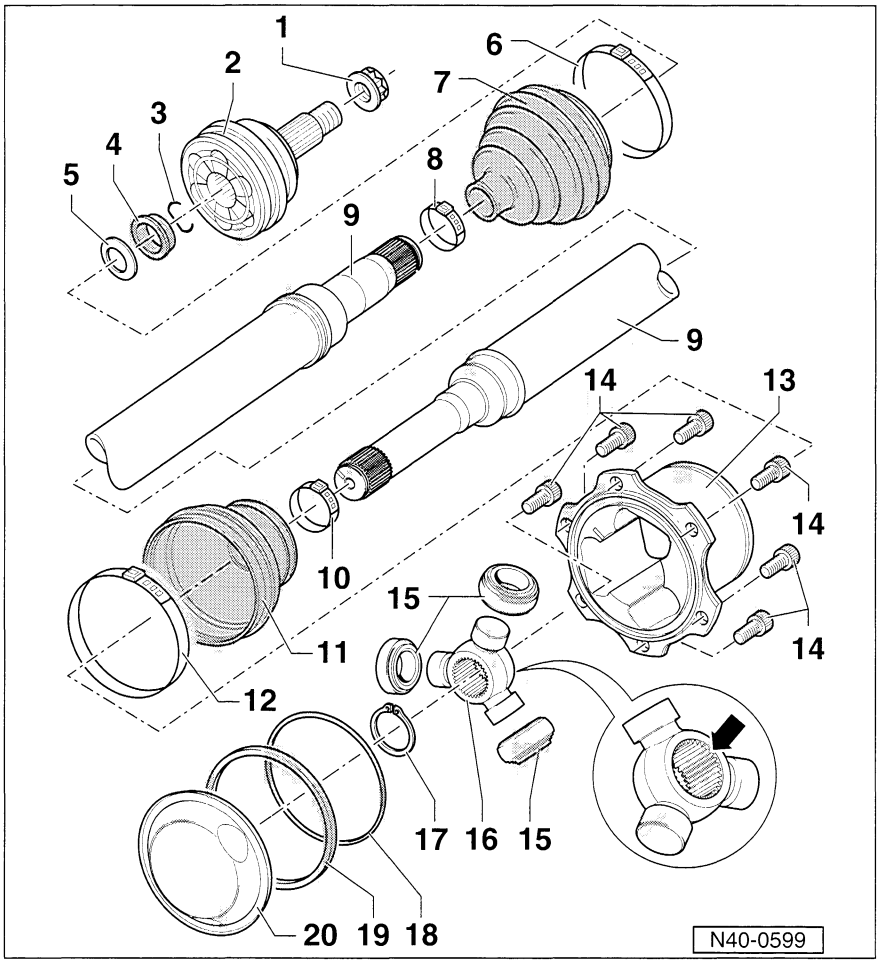


- Slide new clamp onto boot. Position clamping ear (**A**) so that it will not interfere with socket head bolts (**B**) when installing triple roller joint to transmission drive flange.



- Tighten clamp with appropriate tools (VAG 1275 shown).

Drive axles with outer CV joints and inner triple roller joints (version AAR-2900)



1. **Axle nut, self locking 12-point**
   - Always replace
   - Any paint residue and/or corrosion on threads of outer joint must be removed before nut is installed
   - For tightening procedure see: **Axle nut tightening** or **Axle nut tightening (alternate procedure)** given earlier (version 1)
2. **Outer CV joint**
   - Only replace complete unit
   - Removing and installing, see **Outer CV joint removing and installing** given earlier (version 1)
3. **Circlip**
   - Always replace
   - Install in shaft groove
4. **Thrust washer**
   - Installation position, see **Thrust washer and spring washer, outer, installed position** given earlier (version 1)
5. **Spring washer**
   - Installation position, see **Thrust washer and spring washer, outer, installed position** given earlier (version 1)
6. **Clamp**
   - Always replace
   - See: **CV joint boot clamps, tightening** given earlier (version 1)
7. **CV joint boot, outer**
   - Check for tears and chafing
8. **Clamp**
   - Always replace
   - See: **CV joint boot clamps, tightening** given earlier (version 1)
9. **Axle shaft**
10. **Clamp**
    - Always replace
    - See: **CV joint boot clamps, tightening** given earlier (version 1)
11. **Triple roller joint boot**
    - Check for tears and chafing
12. **Clamp**
    - For triple rotor star, left side.
    - Always replace
    - See: **CV joint boot clamps, tightening** given earlier (version 1)
13. **Triple roller joint outer housing**
    - See: **Triple roller joint, disassembling and assembling (AAR-2900).**
14. **Bolt, multi-point socket head**
    - Always replace
    - Pre-tighten diagonally to 10 Nm (7½ ft-lb)
    - Tighten to 70 Nm (52 ft-lb)
15. **Rollers**
16. **Triple roller star (center hub) with rollers**
    - Chamfer (inset **arrow**) points to axle shaft splines
17. **Circlip**
    - Always replace
    - Install in shaft groove
18. **O-ring seal**
    - Factory installed. Installation no longer required if joint is serviced.
    - Replaced by rectangular section seal (item 19) when servicing.
    - Axle must have either item 18 or item 19.
19. **Rectangular section seal**
    - Service installed and only available as part of repair service kit.
    - Replaces O-ring seal (item 18) when servicing.
    - Axle must have either item 18 or item 19.
20. **Cover**
    - Destroyed during disassembly
    - Only available as part of repair service kit.
    - Replacement cover from service kit held in place with circlip (not shown)

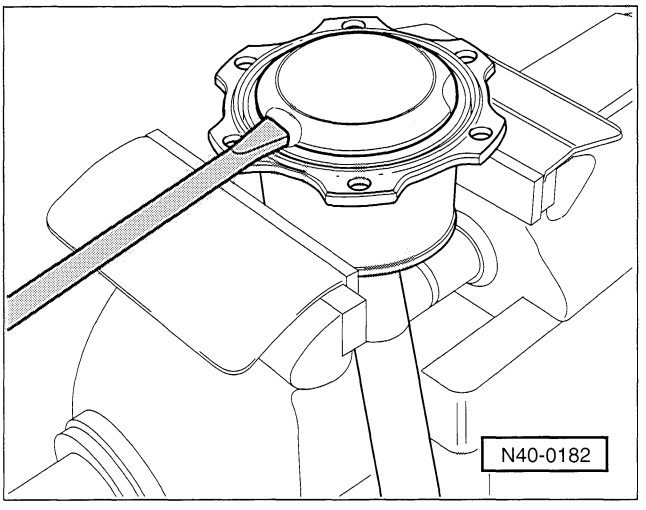
* **High temperature grease (not shown)**
- See: **CV joint/triple roller grease quantity and type**

Outer joint diameter	Total grease	Proportions	
		Joint	Boot
mm/in.	grams/ounces	grams/ounces	grams/ounces
90 (3.5)	100 (3.5)	50 (1.8)	50 (1.8)
Inner joint diameter			
124 (4.9)	140 (4.9)	70 (2.5)	70 (2.5)

CV joint/triple roller grease quantity and type (AAR-2900)

Use special high temperature molybdenum disulphide MoS_2 (moly) grease only. Special grease is generally packaged in reusable tubes of 90, 120, and 140 grams each. Pack the appropriate quantity into the boot and the joint according to the CV joint diameter listed in the table.

- Model years 1999-2001:
  G 000 603 (90 grams)
  G 000 633 (120 grams)
  G 000 605 (140 grams)
- Model years 2002-2004
  G 052 133 A2 (90 grams)
  G 052 133 A3 (120 grams)
  G 000 605 (140 grams)



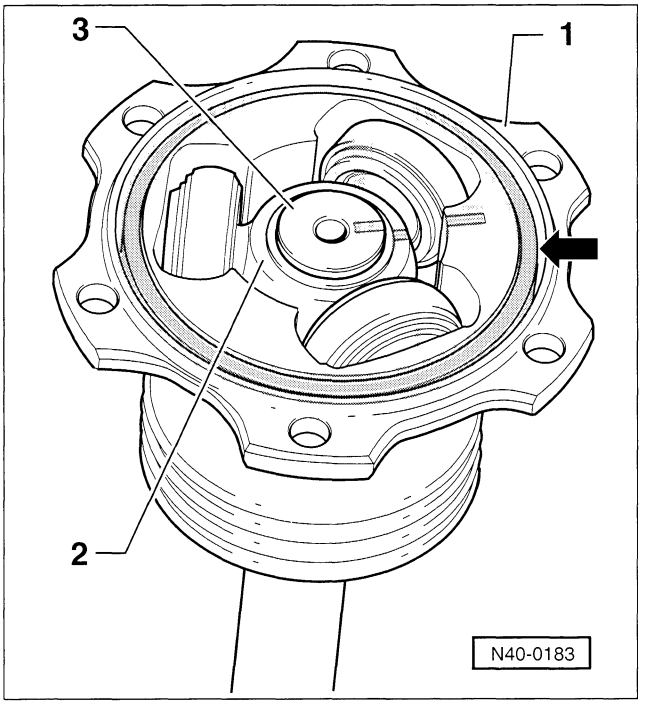
Triple roller joint, disassemble and assembling, version AAR-2900

– Remove axle from vehicle.

– Release large clamp on boot and slide boot off of joint.

– Release small clamp on boot and slide boot down axle.

Pry off cover with a screwdriver as shown. If cover is recalcitrant, use a second screwdriver 180° from first and use both screwdrivers to work joint off



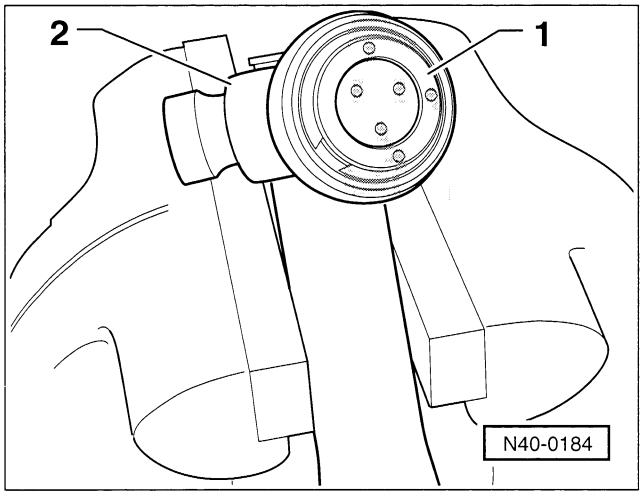
Mark the installed position of the indicated parts so that they can be re-assembled later in the same positions relative to each other. Making index marks minimizes the chance of vibration and noise due to mis-matching.

1 - Triple rotor housing
2 - Triple rotor star (hub)
3 - Axle shaft

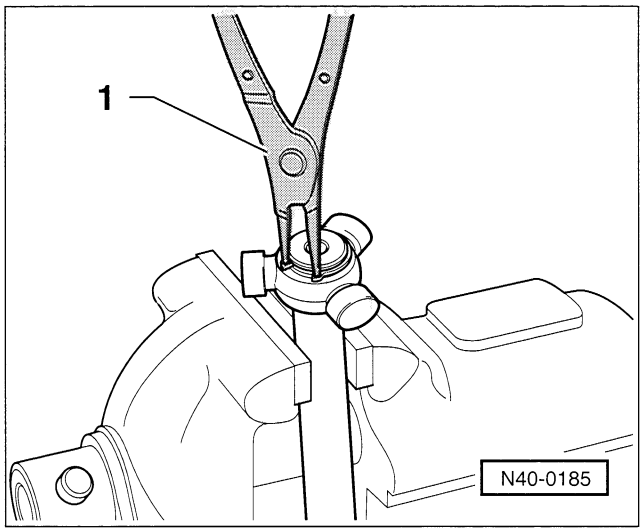
NOTE —
A waterproof felt tipped pen (such as a Sharpie®) is suitable for making these index markings.

– Remove O-ring (arrow) from groove.

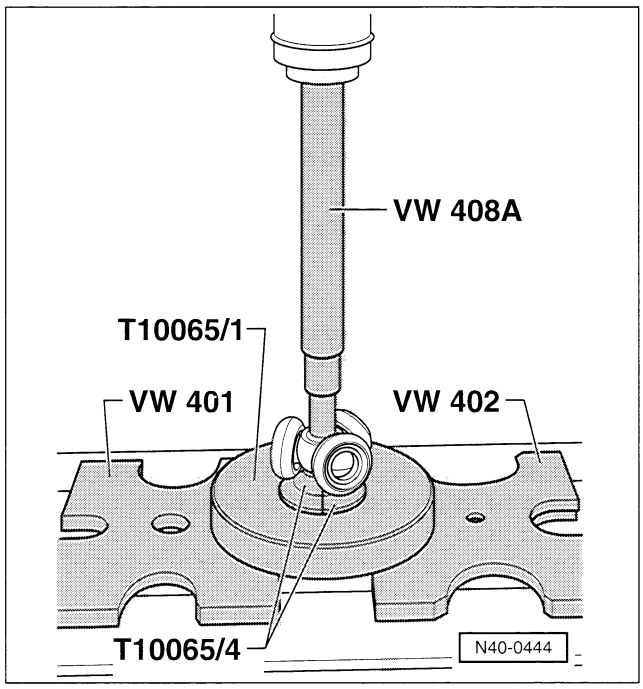
– Slide the outer housing down the axle taking care to prevent the rollers from falling off the star.



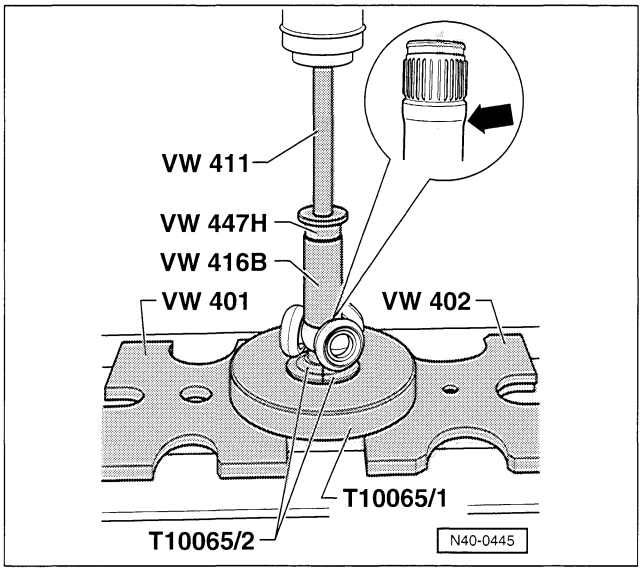
- Mark the roller (**1**) and the star (**2**) so that the roller can be re-assembled later to the same position on the star.
- Mount axle shaft in a vise with soft jaws taking care to protect paint on axle from damage.
- Remove the rollers (**1**) and place on a clean surface.

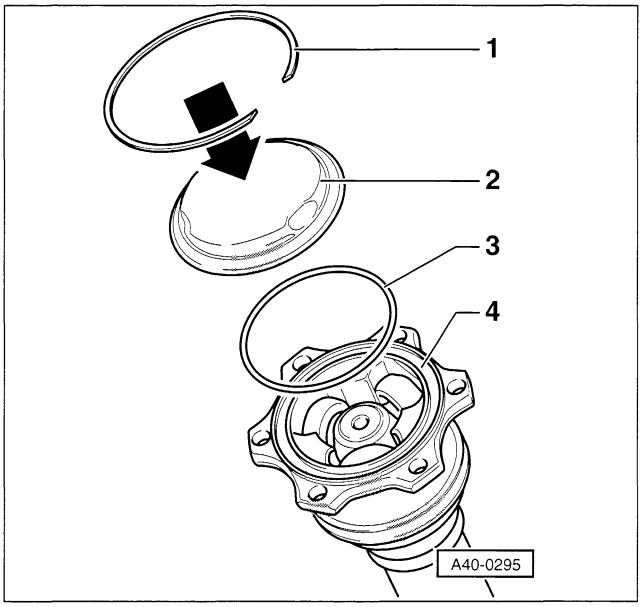


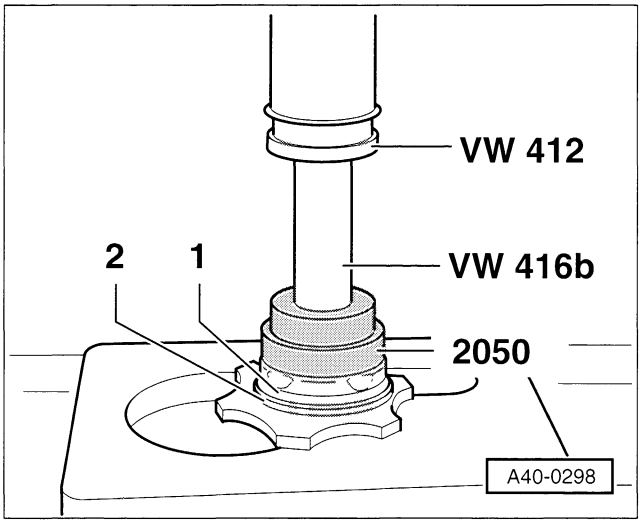
- Remove circlip with circlip pliers.



- Use a hydraulic press set up with the special tools shown or their equivalents. Hold the axle, support the triple rotor star, and press the axle out. Illustration shows earlier version, rollers are removed in previous steps.
- Place the triple roller star on a clean surface.
- Slide triple rotor housing off of axle shaft.
- Pull boot off of shaft.
- Clean shaft, joint, and O-ring groove.
- To assemble, slide a new boot clamps onto axle shaft.
- Slide new boot onto axle shaft.
- Slide outer housing onto axle shaft.







– Install the triple rotor star onto the axle with the chamfered inner splines facing the axle and the previously made index markings in alignment.

NOTE —

- *The chamfered inner splined hub of the star must face the axle.*
- *Confirm that the star is aligned to the axle according to the index marks made during disassembly.*

Use a hydraulic press set up with the special tools shown or their equivalents. Support the axle, press the triple rotor star fully until contact with the stop (**arrow**).

NOTE —

- *Do not use more than 3 metric tons (3.3 short tons) of force to press star onto axle.*
- *Apply lubricating paste G 052 142 A2 to axle shaft splines and star as needed to facilitate pressing operations.*

– Install new circlip to axle and confirm correct seated.

– Install roller to star at original locations, per index markings.

– Slide triple rotor housing up the axle shaft over the rollers taking care to align the previously made index markings.

– Lubricate triple roller joint with one half of the MoS_2 grease from the repair kit. Work lubricant into the joint and rollers.

– Work the remaining half of the MoS_2 grease into the back of the triple roller joint and housing.

– Slide protective boot up the axle shaft and seat in groove in the outer housing, but do not install clamp at this time.

– Mount axle shaft in a vise with soft jaws taking care to protect paint on axle from damage.

Using new parts from service repair kit, install seal (**3**) in groove (**4**) of outer housing.

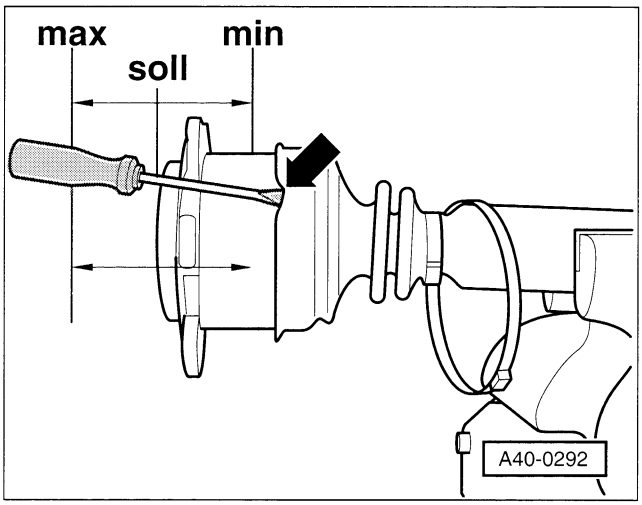
1 - Circlip
2 - Cover from repair kit
3 - Seal
4 - Triple roller joint

Remove axle from vise and place back in a hydraulic press set up with the special tools shown or their equivalents.

– Press cover (**1**) into triple roller joint until the circlip can be installed. Install circlip into groove and ensure proper seating.

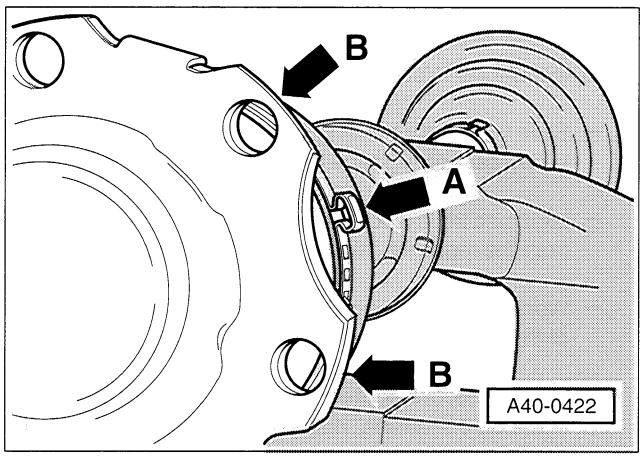
NOTE —

Circlip must be heard and/or felt to seat properly.

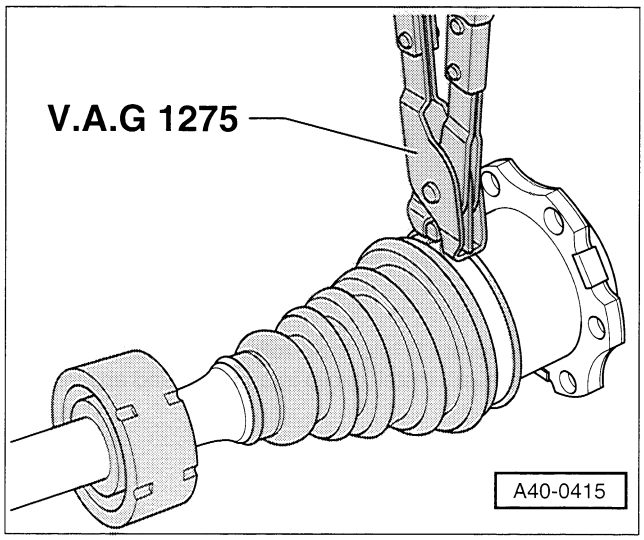


➤ Install boot onto outer housing. Position outer housing at approximate midpoint (**soll**, between **min** and **max**) and position boot as shown.

– Use a screwdriver (**arrow**) to release any trapped air in boot.



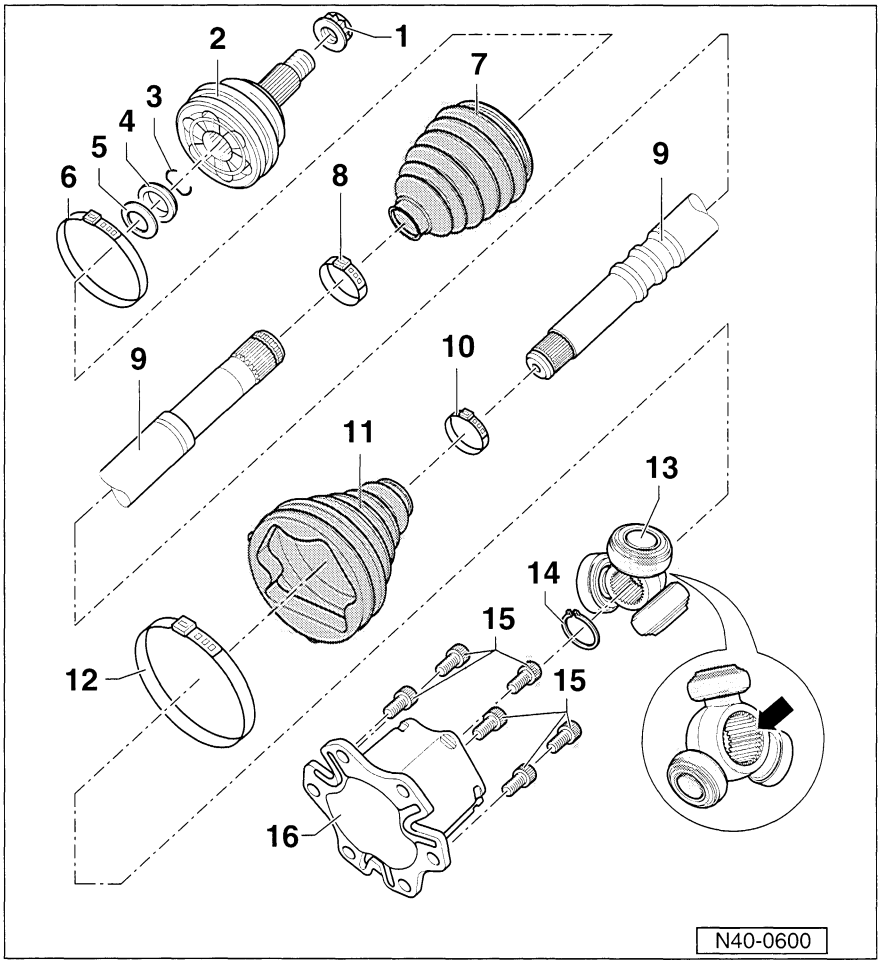
➤ Slide new clamp onto boot. Position clamping ear (**A**) so that it will not interfere with socket head bolts (**B**) when installing triple roller joint to transmission drive flange.



➤ Tighten clamp with appropriate tools (VAG 1275 shown).

Drive axles with outer CV joints and inner triple roller joints, version AAR-3300i

1. **Axle nut, self locking 12-point**
   - Always replace
   - Any paint residue and/or corrosion on threads of outer joint must be removed before nut is installed
   - For tightening procedure see: **Axle nut tightening** or **Axle nut tightening (alternate procedure)** given earlier (version 1).
2. **Outer CV joint**
   - Only replace complete unit
   - Removing and installing, see **Outer CV joint removing and installing.** given earlier (version 1).
3. **Circlip**
   - Always replace
   - Install in shaft groove
4. **Thrust washer**
   - Installation position, see **Thrust washer and spring washer, outer, installed position** given earlier (version 1).
5. **Spring washer**
   - Installation position, see **Thrust washer and spring washer, outer, installed position** given earlier (version 1).
6. **Clamp**
   - Always replace
   - See: **CV joint boot clamps, tightening** given earlier (version 1).
7. **CV joint boot, outer**
   - Check for tears and chafing
   - Material: Hytrel (Polyelastomer)
8. **Clamp**
   - Always replace
   - See: **CV joint boot clamps, tightening** given earlier (version 1).
9. **Axle shaft**



10. **Clamp**
    - Always replace
    - See: **CV joint boot clamps, tightening** given earlier (version 1).
11. **Triple roller joint boot**
    - Check for tears and chafing
12. **Clamp**
    - For triple rotor star, left side.
    - Always replace
    - See: **CV joint boot clamps, tightening** given earlier (version 1).
13. **Triple roller star (center hub) with rollers**
    - Chamfer (inset **arrow**) points to axle shaft splines.
14. **Circlip**
    - Always replace
    - Install in shaft groove
15. **Bolt, multi-point socket head**
    - Always replace
    - Pre-tighten diagonally to 10 Nm (7½ ft-lb)
    - Tighten to 70 Nm (52 ft-lb)
16. **Triple roller joint outer housing**
    - See: **Triple roller joint, disassembling and assembling (AAR-3300i).**

* **High temperature grease (not shown)**
- See: **CV joint/triple roller grease quantity and type**

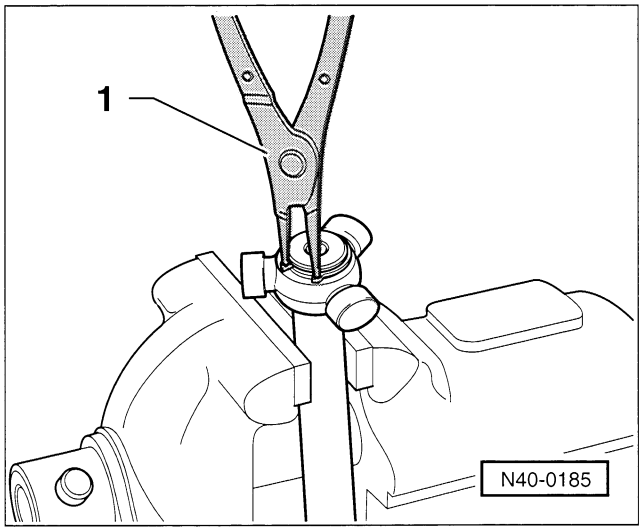
Outer joint diameter	Total grease	Proportions	
		Joint	Boot
mm/in.	grams/ounces	grams/ounces	grams/ounces
98 (3.86)	120 (4.25)	80 (2.8)	40 (1.4)
Inner joint diameter			
123 (4.84)	130 (4.6)	70 (2.5)	60 (2.1)

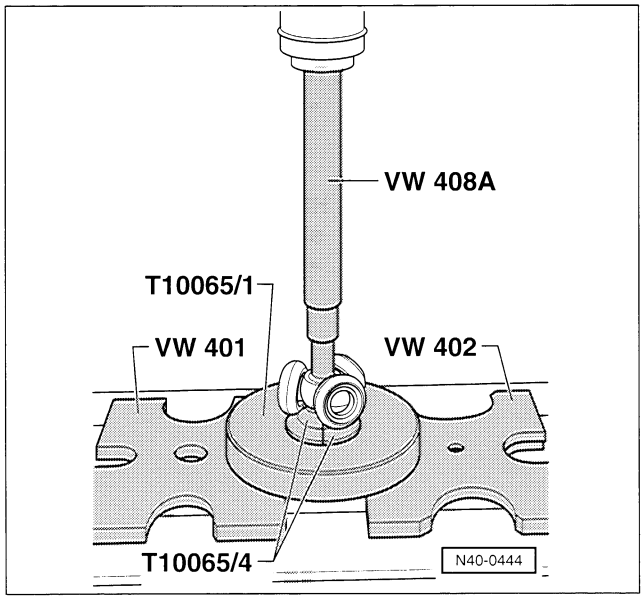
CV joint/triple roller grease quantity and type (AAR-3300i)

Use special high temperature molybdenum disulphide MoS_2 (moly) grease only. Special grease is generally packaged in reusable tubes of 90, 120, and 140 grams each. Pack the appropriate quantity into the boot and the joint according to the CV joint diameter listed in the table.

- Model years 1999-2001:
  G 000 603 (90 grams)
  G 000 633 (120 grams)
  G 000 605 (140 grams)
- Model years 2002-2004
  G 052 133 A2 (90 grams)
  G 052 133 A3 (120 grams)
  G 000 605 (140 grams)

Triple roller joint, disassemble and assembling, version AAR-3300i





– Remove axle from vehicle.

– Release large clamp on boot and slide boot off of joint.

– Release small clamp on boot and slide boot down axle.

– Mark the installed position of the triple rotor housing, triple rotor star (hub), and axle shaft so that they can be reassembled later in the same positions relative to each other. Making index marks minimizes the chance of vibration and noise due to mis-matching.

NOTE —
A waterproof felt tipped pen (such as a Sharpie®) is suitable for making these index markings.

– Slide the outer housing down the axle.

Remove circlip with circlip pliers.

Use a hydraulic press set up with the special tools shown or their equivalents. Hold the axle, support the triple rotor star, and press the axle out. Illustration shows earlier version, rollers are removed in previous steps.

– Place the triple roller star on a clean surface.

– Slide triple rotor housing off of axle shaft.

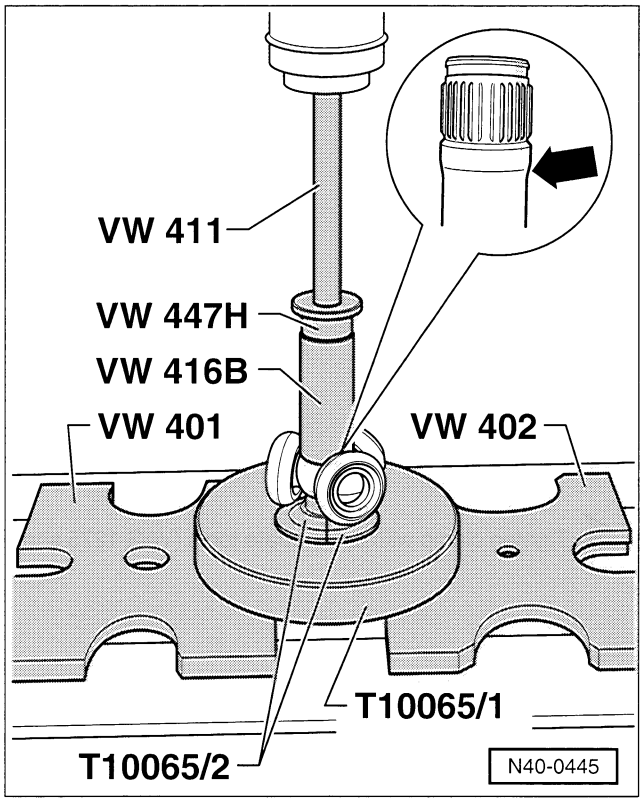
– Pull boot off of shaft.

– Clean shaft, joint, and O-ring groove.

– To assemble, slide new boot clamps onto axle shaft.

– Slide new boot onto axle shaft.

– Slide outer housing onto axle shaft.



– Install the triple rotor star onto the axle with the chamfered inner splines facing the axle and the previously made index markings in alignment.

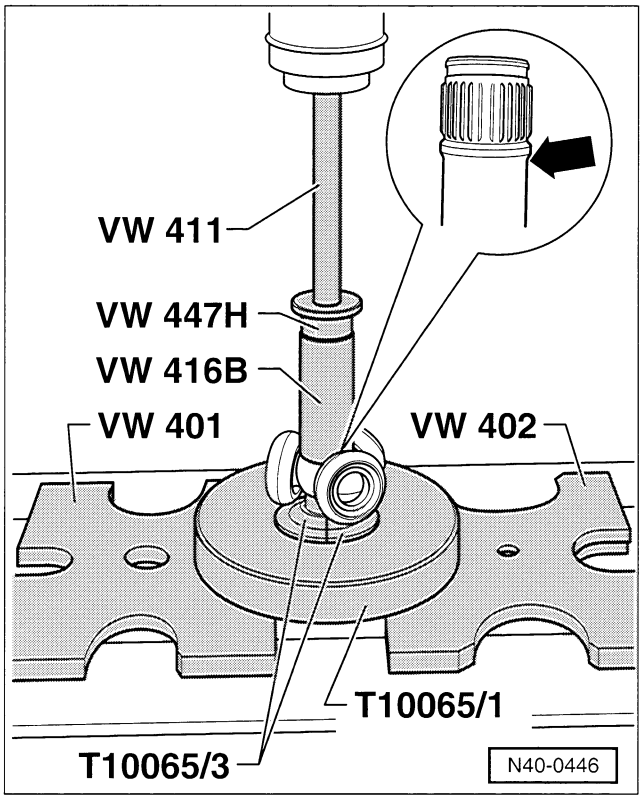
NOTE —

- *The chamfered inner splined hub of the star must face the axle.*
- *Confirm that the star is aligned to the axle according to the index marks made during disassembly.*

➤ **Conical type axle shafts**: Use a hydraulic press set up with the special tools shown or their equivalents. Support the axle, press the triple rotor star fully until contact with the stop.

NOTE —

- *Do not use more than 3 metric tons (3.3 short tons) of force to press star onto axle.*
- *Apply lubricating paste G 052 142 A2 to axle shaft splines and star as needed to facilitate pressing operations.*



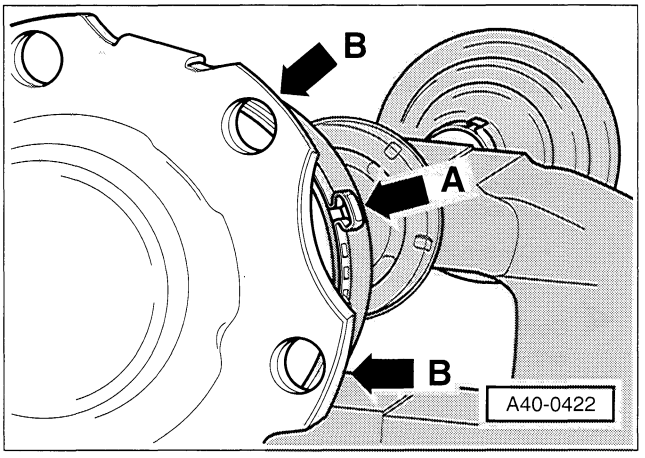
➤ **Cylindrical type axle shafts**: Use a hydraulic press set up with the special tools shown or their equivalents. Support the axle, press the triple rotor star fully until contact with the stop.

– Install new circlip to axle and confirm correct seated.

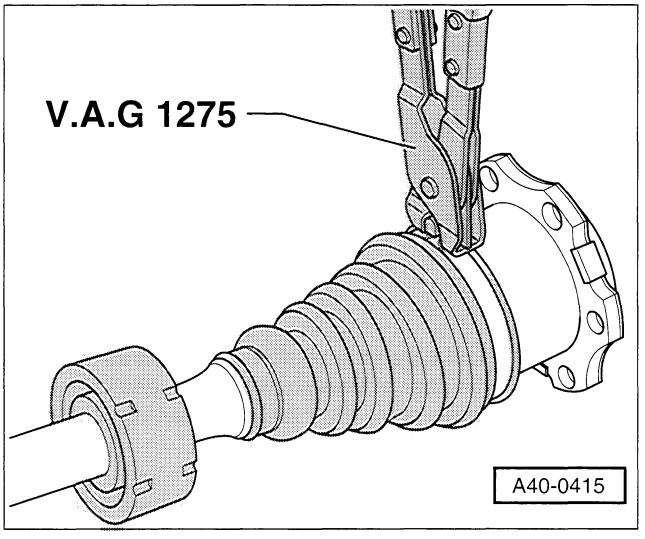
– Slide triple rotor housing up the axle shaft over the rollers taking care to align the previously made index markings.

– Lubricate triple roller joint with 70 grams (2.5 oz.) of the MoS_2 grease from the repair kit. Work lubricant into the joint and rollers.

– Work the remaining 60 grams (2.1 oz.) of the MoS_2 grease into the back of the triple roller joint and housing.



- Slide new clamp onto boot. Position clamping ear (**A**) so that it will not interfere with socket head bolts (**B**) when installing triple roller joint to transmission drive flange.



- Tighten clamp with appropriate tools (VAG 1275 shown).

CONSTANT VELOCITY JOINTS, SERVICING

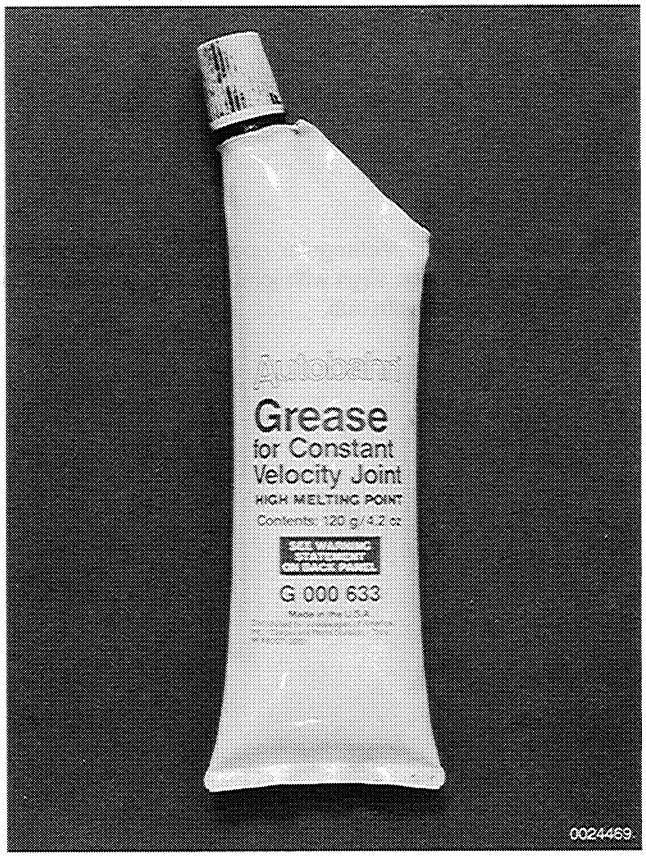
The components of each CV joint are precisely matched during manufacture and they cannot be serviced individually. The joint can be disassembled to replace the grease or to check the balls and ball tracks for wear and damage. See the appropriate section for CV joint removal from the axle, dimensions and grease quantity.

WARNING —

- *CV joints must be removed from the axle shaft prior to disassembly.*
- *DO NOT re-use drive axle circlips or CV boot clamps.*
- *DO NOT interchange parts between CV joints.*

Outer CV joint and boot, removing and installing

- Remove drive axle from vehicle, see **Drive Axles**.
- Mark position of CV boot on drive axle.
- Remove boot clamps.
- Carefully remove CV joint as described in the appropriate section, see **Drive Axles**.
- Remove thrust washer and spring washer.
- Slide boot off of axle.
- Clean drive axle.
- Slide inner (small) CV boot clamp onto drive axle (where applicable).
- Slide new CV boot onto drive axle. Position CV boot on axle, aligning marks made earlier.
- Install dished washer and thrust washer onto axle. Dished washer outer diameter faces thrust washer.
- Install new circlip on outer end of drive shaft, in groove.
- Pack CV joint boot with the appropriate quantity of grease.
- If using new CV joint, pack it with the appropriate quantity of grease. If re-using original CV joint, ensure that sufficient clean grease remains in joint.
- Install the CV joint onto the axle until the circlip is seated (snaps into groove).



– Install grease packed boot to CV joint. Boot should fit into groove in CV joint.

– Install outer clamp and crimp.

NOTE —
The Factory specifies the use of VAG 1275 and/or VAG 1682 in most circumstances. Special CV joint boot clamp pliers such as Snap-On YA 3080 and KD Tools #424 pliers or equivalent may also be suitable.

– Lift the boot slightly off the joint to ventilate and equalize pressure. Then slide inner clamp onto boot and crimp.

– Reinstall axle into vehicle or continue repairs by proceeding to inner CV joint.

Outer CV joint, disassembling and assembling

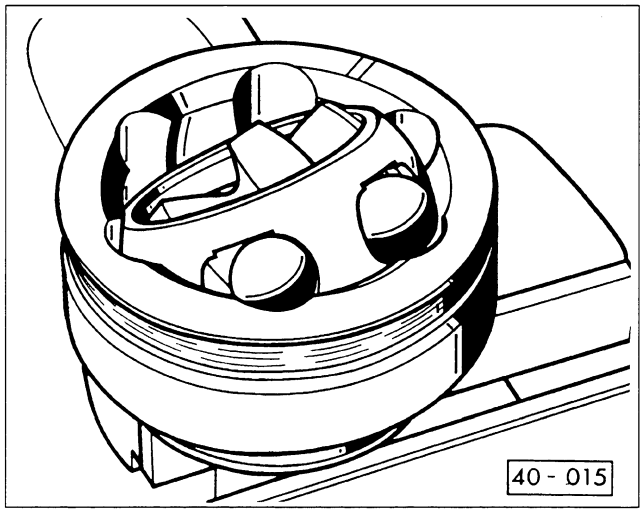
– Remove drive axle from vehicle, see **Drive Axles**.

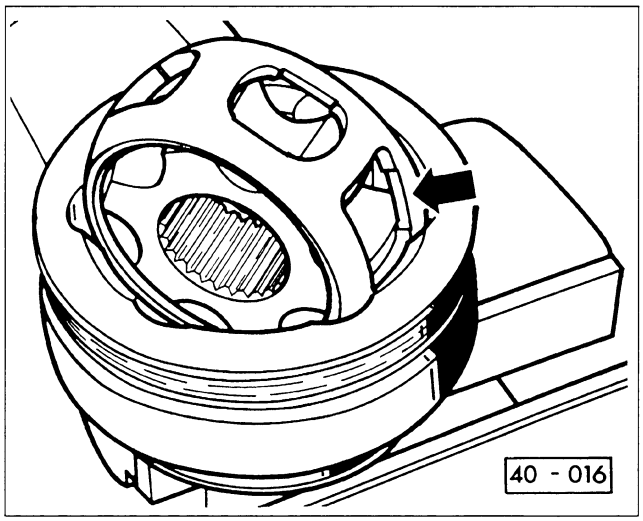
– Carefully remove CV joint as described in the appropriate section, see **Drive Axles**.

– Before disassembly, mark position of ball hub in relation to ball cage and housing with electric scriber.

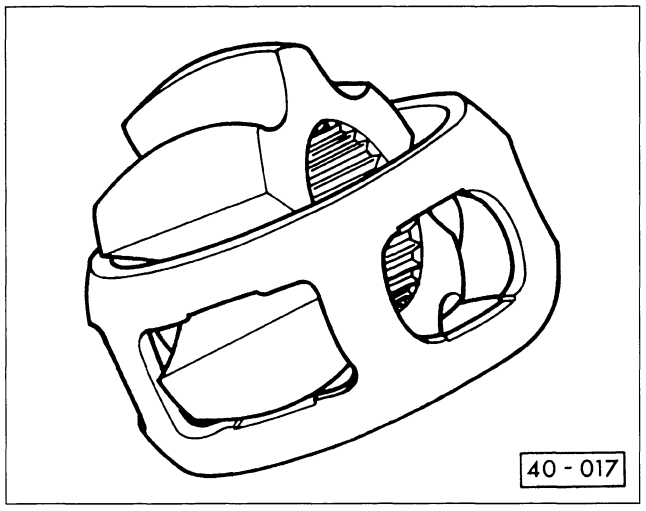
➤ Swivel ball hub and ball cage so that balls are exposed.

– Remove each ball in turn, swiveling the ball hub and cage as necessary.





➤ Turn cage until rectangular openings (**arrow**) on either side of ball cage align with joint housing and lift out ball cage together with hub.



- Remove ball hub from ball cage by swinging segment of hub into rectangular opening of cage and tilting hub out of cage.

- Check housing, hub, cage, and balls for pitting and signs of seizure.

NOTE —

- *The six balls of each joint belong to one tolerance group.*
- *Check stub axle, hub, cage and balls for small indentations (pitting) and signs of seizure.*
- *Excessive backlash in the joint will be noticed as a knock when changing from acceleration to overrun or vice versa. Replace the joint if necessary.*
- *Do not replace the joint because of a polished appearance or because ball tracks are visible.*

- To assemble, insert ball hub into ball cage at rectangular opening as shown above.

- Pack CV joint outer housing with the appropriate quantity of grease from the table for the axle version.

- Install cage together with hub into joint housing while aligning rectangular openings in ball cage. Make sure marks made earlier align when installing the cage into the housing.

- Press in balls separately from alternate sides. Ensure original position of hub in relation to cage.

- Install new circlip on outer end of drive shaft, in groove.

- Pack remaining quantity of grease into joint boot.

- Check operation of CV joint:
  - CV joint is correctly assembled when the ball hub can be moved by hand backwards and forward over the entire axial movement range.

- Install CV joint to drive axle as described previously.

- Re-attach CV joint boot with new clamps.

Inner CV joint and boot, removing and installing

- Remove drive axle from vehicle, see **Drive Axles**.

- Mark position of CV boot on drive axle.

- Remove boot clamps.

- Carefully remove CV joint as described in the appropriate section, see **Drive Axles**.

- Remove spring washer.

- Clean drive axle.

– Slide inner (small) CV boot clamp onto axle (where applicable).

– Slide CV boot onto drive axle.

– Pack CV joint boot with the appropriate quantity of grease.

– Install spring washer so that dished washer outer diameter faces CV joint.

– Pack CV joint with the appropriate quantity of grease.

– Install the CV joint onto the axle and install new circlip into groove in axle.

NOTE —
Chamfer on inner ball hub (splined diameter) must face the contact shoulder on the drive axle.

– Slide axle flange bolts through protective cap and into openings in CV joint. Press protective cap onto CV joint.

– Slide inner clamp onto boot and crimp.

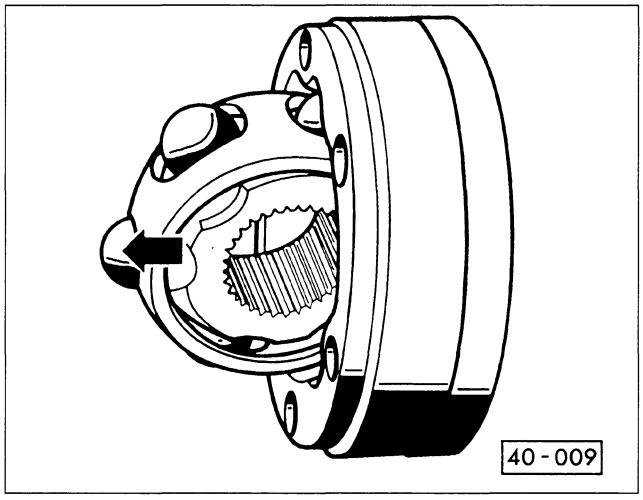
NOTE —
The Factory specifies the use of VAG 1275 and/or VAG 1682 in most circumstances. Special CV joint boot clamp pliers such as Snap-On YA 3080 and KD Tools #424 pliers or equivalent may also be suitable.

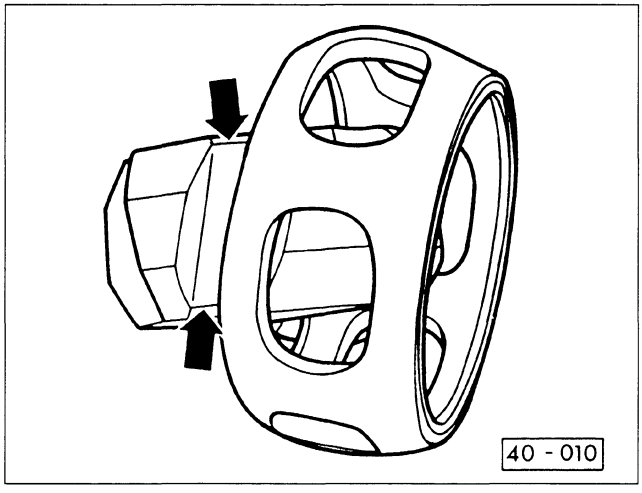
Inner CV joint, disassembling and assembling

– Remove drive axle from vehicle, see **Drive Axles**.

– Mark position of ball hub in relation to ball cage and housing with electric scriber.

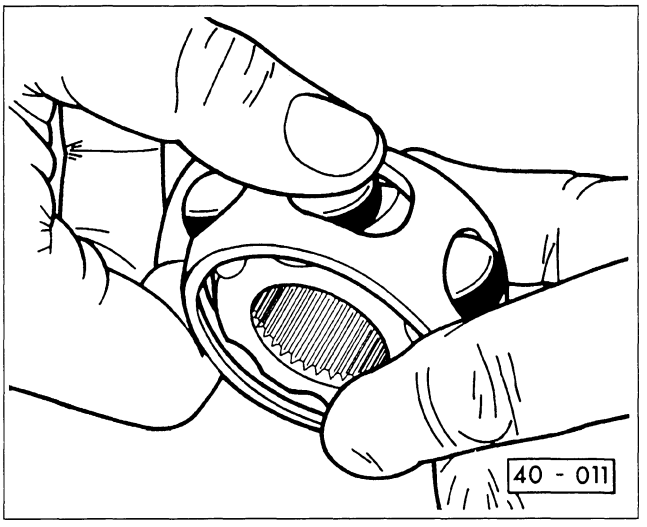
➤ Swivel ball hub and ball cage 90°. Pull ball hub together with cage and balls from housing (**arrow**).





➤ Press balls out of cage. Tilt ball hub so that ball tracks (**arrows**) are aligned with edge of ball cage and remove hub from cage.

– Check housing, hub, cage, and balls for pitting and signs of seizure.

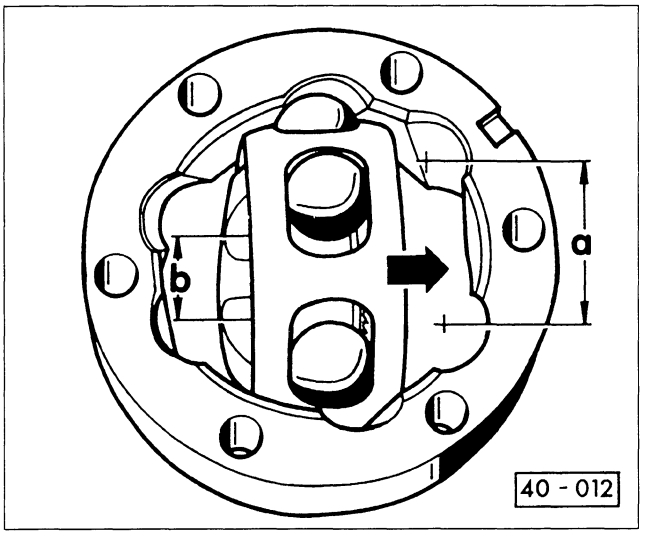


NOTE —

- *The six balls of each joint belong to one tolerance group.*
- *Check stub axle, hub, cage and balls for small indentations (pitting) and signs of seizure.*
- *Excessive backlash in the joint will be noticed as a knock when changing from acceleration to overrun or vice versa. Replace the joint if necessary.*
- *Do not replace the joint because of a polished appearance or because ball tracks are visible.*

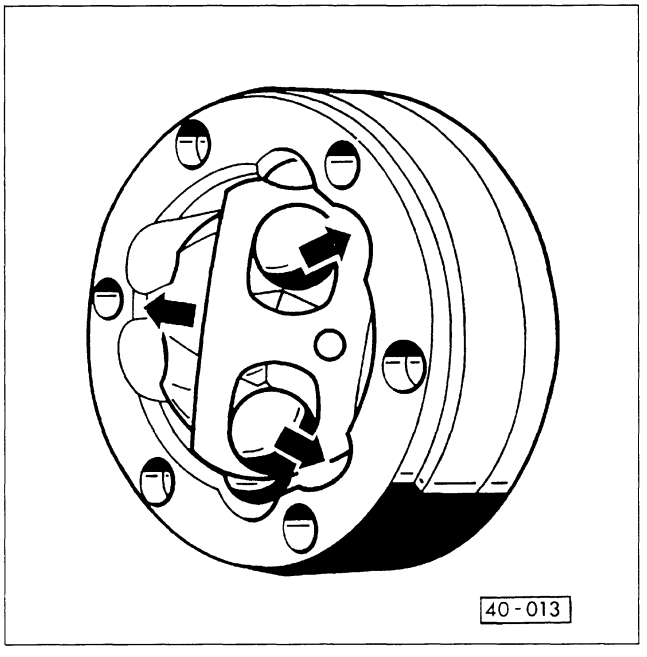
– Insert ball hub over both chamfers into ball cage.

➢ Align ball hub to cage using marks made earlier. Press balls into cage.

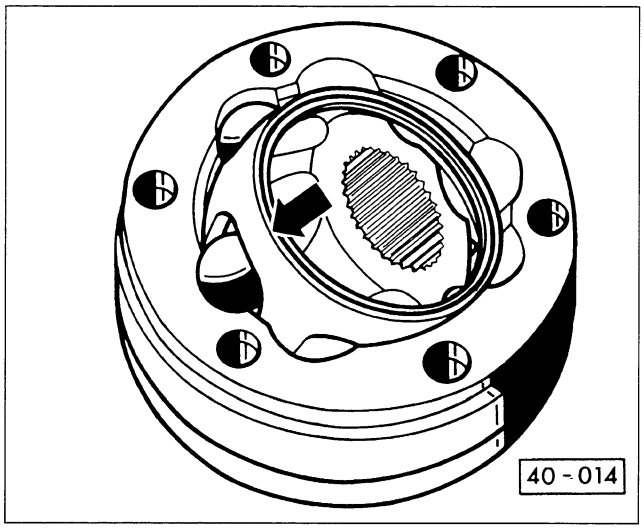


➢ Insert hub with cage and balls into joint at right angles (reverse the removal procedure), and ensure the following:

- Wide ball groove in outer ring (**a**) and narrow groove in hub (**b**) are together on one side when hub is pivoted into housing.
- Matching marks on hub, cage, and housing are aligned.
- Chamfer on inside diameter of ball hub faces larger diameter of joint.



➢ Swivel ball hub with cage and balls into housing. Pivot hub and cage (**arrows**) until balls align.



➤ Press cage firmly by hand until hub swings fully into position (**arrow**).

NOTE —
The joint is correctly assembled when the ball hub can be moved in and out over the full range of axial movement by hand.

– Pack CV joint with the appropriate quantity of grease. Pack grease from both sides of CV joint and pack CV boot with remaining grease.

– Check operation of CV joint:
  • CV joint is correctly assembled when the ball hub can be moved by hand backwards and forward over the entire axial movement range.

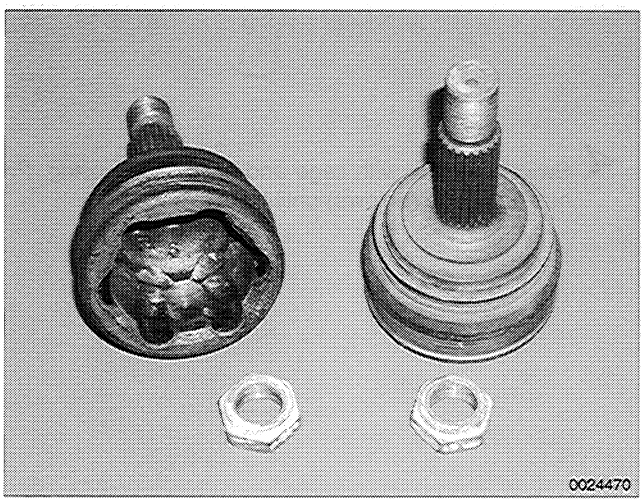
– Install CV joint to axle using a new circlip.

– Reinstall axle into vehicle or continue repairs by proceeding to outer CV joint.

DRIVE AXLES

The drive axles must be removed from the vehicle for proper servicing. Do not move the vehicle unless the axles, or temporary stub axles, are in place. The wheel bearings must not be loaded (such as when moving the vehicle) when the axle nut or axle bolt is loose. If the bearings are loaded by the vehicle's own weight, the wheel bearings will be damaged and the life expectancy is greatly reduced.

If a vehicle must be moved after removing the axle shaft, install an outer CV joint and tighten the axle nut or axle bolt to 50 Nm (37 ft lb). An old pair of CV joints with no hubs, balls or cages is the perfect "special tool" for this operation. The complete axle shaft assembly need not be installed, only the outer joint.



➤ Old set of outer CV joints and axle nuts saved for use as "special tools". Condition of joint is unimportant since hubs, balls, and cages have been discarded, however, splines and threads must not be damaged or worn excessively.

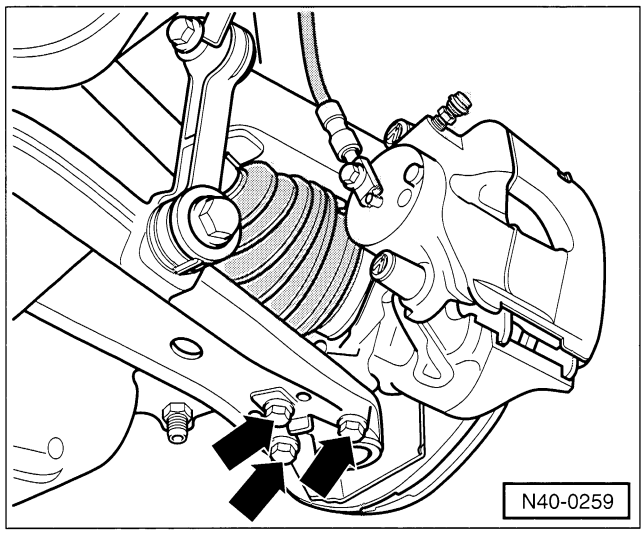
Drive axles, removing

– Lift and properly support vehicle. Loosen axle nut or axle bolt before lifting vehicle if possible.

– Remove wheel assembly.

– Loosen axle nut or axle bolt if not previously loosened.

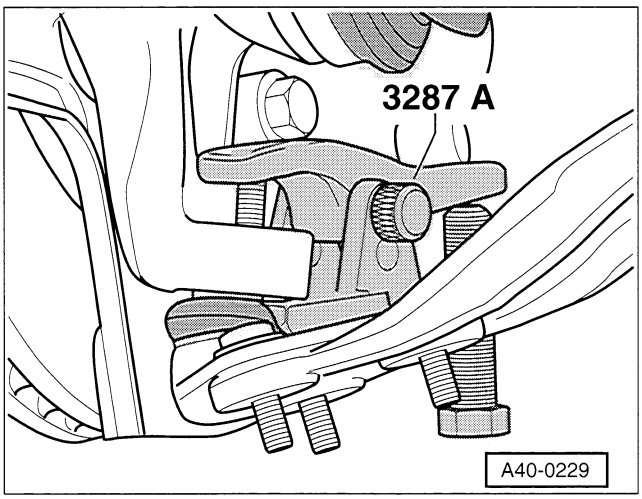
– Unbolt axle shaft from transmission drive flange.



Vehicles with 12-point nut

Mark the installed position of the ball joint in relation to the control arm (**arrows**)

– Remove ball joint bolts.

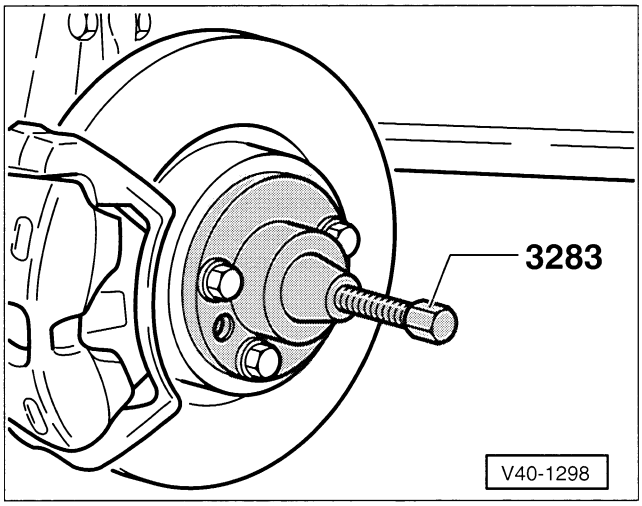


Vehicles with hex bolt

Adjust 3287A ball joint press pivot pin and install press as shown. Pre-tension press slightly by turning bolt. Lightly tap on ball joint with a hammer. Re-adjust the pre-tension if needed. Tapping the ball joint with the pre-tensioned puller in place will release the tapered shaft of the ball joint from the wheel bearing housing.

> ***WARNING —***
> - *Leave ball joint nut threaded on few turns to protect ball joint threads and to keep ball joint from falling out unexpectedly.*
> - *Use care when tapping on the ball joint. Once the ball joint breaks free from the taper in the wheel bearing housing, the press will have a tendency to fall off.*

– Remove puller from ball joint (if still attached), remove nut from ball joint. Slide ball joint out of wheel bearing housing.



Continued for both versions

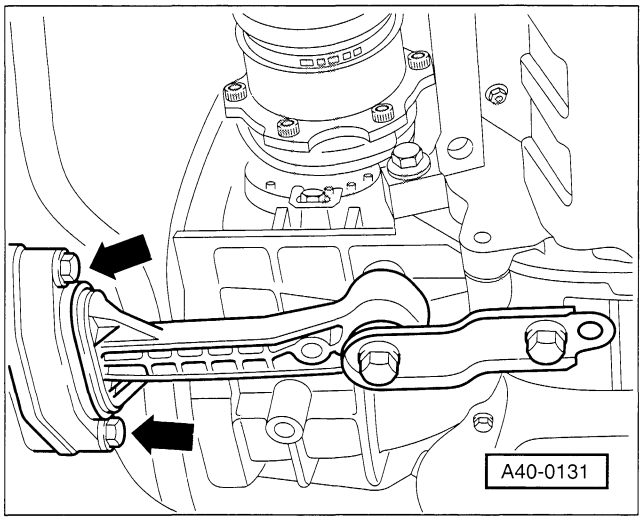
– Press axle shaft out with special tool 3283, or equivalent as shown. Vehicles with hex bolt axles require the use of brass press pad VW 434 or equivalent.

> ***NOTE —***
> *When pressing drive axle out make sure that sufficient clearance is available.*

– Pull wheel bearing housing out from control arm or ball joint.

– Remove axle shaft.

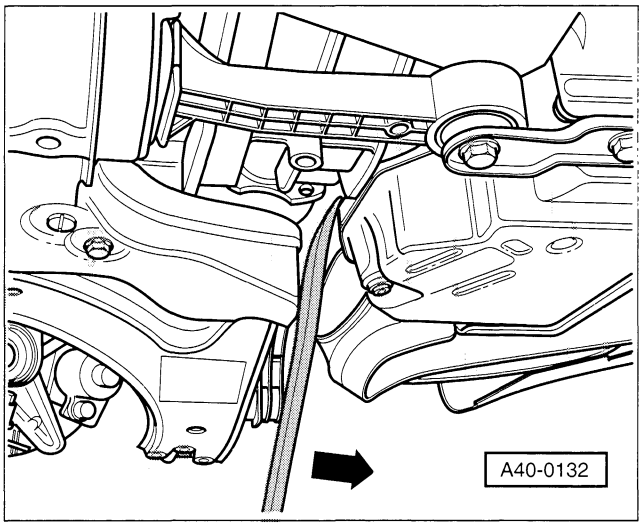
> ***NOTE —***
> *Do not allow the axle to hang unsupported! The inner joint will be damaged due to movement beyond the normal range of travel if not tied up and out of the way.*



Additional for vehicles with automatic transmissions

➢ Remove bolts (**arrows**) from pendulum support at subframe.

– Remove sound absorber panels (belly pans) from left side as required.



➢ Push engine/transmission assembly forward (**arrow**) with a suitable pry bar sufficiently to allow axle to be removed.

Drive axles, installing

– For vehicles with an axle nut or an axle bolt:

- Always replace bolt/nut.
- Any paint residue and/or corrosion on threads of outer joint must be removed before installation.
- Lubricate the hex nut contact surface and threads.
- Lubricate the wheel hub splines, CV joint splines, and axle thread with oil before installing axle.

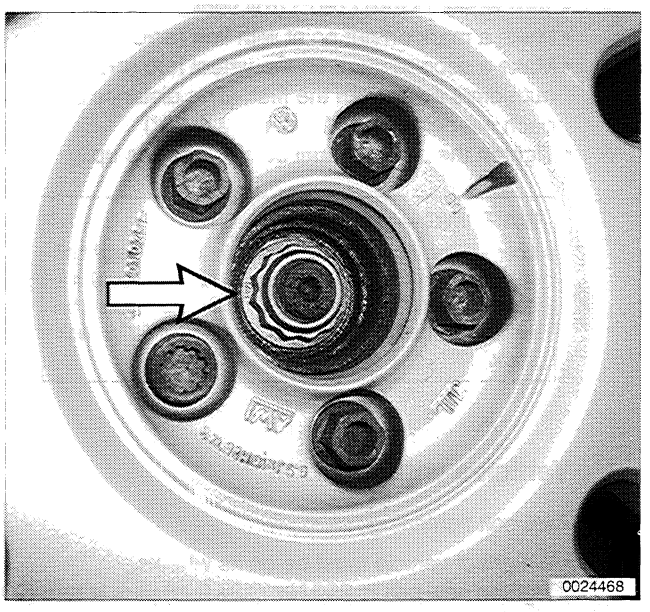
NOTE —
Do not oil threads of axle bolt.

– Install axle and guide outer joint into wheel hub as far as possible.

– Connect ball joint to control arm at marks or connect ball joint to wheel bearing housing as applicable.

– Install inner joint to transmission drive flange and pretension to 10 Nm (7 ft-lb).

– Bolt pendulum support to subframe as required.

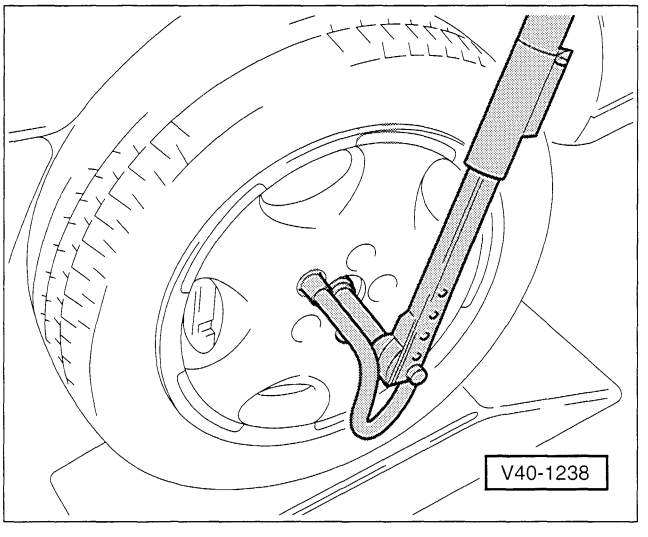


➤ Install axle nut or axle bolt. Axle nut (**arrow**) in this instance requires a 30 mm 12 point socket.

– Pull outer CV joint into wheel hub until fully seated.

Tightening torques

- Ball joint to control arm (always replace) . . . . . 20 Nm (15 ft-lb) plus ¼ turn (90°)
- 12-point nut for drive axle to wheel hub (always replace) . . . . . 200 Nm (148 ft-lb) loosen ½ turn (180°) turn wheel ½ turn (180°) then tighten to 50 Nm (37 ft-lb) plus 1/6 turn (60°)
- Hex bolt for drive axle to wheel hub (always replace) . . . . . 250 Nm (184 ft-lb) plus ¼ turn (90°) loosen ½ turn (180°) turn wheel ½ turn (180°) then tighten to 250 Nm (184 ft-lb) plus ¼ turn (90°)
- Ball joint to wheel bearing housing. . 45 Nm (33 ft-lb)
- Pendulum support to subframe . . . . 25 Nm (18 ft-lb)
- CV joint to drive flange on transmission, always replace, tighten diagonally
  M8 . . . . . 40 Nm (30 ft-lb)
  M10 . . . . . 70 Nm (52 ft-lb)
- Drive axle boot protective shield to engine block . . . . . 35 Nm (26 ft-lb)
- Drive flange to transmission nut plate (socket head bolt) . . . . . 25 Nm (18 ft-lb)

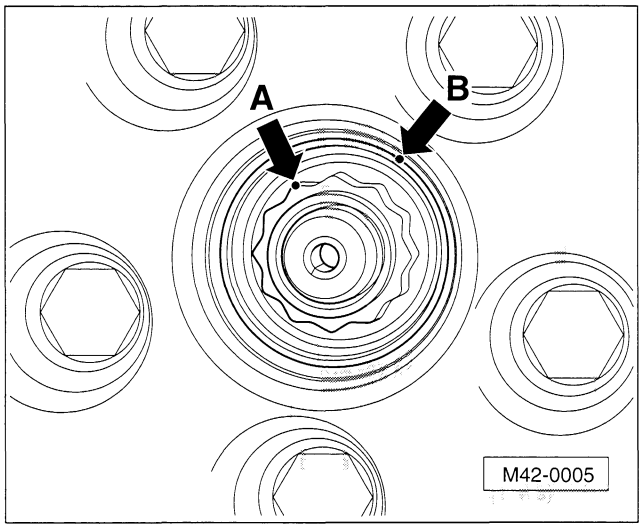


Vehicles with 12-point nut

➤ Tighten axle nut:

- Weight of vehicle must be on its wheels.
- Tighten new 12-point nut to 200 Nm (148 ft-lb) and immediately loosen ½ turn (180°)
- Turn wheel ½ turn (180°) (roll vehicle), then tighten to 50 Nm (37 ft-lb) plus 1/6 turn (60°)

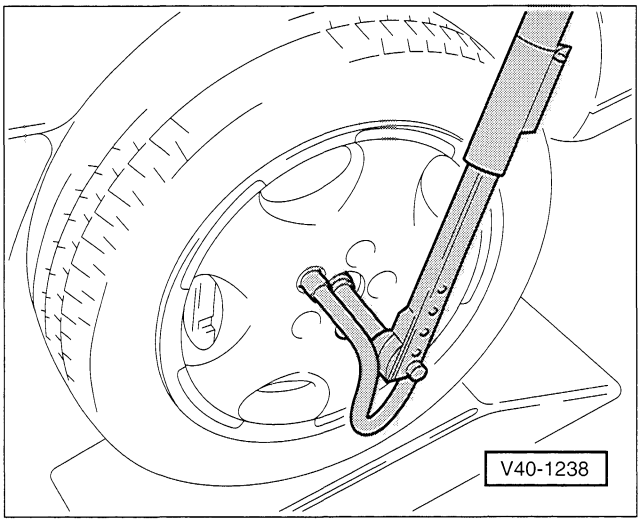
WARNING —
Loosen and tighten axle nuts only when weight of vehicle is on the wheels. The leverage (torque) required for this operation is sufficient to topple the vehicle to the ground if supported on a lift or jack stands.



Axle nut tightening (alternate procedure)

- Weight of vehicle must be on its wheels.
- Tighten new 12-point nut to 200 Nm (148 ft-lb) and immediately loosen ½ turn (180°)
- Turn wheel ½ turn (180°) (roll vehicle)
- Make a mark on nut point with line (**arrow A**).
- Make a second mark on the wheel hub (**arrow B**) two nut points away from the first. (The distance between each nut point on a 12-point nut is 30°)
- Tighten the axle nut until both marks line up.

> ***WARNING —***
> *Loosen and tighten axle nuts only when weight of vehicle is on the wheels. The leverage (torque) required for this operation is sufficient to topple the vehicle to the ground if supported on a lift or jack stands.*



Vehicles with hex bolt

Axle bolt tightening

- Weight of vehicle must be on its wheels.
- Tighten new bolt to 250 Nm (184 ft-lb) plus ¼ turn (90°) and immediately loosen ½ turn (180°)
- Turn wheel ½ turn (180°) (roll vehicle), then tighten to 250 Nm (184 ft-lb) plus ¼ turn (90°)

> ***WARNING —***
> *Loosen and tighten axle nuts only when weight of vehicle is on the wheels. The leverage (torque) required for this operation is sufficient to topple the vehicle to the ground if supported on a lift or jack stands.*

42 Rear Suspension

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QUALITY REVIEW 42-17

GENERAL

Special tools, equipment and procedures are required for most rear suspension repair and component replacement. In addition, wheel alignment is often disturbed when rear suspension components are removed or replaced.

This section covers repairs to the rear suspension and related components. For front suspension servicing and repair information, see **40 Front Suspension**. For wheel alignment specifications, see **44 Wheels – Tires, Wheel Alignment**.

WARNING —

- *Do not re-use any fasteners that are worn or deformed in normal use. Most fasteners are designed to be used only once and become unreliable and may fail when used a second time. This includes, but is not limited to, nuts, bolts, washers, circlips, cotter pins, self-locking nuts and bolts. For replacements, always use new parts.*
- *Do not reinstall bolts and nuts coated with undercoating wax, as correct tightening torque cannot be ensured. Always clean the threads of removed bolts and nuts that are to be re-used with a suitable solvent before installation. Ensure that new parts are clean.*

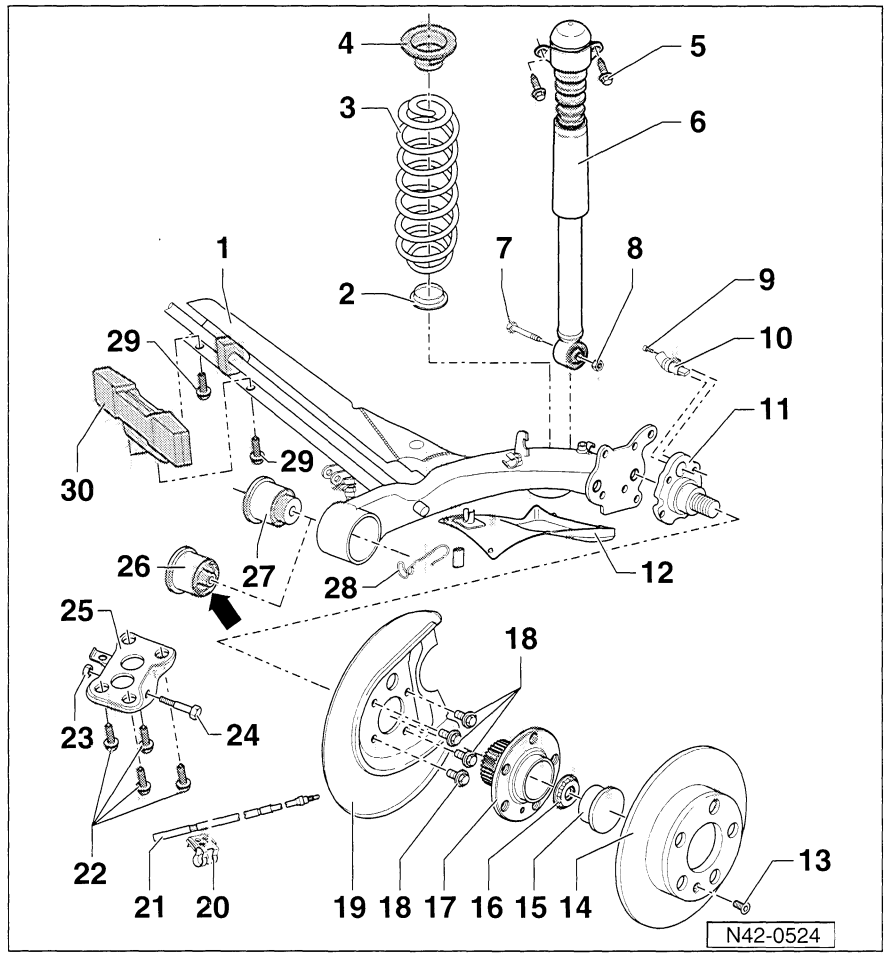
REAR SUSPENSION

WARNING —

- *Do not use standard nuts and bolts in place of green colored parts. The green color denotes a special anti-corrosion process known as "dacromet" or "delta-tone". Torque specifications are given based on use of these parts only.*
- *Always replaced rusted or corroded bolts, nuts and washers even if not specifically indicated.*
- *DO NOT attempt to straighten or weld suspension struts, wheel bearing housings, control arms or any other wheel locating or load bearing components of the front suspension.*

The beam-type rear axle is a one-piece welded assembly consisting of an axle beam, trailing arms, stabilizer bar, and coil spring seat. Rear wheel stub axles are bolted to the trailing arms. Coil springs are mounted low on the beam with the upper spring seats attached to the rear body structure. Gas-pressure telescopic rear shock absorbers are bolted to the outside of the wheel wells and are can be without removing the coil springs. Rear wheel bearings are sealed into the hub assembly and are not serviceable, but replaced as a unit.

Rear suspension assembly



1. **Axle beam**
   - Stub axle contact surfaces and threaded holes must be free of paint and dirt
2. **Spacer bushing**
   - Material: zinc.
   - Check for damage
3. **Coil spring**
   - Note color coded marking for identification
   - Outer surface of spring must not be damaged
4. **Spring seat, upper**
   - End of coil spring must be against spring seat stop, see **Rear coil spring, removing and installing**
5. **Bolt, hex**
   - Upper shock mount.
   - Damaged welded nut threads in crossmember can be repaired with HeliCoil® inserts
   - Always replace
   - Tighten to 30 Nm (22 ft-lb) +¼ turn (90°) with weight of one person in vehicle!
6. **Shock absorber**
   - Gas pressure
   - Can be replaced individually
7. **Bolt, hex**
   - Lower shock mount
   - Always replace
   - Tighten to 40 Nm (30 ft-lb) +¼ turn (90°)
8. **Nut, hex**
   - Always replace
   - Axle beam must be at midpoint of vertical travel (not bottomed out nor hanging) when tightening nut to insure proper shock bushing preload
   - Load car rear with weight of one person when tightening
9. **Bolt, socket head**
   - Tighten to 8 Nm (71 in-lb)
10. **ABS wheel speed sensor**
11. **Stub axle**
    - Do not attempt to straighten.
    - Do not attempt to re-cut threads
12. **Stone shield**
13. **Screw, philips head**
    - Locates brake rotor on hub
    - Tighten to 4 Nm (35 in-lb)
14. **Brake disc (rotor)**
15. **Dust cap**
    - Always replace
    - Proper function and long service life can only be ensured by perfect seal of new dust cap
16. **Nut, self-locking 12-point**
    - Always replace
    - Tighten to 175 Nm (129 ft-lb)
17. **Wheel hub unit with bearings and ABS wheel speed sensor rotor**
    - Wheel bearing, wheel hub and wheel speed sensor rotor are integral components
    - Wheel bearing/hub unit is maintenance and adjustment free
18. **Bolt, hex**
    - Always replace
    - Tighten to 60 Nm (44 ft-lb)
19. **Splash shield**
20. **Parking brake cable bracket**
21. **Parking brake cable**
22. **Bolt, hex**
    - Always replace
    - Tighten to 75 Nm (55 ft-lb)
    - Damaged welded nut threads in crossmember can be repaired with HeliCoil® inserts
23. **Nut, hex**
    - Always replace
    - Tighten to 80 Nm (59 ft-lb)
    - Axle beam must be at midpoint of vertical travel (not bottomed out nor hanging) when tightening nut to insure proper shock bushing preload
24. **Bolt**
    - Always replace
    - Tighten to 80 Nm (59 ft-lb)

(continued on following page)

Rear suspension assembly (continued)

25. Rear axle beam mounting bracket
- Check, and if necessary adjust rear axle total toe after installation
- If possible do not loosen when removing rear axle

26. Hydraulic bonded rubber bushing
- Only installed on some vehicle suspension types (0N1)
- Suspension identification code, if relevant, can be found on vehicle data label in luggage compartment or owner's manual
- Suspension identification, see: **Suspension identification**, and **44 Wheels-Tires, Wheel Alignment**
- Replace with bonded rubber bushings on both sides if leaking (**arrow**). Hydraulic bonded rubber bushings are not available as a spare part
- Bushings must both be hydraulic or bonded rubber. Do not mix types on the same vehicle
- Removing and installing, see **Hydraulic bonded rubber bushings, removing and installing**

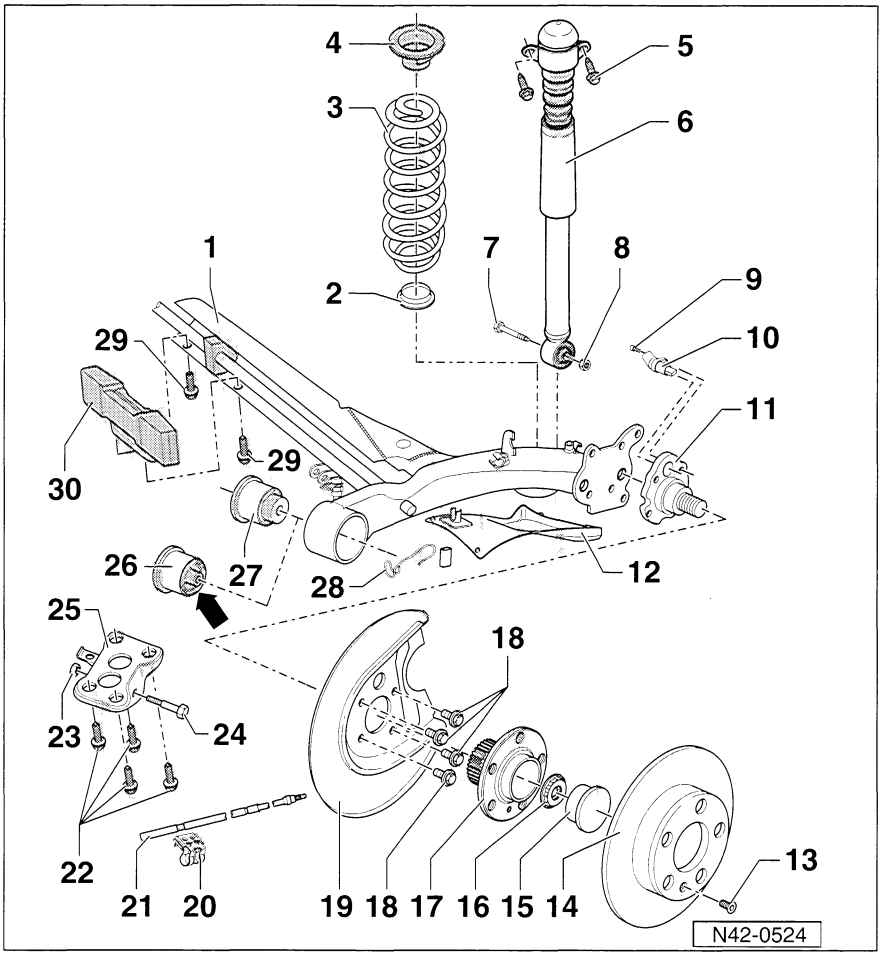
27. Bonded rubber bushing
- Only installed on some vehicle suspension types (0N5)
- Suspension identification code, if relevant, can be found on vehicle data label in luggage compartment or owner's manual
- Suspension identification, see: **Suspension identification**, and **44 Wheels-Tires, Wheel Alignment**
- Installed position, see **Bonded rubber bushing, removing and installing**

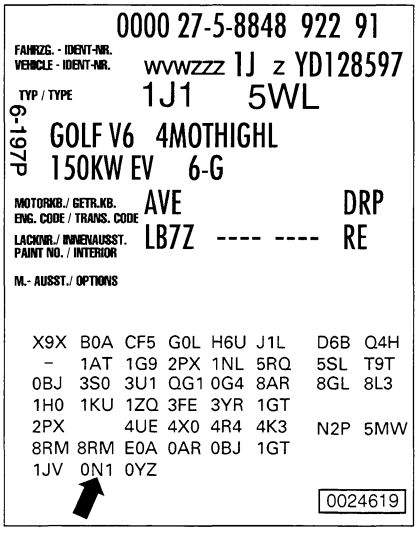
28. Parking brake cable support clip

29. Bolt, hex
- Always replace
- Tighten to 20 Nm (15 ft-lb) + 1/8 turn (45°)

30. Vibration dampener
- Tuned to 115 Hz
- Not installed on Jetta Wagon versions

* **Wheel (lug) bolts (not shown)**
- Tighten to 120 Nm (89 ft-lb)





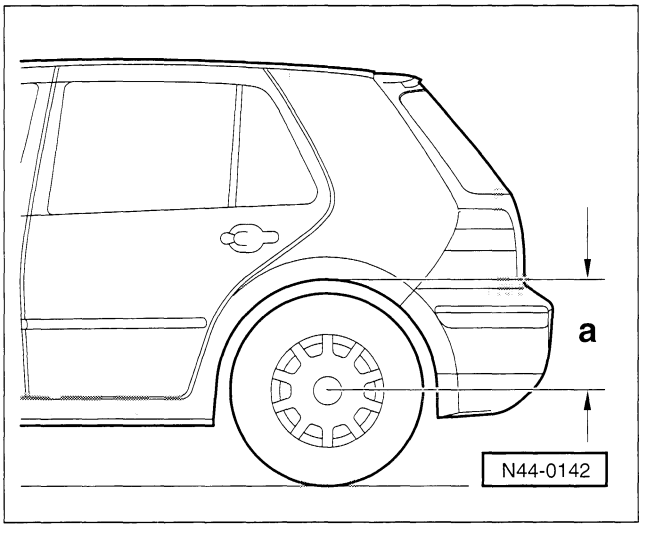
Suspension identification
- Suspension data (**arrow**) determines axle beam bushing type.
- **0N1** denotes hydraulic bonded rubber bushing
- **0N5** denotes bonded rubber bushing
- Golfs use bonded rubber bushing or hydraulic bonded rubber bushing from start of production. Either type may be installed
- Jettas use bonded rubber bushing from start of production. Hydraulic bonded rubber bushing introduced as running change in 2002. From that point either type may be installed.
- Jetta Wagons use only bonded rubber bushing
- Vehicle data sticker does not always indicate which version is installed, particularly on vehicles built prior to model year 2002

Bonded rubber and hydraulic bonded rubber bushings, removing and installing

Both bonded rubber and hydraulic bonded rubber bushings are install during production. If replacement of the hydraulic version is required, it must be replaced with the non-hydraulic bonded rubber version. Hydraulic bonded rubber bushings are not supplied as spare parts except in complete rear axle beam assemblies.

If it become necessary to replace the hydraulic bonded rubber bushing of one side, a non-hydraulic bonded rubber bushing will be used. It will also be necessary to replace the hydraulic bonded rubber bushing on the other side with a non-hydraulic bonded rubber bushing to maintain proper handling characteristics. A mixed installation can result in undesirable handling and ride and is not permissable.

It is advisable to read and understand the complete procedure before beginning ant repairs.



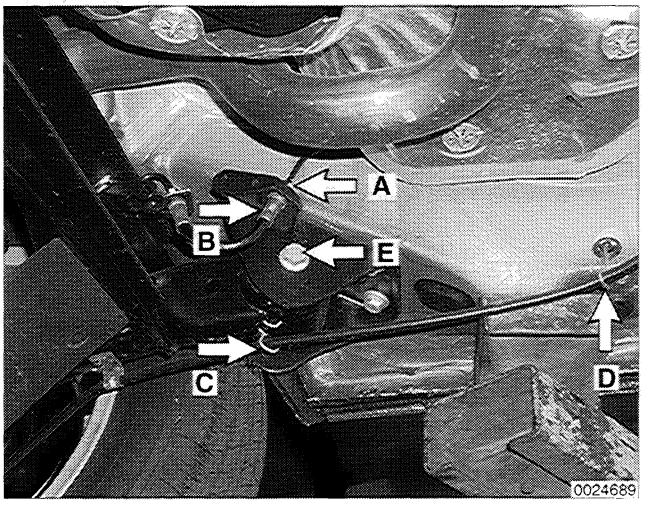
➤ With the vehicle sitting on a level surface, measure and record the distance from the center of the wheel hub to the lower edge of the wheel well opening as shown (dimension **a**).

NOTE —
This measurement will be needed during reassembly to properly tighten the bolts for the rear axle to the mounting bracket.

– Install a brake pedal depresser such as the VAG 1869/2 so that the brakes are applied.

– Lift vehicle and place vehicle securely on jack stands (if not using vehicle hoist).

– Remove wheels.



➤ Separate brake lines (**arrow A**) and remove support clip.

– Remove left rear brake hose from bracket (**arrow B**).

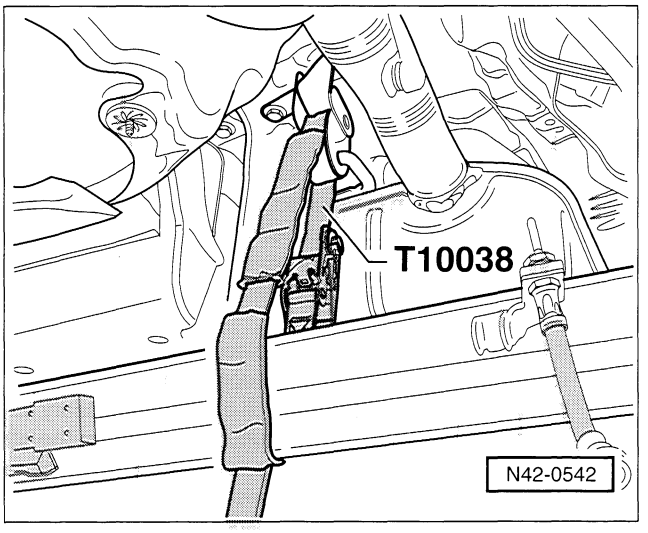
– Remove right rear brake hose from axle.

– Remove parking brake cables from support brackets (**arrows C** and **D**).

– Place VAG 1383A engine/transmission jack or equivalent under rear axle beam so that it just contacts the beam.

– Remove bolts (**arrow E**) from both of the rear axle beam mounting brackets.

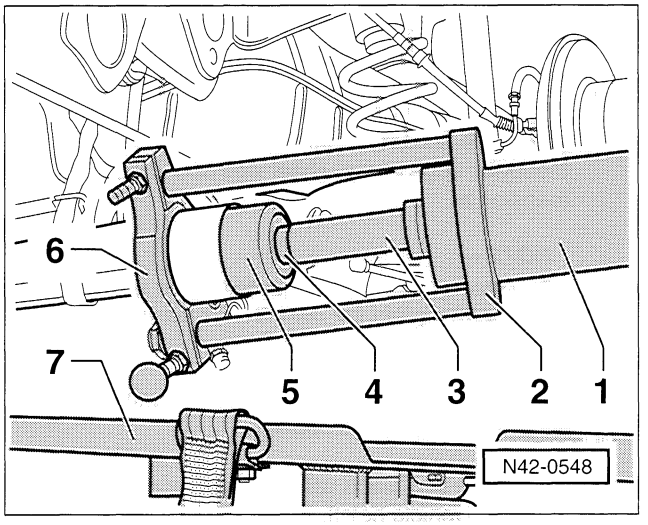
– Lower rear axle beam with engine/transmission jack.



➤ Secure the rear axle beam to the exhaust system mount as shown with Strap T10038 or equivalent. Do not let axle hang by it's own weight.

> ***CAUTION —***
> *Use care to prevent axle beam from hanging by it's own weight to prevent damage to bushings, hoses, and lines due to stretching.*

– Press out either type of bushing per the appropriate step(s). In both cases, the bushing will be destroyed during removal.

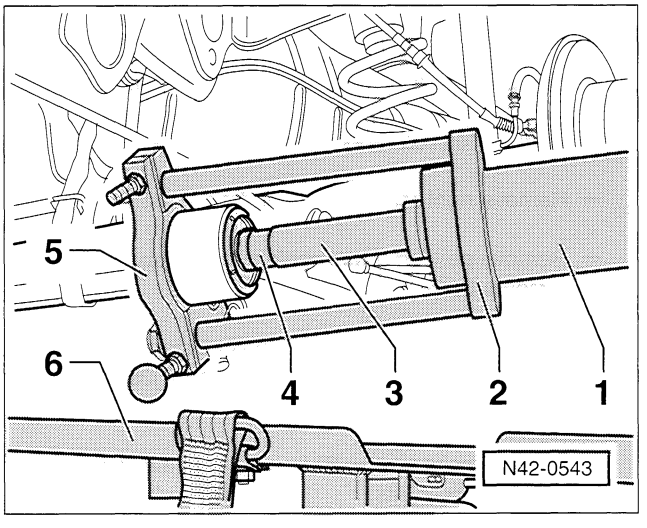


➤ **Bonded rubber bushing**: use the set up shown, with the noted special tools, or equivalent, to remove the **complete** bonded rubber bushing.

1 - VAS 6178 hydraulic foot pump
2 - VAS 6180/1 assembly tool
3 - VAS 6180/4 (long) adapter
4 - VAS 6180/3 adapter
5 - 3416/2 press piece
6 - VAS 6180/2 yoke
7 - VAG 1383 A jack with VAG 1359/2 adapter

NOTE —

- *Machined edges of VAS 6180/2 must be positioned so that they are on the axle beam and not the bushing being pressed out.*
- *The "TOP" marking of VAS 6180/2 must point towards the axle beam arm.*

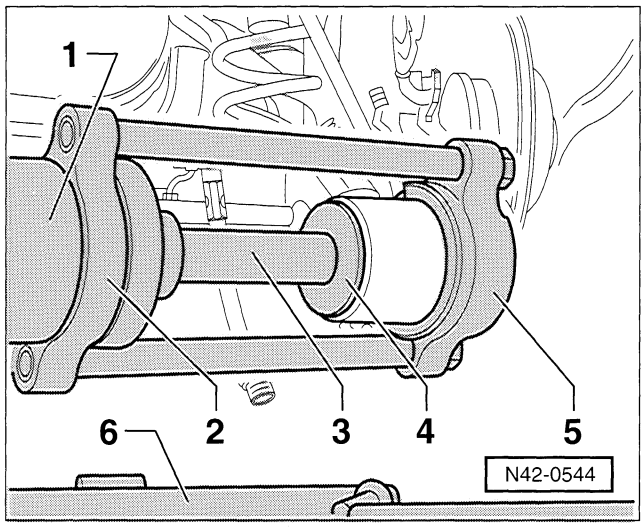


➤ **Hydraulic bonded rubber bushing**: use the set up shown, with the noted special tools, or equivalent, to remove the **center** of the hydraulic bonded rubber bushing.

1 - VAS 6178 hydraulic foot pump
2 - VAS 6180/1 assembly tool
3 - VAS 6180/4 (long) adapter
4 - VAS 6180/3 adapter
5 - VAS 6180/2 yoke
6 - VAG 1383 A jack with VAG 1359/2 adapter

NOTE —

- *Machined edges of VAS 6180/2 must be positioned so that they are on the axle beam and not the bushing being pressed out.*
- *The "TOP" marking of VAS 6180/2 must point towards the axle beam arm.*
- *Use a large plastic bag over the tools and axle beam to contain the oil that leaks out during pressing operations.*



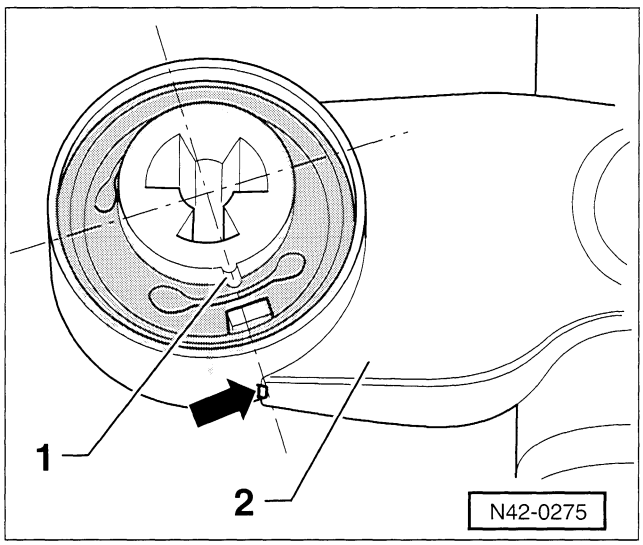
Hydraulic bonded rubber bushing: use the set up shown, with the noted special tools, or equivalent, to remove the **outer sleeve** of the hydraulic bonded rubber bushing.

1 - VAS 6178 hydraulic foot pump
2 - VAS 6180/1 assembly tool
3 - VAS 6180/4 (long) adapter
4 - VAS 6180/5 adapter
5 - VAS 6180/8 yoke
6 - VAG 1383 A jack with VAG 1359/2 adapter

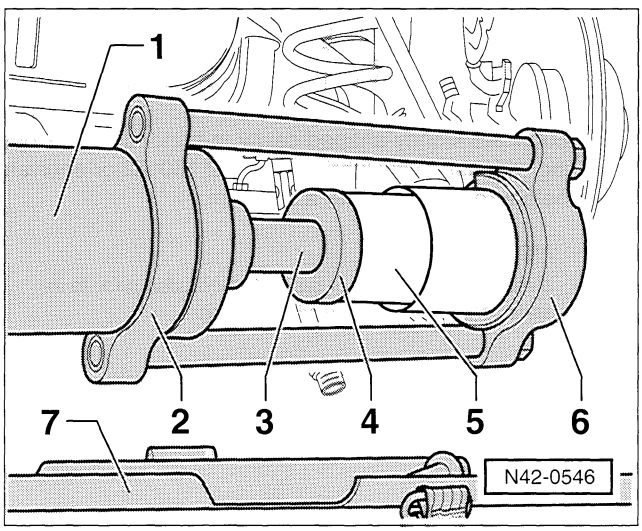
NOTE —

- *The "TOP" marking of VAS 6180/2 must point towards the axle beam arm.*

continued for all vehicles



Install new bonded rubber bushing into axle beam arm with index mark (**1**) on bushing aligned to edge (**arrow**) on axle beam arm (**2**).

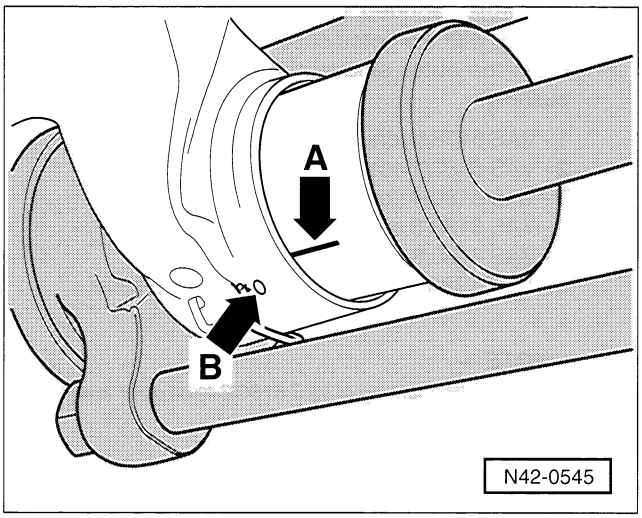


Use the set up shown, with the noted special tools, or equivalent, to install the bonded rubber bushing into the axle beam arm.

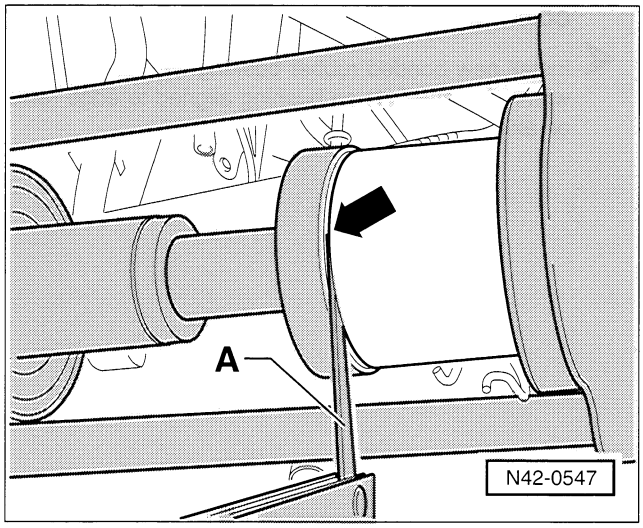
1 - VAS 6178 hydraulic foot pump
2 - VAS 6180/1 assembly tool
3 - VAS 6180/6 adapter
4 - VAS 6180/7 adapter
5 - Bonded rubber bushing
6 - VAS 6180/8 adapter
7 - VAG 1383 A jack with VAG 1359/2 adapter

NOTE —

- *The "TOP" marking of VAS 6180/2 must point towards the axle beam arm.*

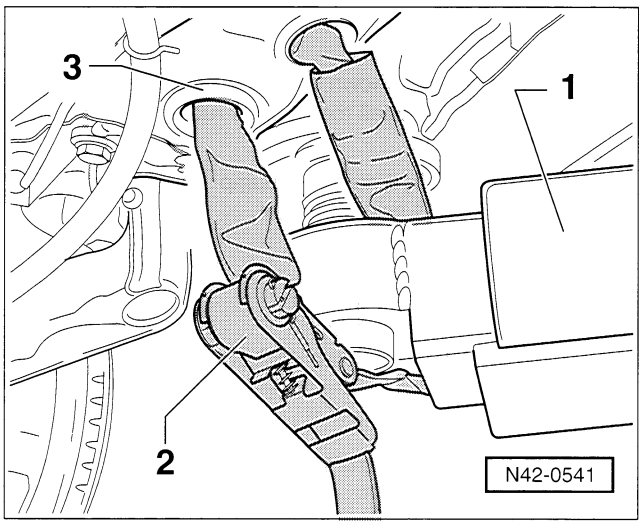


➢ Once the above press set up is in place, but before actually beginning any press operations, ensure that index mark (**arrow A**) on bushing aligns with edge of axle beam arm (**arrow B**).



➢ Press bushing into the axle beam arm until a gap of 0.20 mm (0.008 in.) exists between press tool and axle beam arm (bushing is **NOT** pressed in so far that bushing is flush with axle beam arm).

WARNING —
Vehicle MUST be secured to lift or hoist on both sides according to the following procedure before BEFORE pushing rear axle beam into position with VAG 1383 A jack or equivalent. Failure to secure the vehicle to the lift can cause the vehicle to fall off (nose dive) when the jack pushes against the tension of the rear springs!



➢ Remove plugs from access holes (**3**) and secure vehicle to the lift on both sides as shown.

1 - Support arm of lift or hoist.
2 - Tensioning (securing) strap T10038.
3 - Access holes in body (sealing plugs removed).

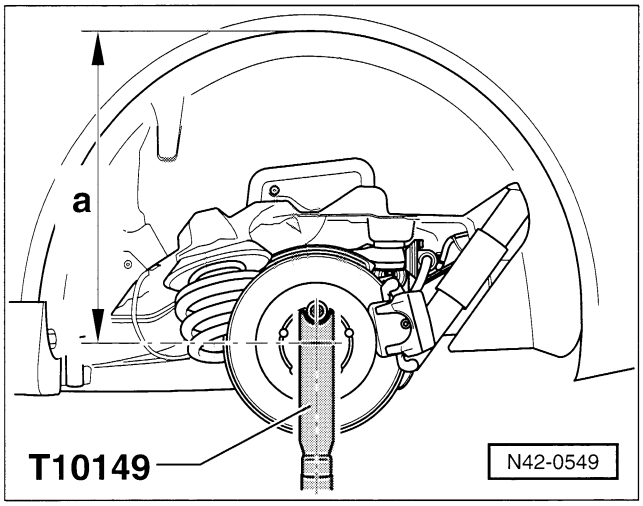
– Lubricate kidney-shaped cavity in bonded rubber bushing with assembly lubricant G 052 150 A2 or equivalent before re-installing rear axle beam.

NOTE —
If rear axle beam is not properly lubricated prior to installation, it will be noisy when driving.

– Tighten axle beam into rear axle beam mounting bracket only when installed in the same position (dimension **a**) as measured before dis-assembly.

> ***CAUTION —***
> *Failure to return rear suspension to original position before tightening bolt will result in bushing pre-load which will shorten service life and may result in noise.*

– Turn rear wheel hub until one of the wheel bolt holes in the hub is up. Install T10149 in that hole in the hub with one of the wheel (lug) bolts.



➤ Push up on tool T10149 with VAG 1383 A jack until original position is obtained (dimension **a**). Immediately install new through bolt and torque to specification.

> ***CAUTION —***
> • *Axle beam and vehicle will be under spring tension! Do not lift or release vehicle when engine/transmission jack VAG 1383 A is in place under vehicle.*
>
> • *Do not leave vehicle supported in this manner any longer than is required to complete the installation and torquing of through bolts.*

Tightening torque

- Axle beam to rear mounting bracket through bolt and nut (always replace) . . . . . 80 Nm (59 ft-lb)

– Repeat procedure for other side observing all **Cautions** and **Warnings**.

– Remaining installation is the reverse of removal.

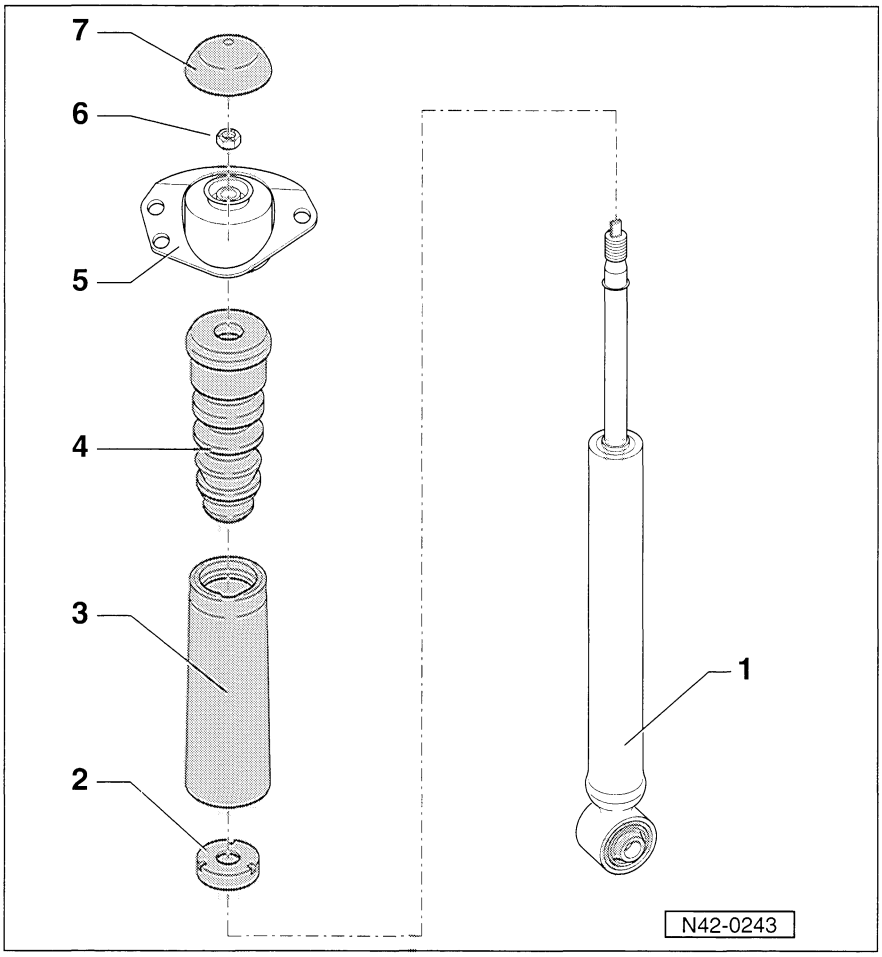
– Bleed brake system.

REAR SHOCK ABSORBERS

The rear shock absorbers on the A4 Golf and Jetta primarily differ from previous Golf and Jetta versions in the area of spring placement. Earlier Golfs and Jettas use a coil spring and shock combination in a strut arrangement. The Golfs and Jettas covered in this manual use a separate shock and coil spring configuration.

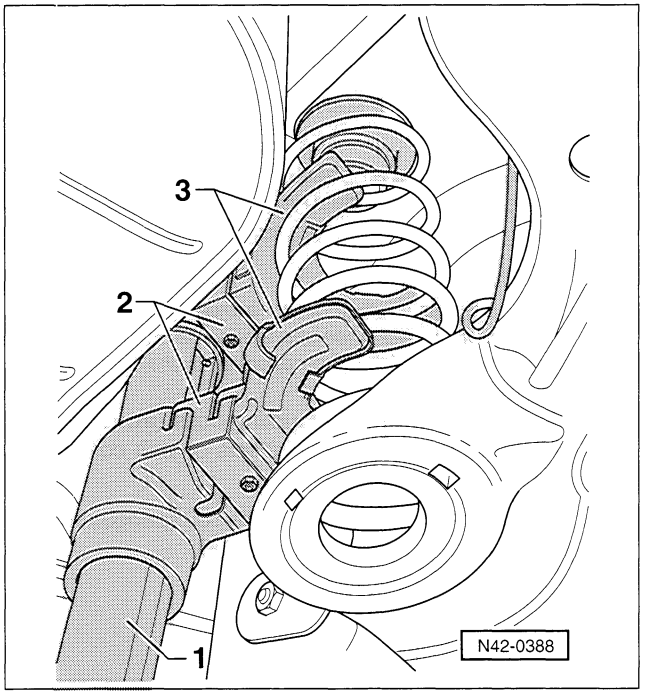
Factory installed rear shocks use pressurized nitrogen gas to minimize hydraulic oil foaming under heavy duty dampening conditioning. Always replace with shock absorbers of comparable type.

Rear shock absorber assembly



1. **Gas-filled shock absorber**
   - Can be replaced individually.
   - Slight traces of oil do not necessitate replacement.
   - Observe proper disposal methods for oil-filled components.
   - Functional check: Press shock absorber together by hand. Resistance should be felt. Piston rod must move over it's full range of travel smoothly and with even force. Shock absorber is OK if piston rod returns the extended position. Shock absorber is also OK if piston rod does not extend, provided that there is no evidence of oil loss.
   - Volkswagen recommends rear coil spring removal when replacing rear shocks. See **Rear coil springs, removing and installing**.
   - See **Rear shock absorbers, removing and installing**.
2. **Protective cap**
3. **Protective tube**
4. **Bump stop (buffer)**
5. **Upper shock absorber mount**
6. **Nut, self-locking hex**
   - Always replace
   - Tighten to 25 Nm (18 ft-lb)
7. **Upper cover**

* **Upper shock absorber mount securing bolts (not shown)**
   - Always replace
   - Tighten to 30 Nm (22 ft-lb) +¼ turn (90°) with weight of one person in vehicle!



Rear coil springs, removing and installing

– Remove rear wheel assembly.

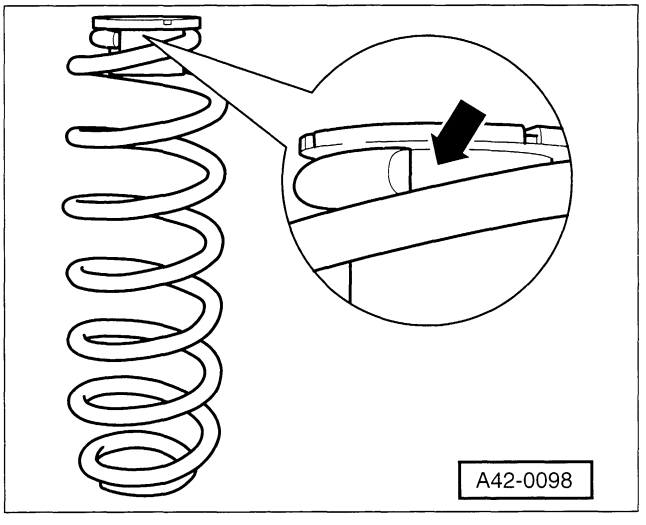
– Raise vehicle.

➤ Using the set up shown (or equivalent), insert spring compressor (**1**) and compress spring sufficiently to allow removal.

1 - VAG 1752/1 strut spring tool
2 - VAG 1752/9 adapter
3 - VAG 1752/3 adapter

– Remove coil spring, lower zinc spacer, and upper spring seat.

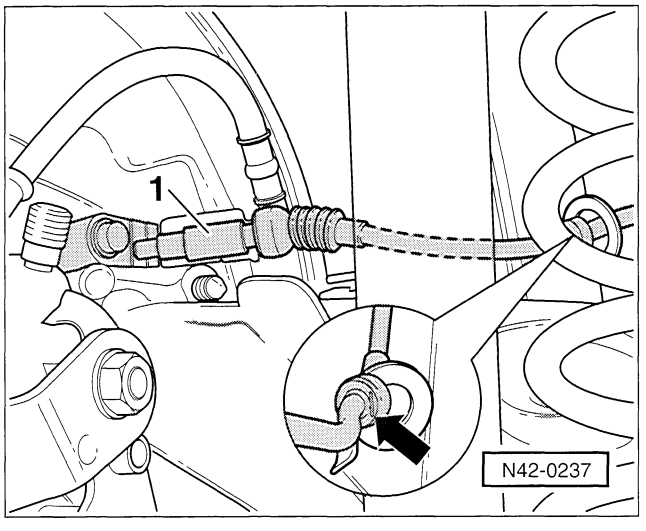
– Before installing coil spring, inspect lower zinc spacer bushing for damage and replace as needed.



➤ Install spring together with upper spring seat using spring compressor. Observe installed position; end of spring (**arrow**) must be positioned against stop on upper spring seat.

– If a spring compressor is not available, use alternate method of removal.

– Disconnect harness connector for ABS wheel speed sensor.



➤ Unclip wheel speed sensor (**1**) and wiring from retainer (**arrow**).

– Raise vehicle slightly with a lift or floor jack, but leave vehicle resting on its wheels.

– Remove upper shock mounting bolts.

– Raise vehicle further to relieve coil spring pressure.

– Remove coil spring, lower zinc spacer, and upper spring seat.

– Before installing coil spring, inspect lower zinc spacer bushing for damage and replace as needed.

– Installation is the reverse of removal.

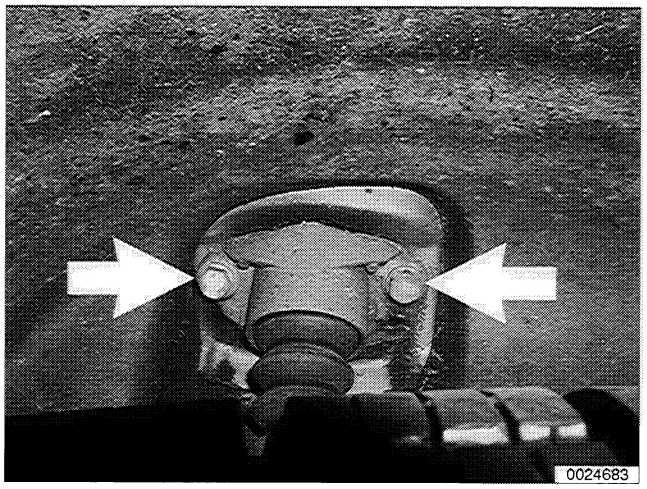
Rear shock absorbers, removing and installing

– Prepare vehicle for shock absorber removal in one of the following ways:

- Remove spring as previously described.
- Raise vehicle slightly with a lift or floor jack, but leave weight of vehicle on the wheels.

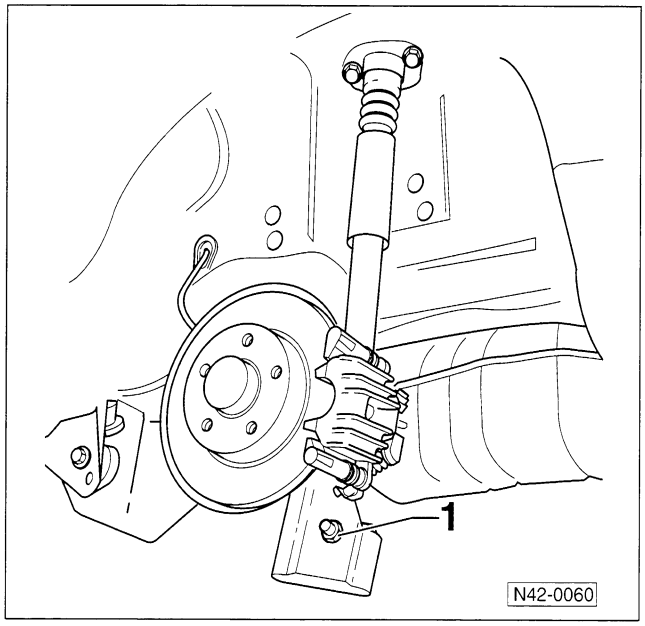
NOTE —

Rear suspension must not be allowed to extend fully. Spring will fall out when shock absorber is unbolted if some vehicle weight is not supported by the rear wheel.



➢ Remove upper shock mounting bolts (**arrows**) with the vehicle still resting on its wheels or with coil spring removed.

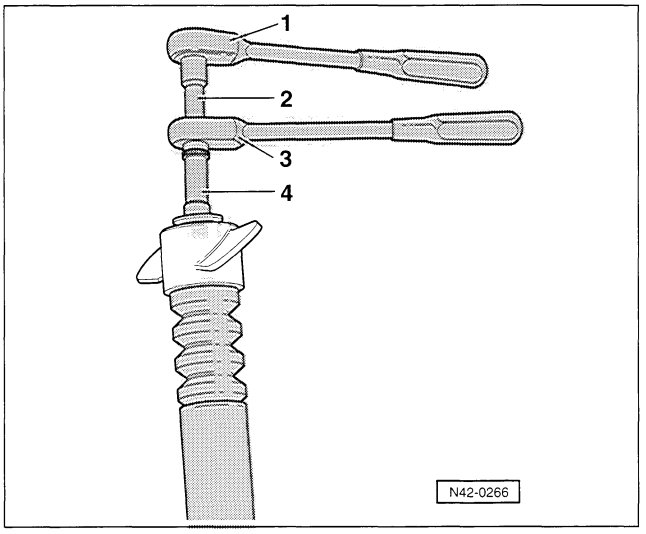
- Raise vehicle slightly to relieve coil spring pressure if coil spring has not been removed.



➢ Remove lower shock absorber bolt (**1**) on rear axle.

- Wheel can remain installed on vehicle in both situations.
- If the weight of the vehicle remains on the wheels, the shock can be removed without disturbing the coil spring.

– Remove rear shock absorber.



➤ Remove upper shock mount using Volkswagen special tools or equivalent:

1 - ½ inch drive ratchet
2 - T10001/9.
3 - T10001/11
4 - T10001/1

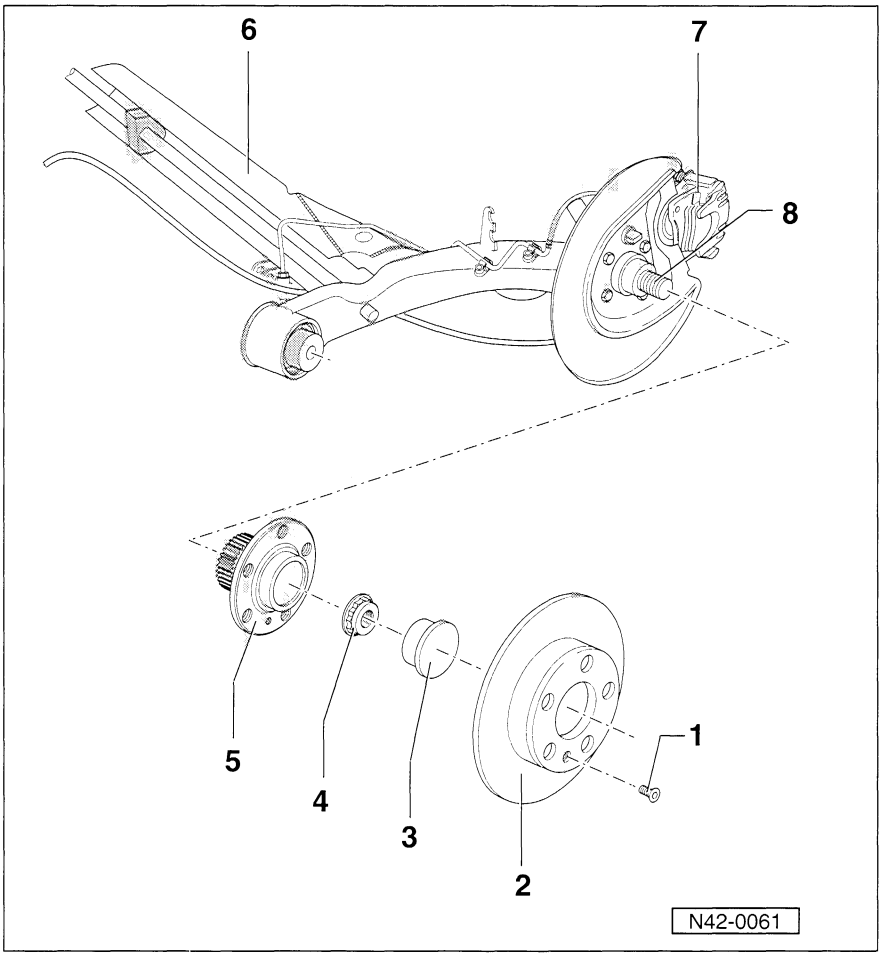
NOTE —
A set up using special tool 3079 is also suitable.

Tightening torque

- Upper shock self locking hex nut always replace . . . . . 25 Nm (18 ft-lb)
- Upper shock bolt, always tighten with weight of one person in vehicle! always replace . . . . . 30 Nm (22 ft-lb) +¼ turn (90°)
- Lower shock bolt and nut always replace . . . . . 40 Nm (30 ft-lb) +¼ turn (90°)

REAR WHEEL BEARINGS

Inner and outer rear wheel bearings along with the hub and ABS speed sensor rotor are combined into a single integrated assembly. This assembly must be replaced as a complete unit as there are no individually serviceable components.

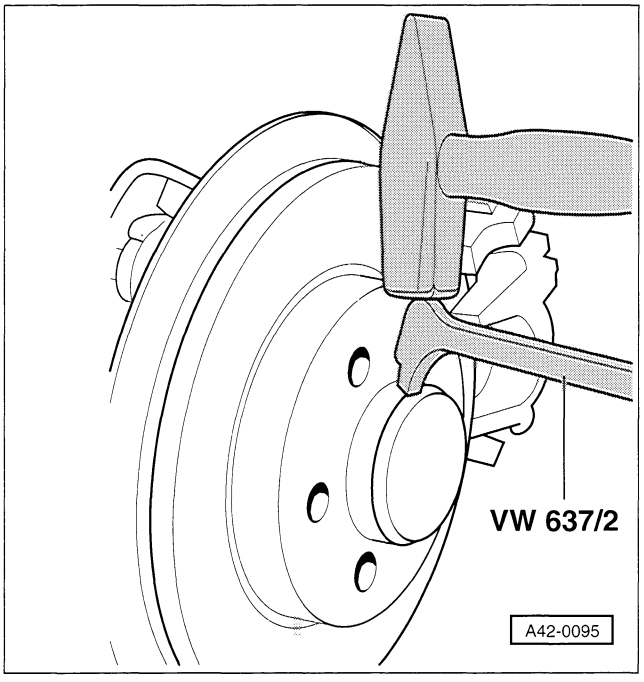


Rear wheel bearing/hub unit/stub axle, assembly

1. **Screw, philips head**
   - Locates brake rotor on hub.
   - Tighten to 4 Nm (35 in-lb)
2. **Brake disc (rotor)**
3. **Dust cap**
   - Always replace
   - Proper function and long service life can only be ensured by the perfect seal of a new dust cap
4. **Nut, self-locking 12-point**
   - Always replace
   - Tighten to 175 Nm (129 ft-lb)
5. **Wheel hub unit with bearings and ABS wheel speed sensor rotor**
   - Wheel bearing, wheel hub and wheel speed sensor rotor are integral components.
   - Wheel bearing/hub unit is maintenance and adjustment free.
6. **Axle beam**
   - Stub axle contact surfaces and threaded holes must be free of paint and dirt.
7. **Rear brake caliper**
8. **Stub axle**
   - Do not attempt to straighten.
   - Do not attempt to re-cut threads.

* **Bolt, hex (not shown)**
   - Stub axle to axle beam
   - Always replace
   - Tighten to 60 Nm (44 ft-lb)

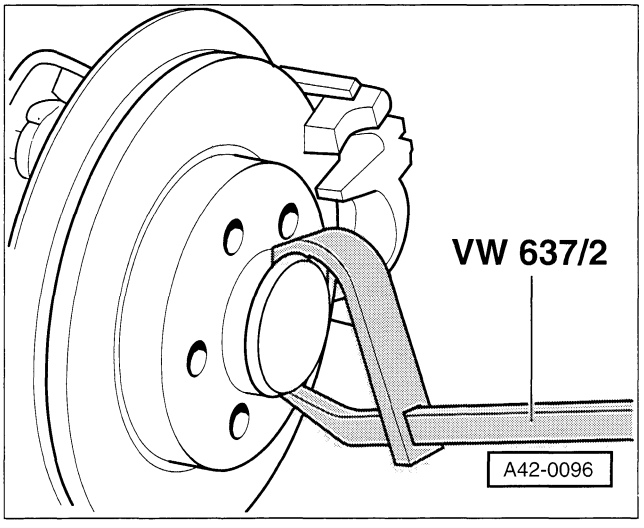
Rear wheel bearing/hub unit/stub axle, removing and installing



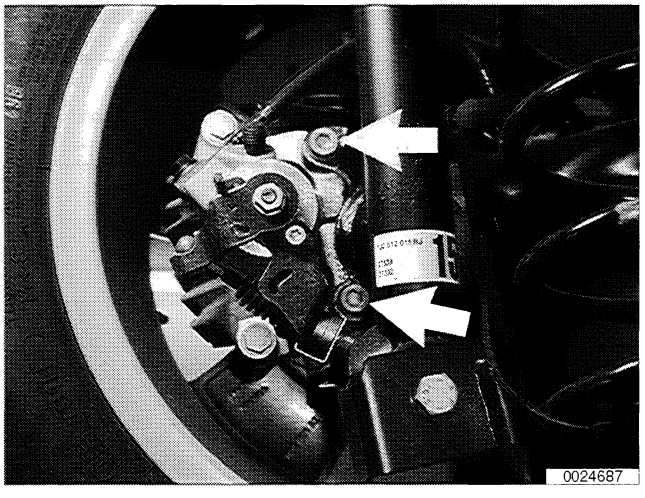
– Lift vehicle and place vehicle securely on jack stands (if not using vehicle hoist).

– Remove wheel assembly.

➢ Loosen rear hub dust cap from seat on rotor.



➢ Remove dust cap by working it with VW 637/2 or equivalent.



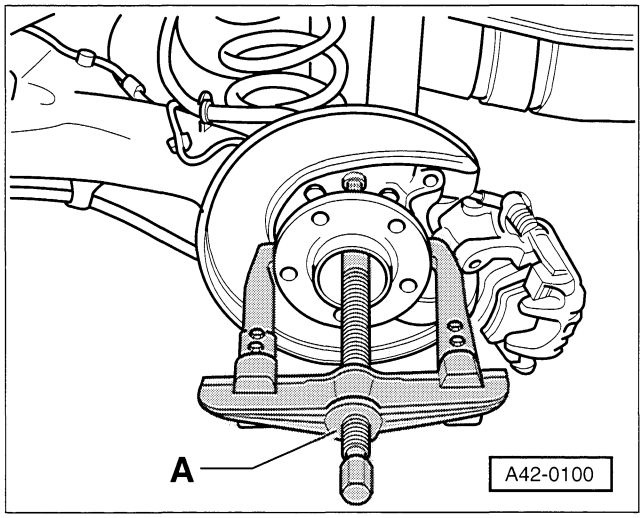
➢ Remove caliper securing bolts (**arrows**).

– Remove rear brake caliper and tie up on body with wire.

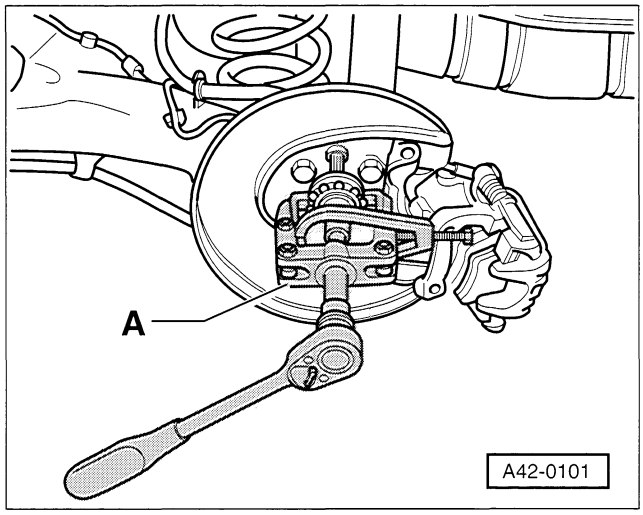
> ***CAUTION —***
> *Do not allow the caliper to hang by the brake hose. The unsupported weight can stretch and damage the hose.*

– Remove locating screw from brake disc (rotor) and remove brake disc.

– Remove 12-point nut at center of hub assembly.



➤ Using a puller such as Kukko 20/2 (**A**) or equivalent, remove bearing/hub unit.



➤ Pulling the bearing/hub unit may leave the inner wheel bearing on the stub axle. Using a puller such as Kukko 204-2 (**A**) or equivalent, carefully remove the inner wheel bearing. Puller should have a leg clamp to prevent spreading of legs/jaws during bearing removal.

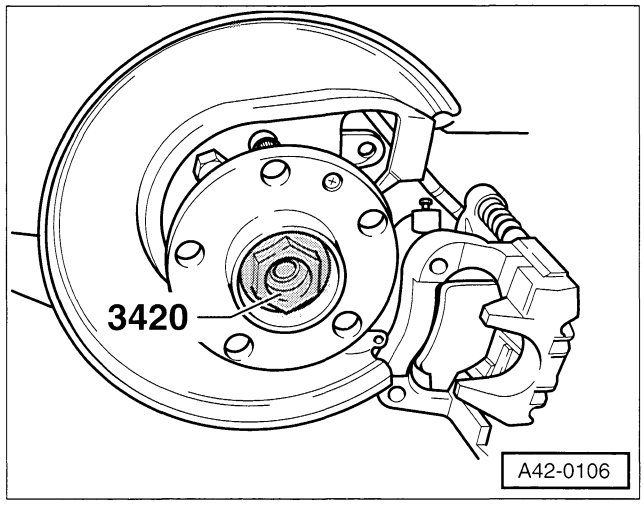
– Unbolt stub axle and splash shield as required.

– If installing a new stub axle, completely remove protective coatings from all surfaces.

– Install stub axle to axle beam with new bolts.

Tightening torque

- Stub axle bolts to axle beam always replace . . . . . 60 Nm (44 ft-lb)

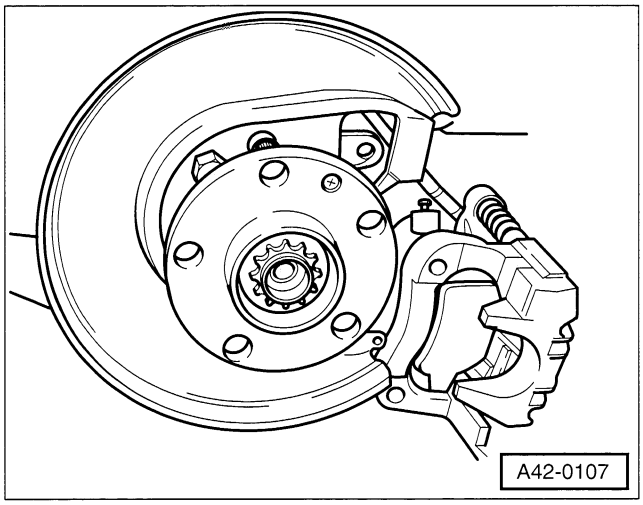


– Place inner wheel bearing squarely onto hub and install wheel bearing/hub unit as far as possible onto stub axle.

➤ Attach assembly tool 3420 as shown and pull wheel bearing/hub unit squarely all the way onto stub axle.

CAUTION —
Do not allow the bearing/hub assembly to become cocked during installation.

– Remove assembly tool 3420.

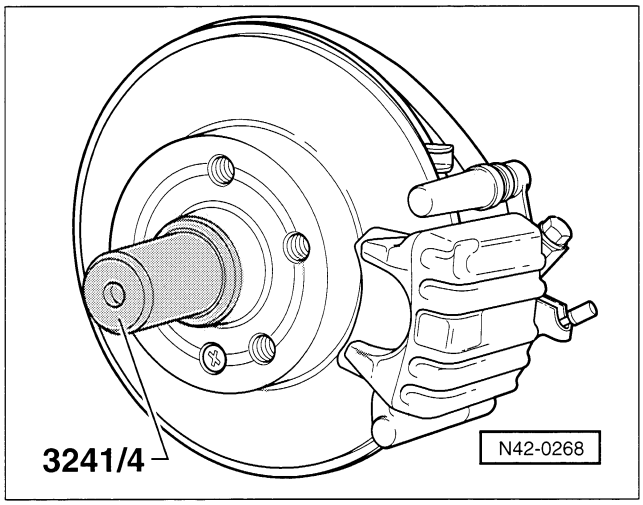


➤ Install a new self-locking 12-point nut and torque to specification.

Tightening torque

- Stub axle nut, self-locking, shouldered always replace . . . . . 175 Nm (129 ft-lb)
- Screw, brake rotor (M6) . . . . . 4 Nm (35 in-lb)
- Bolt, brake caliper . . . . . 65 Nm (48 ft-lb)
- Wheel bolt to wheel hub. . . . . 120 Nm (87 ft-lb)

– Install brake disc (rotor) and caliper.



➤ Install new dust cap using special tool 3241/4 or equivalent.

NOTE —
Use care when installing new dust cap as dented and damaged dust caps allow moisture contamination that shortens bearing life.

– Install and torque wheel assembly.

QUALITY REVIEW

When you have finished working under the vehicle and around other areas, it is advisable to take a moment to quality check or review your work. This helps to insure that the operation or repair has been completed properly with all affected systems functioning within normal parameters. These may include the following:

- If brake calipers have been disturbed or removed, pump brake pedal several times before moving vehicle to insure correct positioning of pistons and pads.
- Ensure that all cable ties and clamps that were removed as part of the repair are replaced.
- Ensure that all fasteners and hardware were replaced and torqued as specified.
- Make sure that all other components involved in the repair are positioned correctly, properly torqued and function properly.
- Make sure that all tools, shop cloths, fender covers and protective tapes are removed before closing the hood.
- Clean grease and fingerprints from painted surfaces, steering wheel and shifter.

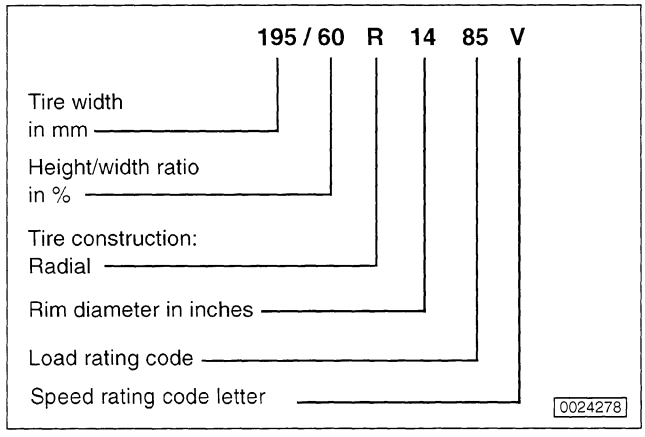
44 Wheels–Tires, Wheel Alignment

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WHEEL ALIGNMENT 44-3
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GENERAL

This repair group covers basic tire, wheel, and wheel alignment information. Also covered here is wheel alignment specifications to be used in conjunction with professional alignment tools and measuring equipment.

Wheels and tires

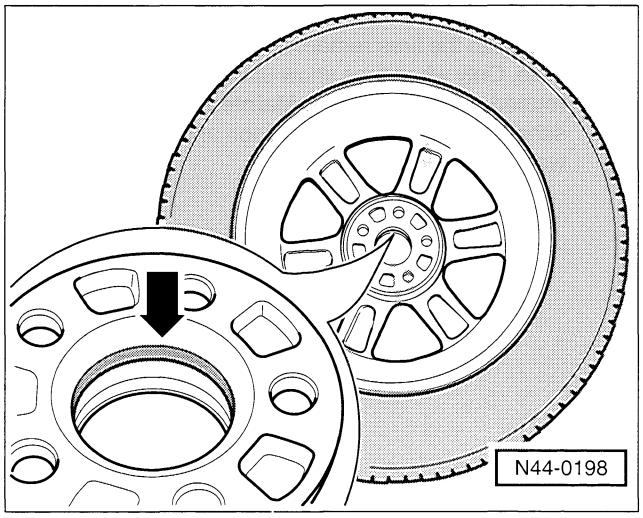
Wheels and tires approved by the manufacturer have been matched to the vehicle and contribute largely to road handling and driving characteristics. To retain the handling characteristics, it is recommended that the tires be replaced only with tires having the same specifications with regard to size, design, load carrying capacity, speed rating, tread pattern, tread depth, etc. This information can be found on the tire's sidewall. Various tire and wheel applications can be found in **Table a**.

Volkswagen recommends that the tires be rotated front to rear, with the tires remaining on the same side of the vehicle. Only when tires show unusual wear should they be rotated diagonally. See **0 Maintenance** for maintenance schedules regarding tire rotation and additional tire sidewall information.

Table a. Wheel and Tire applications

Wheel package	Tire size	Wheel size	Offset (mm)	Track width (mm)	Snow chains permissible
Standard	195/65 R 15 91 H	6 J x 15 steel	38	1516 front 1494 rear	Yes
Optional (I)	195/65 R 15 91 H	6 J x 15 alloy	38	1516 front 1494 rear	No
Optional (II)	for winter tires	5½J x 16 alloy	36	1520 front 1498 rear	n/a
Optional (III)	205/55 R 16 91 H	6½ J x 16 alloy	42	1508 front 1486 rear	No
Optional (IV)	225/45 R 17 90/91 H	7 J x 17 alloy	38	n/a	No
Optional (V)	225/40 R 18 90/91 Z	7½ J x 18 alloy	38	n/a	No
Spare, full size (equip most vehicles with alloy wheels)	205/55 R 16 91 H	6½ J x 16 steel	42	n/a	No





Wheel bolts should be snugged down in the standard diagonal pattern as shown and then tightened to the final torque with the same pattern.

NOTE —
Wheel shown has trim covers on wheel bolts which must be removed to allow access to bolts.

Tightening torque

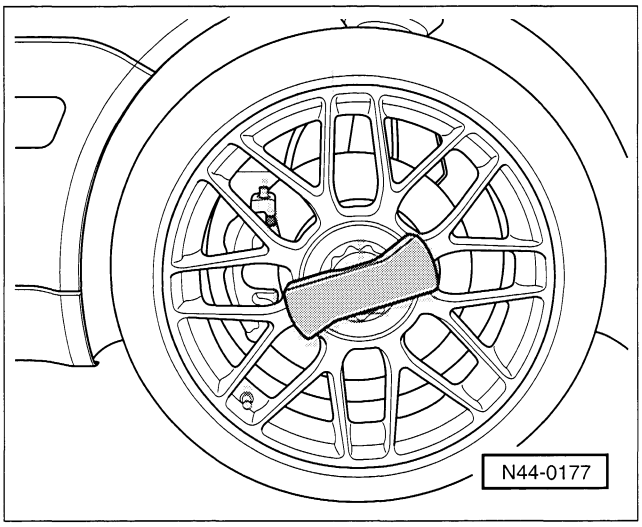
- Wheel bolt to hub (all) (diagonally and evenly) . . . . . 120 Nm (89 ft-lb)

Wheel seat protection

When changing a steel wheel or a light alloy wheel, the centering (hubcentric) seat should be protected against corrosion. Failure to protect the wheel in the noted area will allow rust and/or corrosion to form which will make it difficult to remove the wheel at a later time.

Apply protection wax to center area (**arrow**). Factory recommended spray wax **D 322 000 A2** or equivalent should only be applied after noted area has been cleaned with a wire brush.

WARNING —
Only apply protection wax to center seat area of wheel. Avoid getting wax on mounting surfaces of wheel and brake rotor, brake pad contact surfaces of brake rotor, and threaded surfaces. Protection wax on brake pad contact surfaces can result in poor brake performance. Protection wax on threads will affect torque values.

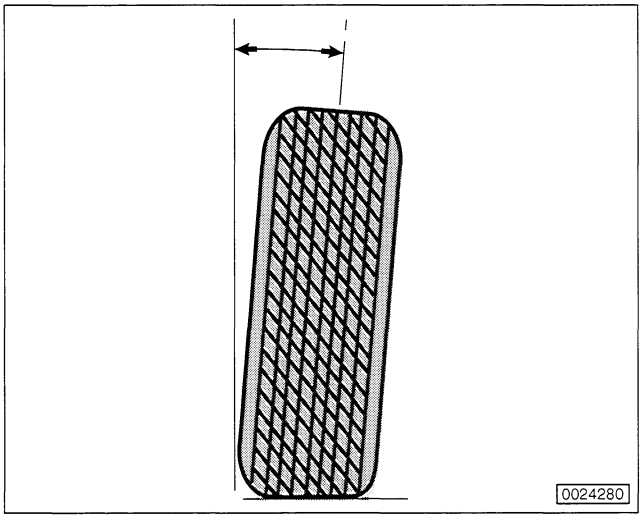


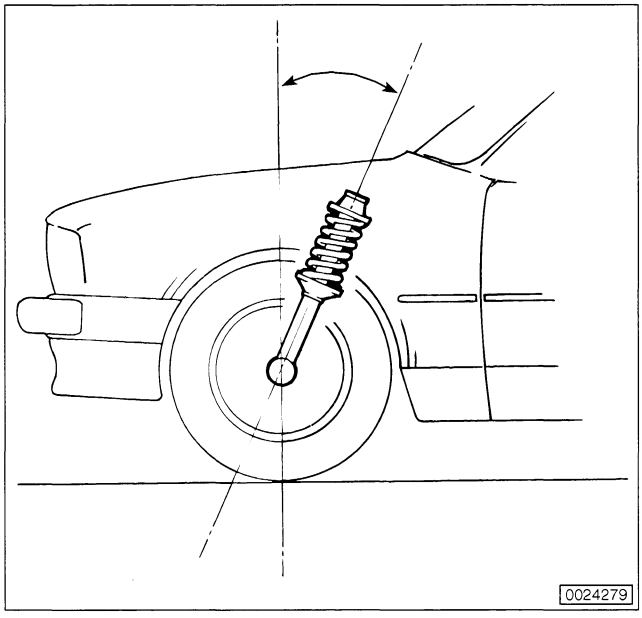
Alloy wheel trim, removing and installing (GTI)

Alloy wheels installed on some GTI models have a special center trim piece. You can remove and install the trim with the assembly tool provided in the vehicle tool kit.

NOTE —

- *Do not use other assembly tools! Otherwise the wheel trim or alloy wheel can be damaged.*
- *The assembly tool is also available as a replacement part (part no. 4B0 012 219 B).*





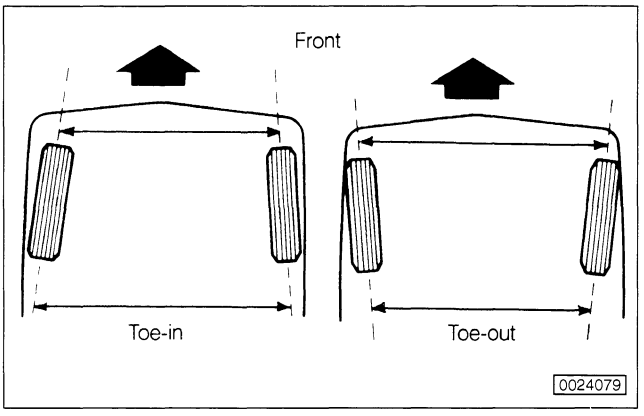
WHEEL ALIGNMENT

Tire pressures, tire wear, and wheel alignment will all influence how the car feels and responds on the road. For stability and control, all four wheels and tires must be in good condition, balanced, and be properly aligned. Precise wheel alignment can only be accomplished when the tires, the suspension, and the steering are in good condition. Reputable wheel alignment technicians will always inspect the front and rear suspension and the steering for worn parts before an alignment, and will recommend that any necessary repairs be made before proceeding. The important front wheel alignment angles are camber, caster, and toe. In the rear, the important angles are camber, toe and thrust line. Although rear alignment angles are not generally adjustable, they should be checked because of the effect that they have on rear tire wear and straight-line stability of the vehicle.

Camber is the angle that the wheels tilt from vertical when viewed from front or rear. Wheels which tilt out at the top have positive (+) camber. Wheels that tilt in at the top have negative (–) camber. On the Volkswagens covered by this manual, individual wheel camber is non-adjustable. However, total camber is adjustable and equalizations are made by moving the front subframe slightly from side to side.

Camber influences cornering, directional stability, and tire wear. Different camber on the two front wheels may cause the car to pull to one side. Incorrectly adjusted camber will cause uneven tire wear.

Caster is the angle at which the steering axis deviates from vertical. Most cars are designed with positive caster, which improves directional stability and tends to make the steering more self-centering. Caster angle should be checked as part of wheel alignment, but it is not adjustable on vehicles covered by this manual.



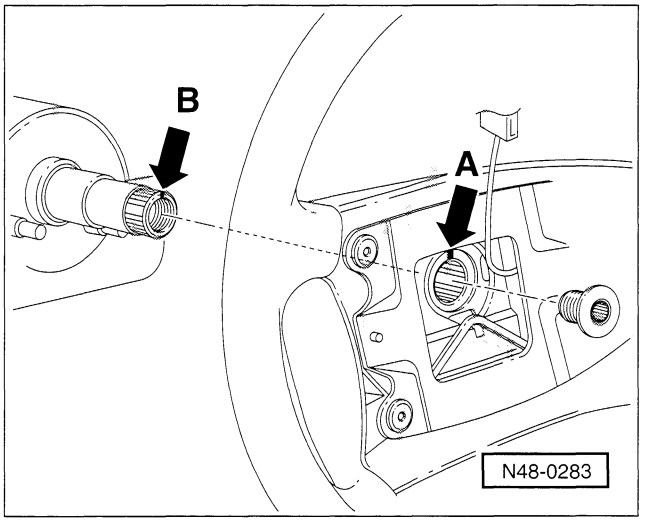
Toe is a measurement of the amount that two wheels on the same axle point toward each other (toe-in) or away from each other (toe-out). Toe affects directional stability and tire wear. Toe also affects response to steering input. Too much toe will cause tires to "scrub" and to wear unevenly and quickly. Too little toe may cause the car to be less stable and wander at highway speeds.

Wheel alignment, checking

Accurate wheel alignment will best be obtained by having your Volkswagen dealer or a certified alignment shop perform the procedure. Following are a list of required conditions and alignment specifications.

CAUTION —

- *It is recommended that both the front and rear axles are measured (thrust angle) when carrying out alignment measurements.*
- *If the installation position of the rear axle (which affects the direction of travel of the vehicle) is not taken into account the steering wheel may not be centered.*



Before evaluating alignment, be sure that marks on steering wheel (**A**) and steering column (**B**) are aligned.

NOTE —

Steering columns supplied as a replacement parts do not have a center punch mark. These spare parts steering columns must be marked in the same manner after determining the center position.

WARNING —

- *Do not remove air bag without reviewing cautions and warnings in **69 Seatbelts, Airbags**.*
- *To remove steering wheel and airbag, see **48 Steering**.*
- *If the vehicle is equipped with Electronic Stabilization Program (ESP), and the steering wheel has been repositioned, the basic setting of the steering angle sensor G85 must be checked with a scan tool.*

Tightening torque

- Steering wheel bolt to steering column . . . . . 50 Nm (37 ft-lb)

Wheel alignment should be checked whenever the vehicle is not tracking properly, if there is tire wear on one side, uneven tire wear, or if there has been damage from an accident. An alignment should also be performed when the following suspension components have been replaced:

- Front lower control arm
- Front wheel bearing housing
- Front tie rod or tie rod end
- Steering gear
- Sub-frame
- Front shock absorber
- Rear axle assembly
- Rear sub-assemblies
- Rear lower or upper control arm
- Rear trailing arm

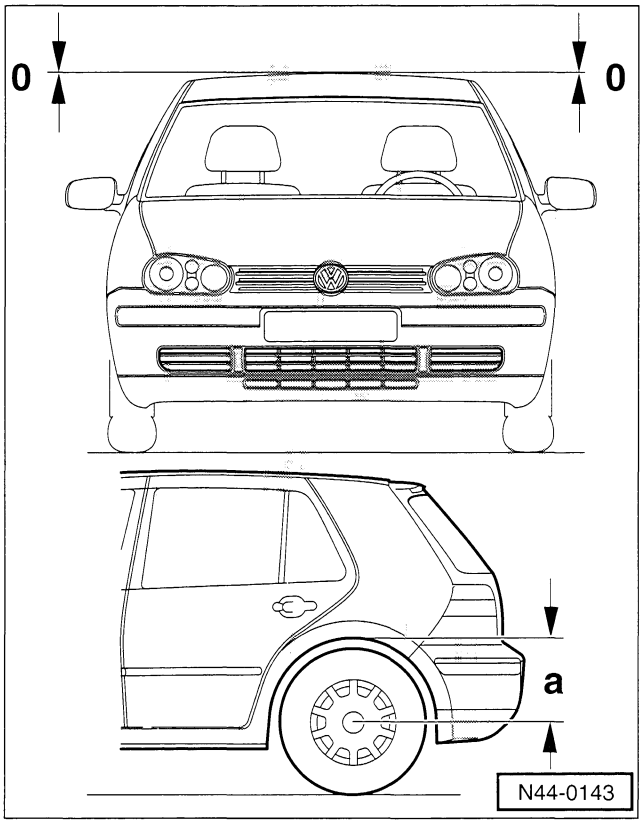
It is not generally necessary to do an alignment when the rear shocks or coil springs are replaced.

Alignment requirements

- Vehicle at curb weight
- Fuel tank full
- Spare wheel and vehicle tools are stored at correct locations
- Fluid reservoir for windshield/headlight washer system full
- Equal tread depth for both tires on each axle, with difference between two not more than 2 mm (0.079 in.)
- Tires inflated to correct pressure
- Test equipment must be properly adjusted and attached to vehicle. Observe all instructions, cautions and warnings of the test equipment manual.
- Vehicle accurately positioned, suspension bounced and rocked several times
- Suspension, steering and steering linkage in proper condition; without excessive play or damage
- Do not check alignment before vehicle has been driven 600 to 1,200 miles (1,000 to 2,000 km) so as to allow coil springs to settle

NOTE —

The vehicle alignment should not be checked before the vehicle has completed 1000-2000 km (600-1200 miles) so that the coil springs can have a chance to settle.



Before performing a vehicle alignment, the vehicle must sit level (line **0**). Vehicle level can also be checked by measuring dimension **a** on each side. It is normal for a vehicle so sit slightly higher on one side depending on installed equipment. Side to side differences must be corrected through the use of temporarily ballast prior to aligning.

Wheel alignment specifications

Wheel alignment specifications depend on suspension type. Suspension type can be obtained from the vehicle data sticker spare wheel recess or in the glovebox owner's manual.

Table b. Wheel Alignment Data—Front Suspension

Suspension (version)	**Base**	**Sport**	**Sport**	**Heavy duty**
PR number (from vehicle data label)	**1GA,1GC,1GE, 1GG,1GJ,1GU, G08, G09, G11 G27, G28, G29, G34, G36, G37, G38, G41, G44, G45, G46, G47, G48, G49, G52, G53, G76, G77, G80, G81, G82, G83**	**1GD, 1GV, 1GT, G16, G72, G73, G75, G84, G86, G87, G88**	**G70 (180 HP 1.8T)**	**1GB, 1GW, G10, G39, G48**
Total toe (wheels not pressed)	0° ± 10'			
Camber [1] (in straight-ahead position)	–30' ± 30'	–33' ± 30'	–35' ± 30'	–16' ± 30'
Maximum permissible difference between left and right	max. 30'			
Toe angle difference at 20° lock from left to right	1° 30' ± 20'	1° 31' ± 20'	1° 32' ± 20'	1° 27' ± 20'
Caster (not adjustable)	+7° 40' ± 30'	+7° 50' ± 30'	+8° ± 30'	+7° 15' ± 30'
Maximum permissible difference between left and right	30'			

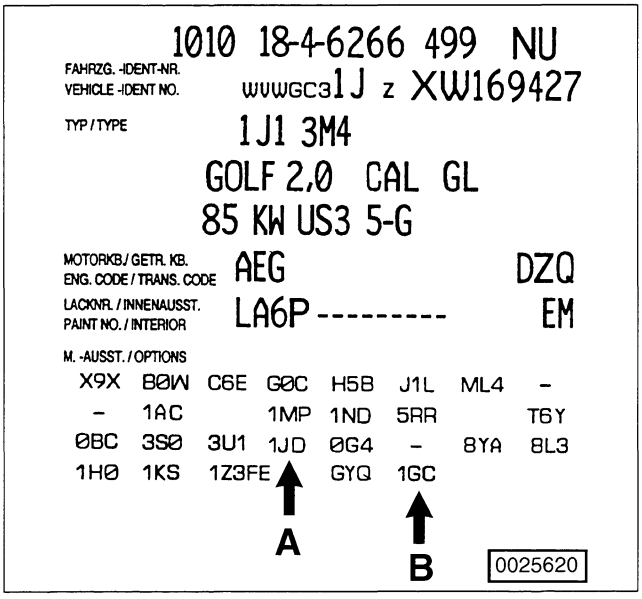
[1] Individual camber adjustments are not possible. Corrections to equalize are possible by shifting the subframe slightly side to side. Adjustment range is approx. 10′ to 15′.

Table c. Wheel Alignment Data—Rear Suspension

Suspension (version)	**Base**	**Sport**	**Sport**	**Heavy duty**
PR number (from vehicle data label)	**1JY, 1JA, 1JD, 1JH**	**1JC**	**1JC (180 HP 1.8T)**	**1JG, 1JB, 1JN**
Camber	–1°27' ± 20'			
Maximum permissible difference between left and right	30'			
Total toe (with specified camber)	+20' ± 10'	+25' ± 10'	+29' ± 10'	+10', + 10' - 7"
Maximum permissible deviation from direction of travel (thrust angle)	20'			

Table d. Wheel Alignment Data—Rear Suspension, Jetta Wagon

Suspension (version)	**Base**	**Sport**	**Heavy duty**
PR number (from vehicle data label)	**1JY, 1JA, 1JD, 1JH**	**1JC**	**1JG, 1JB, 1JN**
Camber	–1°27' ± 20'		
Maximum permissible difference between left and right	30'		
Total toe (with specified camber)	+16' ± 10'	+22' ± 10'	+10', + 10' - 7"
Maximum permissible deviation from direction of travel (thrust angle)	20'		



Suspension type

Various suspension versions are available. Vehicle data label in spare wheel recess or in the glovebox owner's manual identifies the front suspension (**arrow B**) and rear suspension (**arrow A**) types.

Some model year 2001, 2002, and early production 2003 Jettas may not have suspension PR numbers on the vehicle data stickers. Reference **Table e** if suspension type identification is missing from vehicle data sticker.

Table e. Suspension type identification (Jetta 2001, 2002, 2003[1])

PR number (from vehicle data label)	Country code	Engine Type	Trim level	Suspension codes
X9A	USA	1.9L TDI	GL, GLS	G28, G29, G52, G53, G76, G77, G81, G82 (Base)
	USA	2.0 L	GL, GLS	
X9B	Canada	1.8L	GLS	
	Canada	2.8L (with 6J x 15 wheels)	GLS	
X9A	USA	1.8L	GLS, GLX	G83, G84, G86, G87 (Sport)
	USA	2.8L (with 7J x 17 alloy wheels, and 225/45 R17 tires)	GLS, GLX	

[1] Model year 2003 up to approximate build date 11/12/2002 (chassis 9M098184), automatic and manual transmissions.

TB 44-03-01

Thrust angle, calculating

Thrust angle (deviation from direction of travel) can be calculated using one of the two following examples. The result is the deviation of the actual running direction from the longitudinal center line of the vehicle.

If alignment readings for rear toe are both positive or both negative (+/+ or -/-), subtract smaller figure from larger figure to determine total toe angle, then divide by 2.

Example:

- Left rear wheel track. . . . . + 15'
- Right rear wheel track . . . . . + 5'

15' - 5' = 10'

10' ÷ 2 = 5'

- Thrust angle (deviation from direction of travel): 5'

If alignment readings for rear toe are different signs, one positive and one negative (+/-), add two figures to determine total toe angle, then divide by 2.

Example:

- Left rear wheel track. . . . . + 15'
- Right rear wheel track . . . . . - 5'

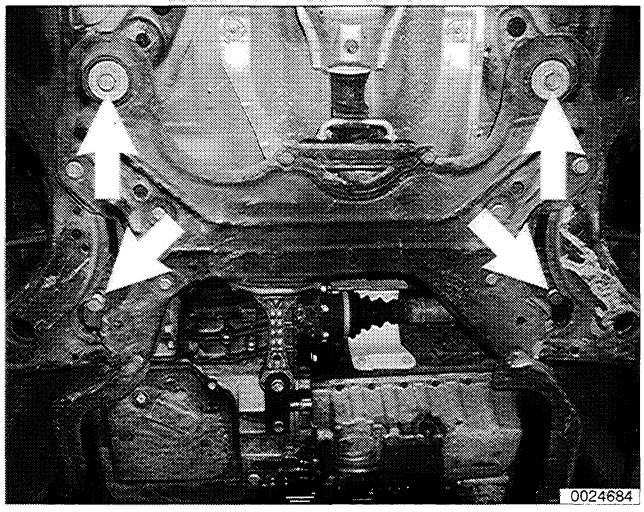
15' + 5' = 20'

10' ÷ 2 = 10'

- Thrust angle (deviation from direction of travel): 10'

Front axle camber, adjusting

Individual camber values are not adjustable. Camber can be equalized, however, by moving the subframe slightly side to side.



➤ Loosen bolts (**arrows**) and move subframe slightly.

NOTE —

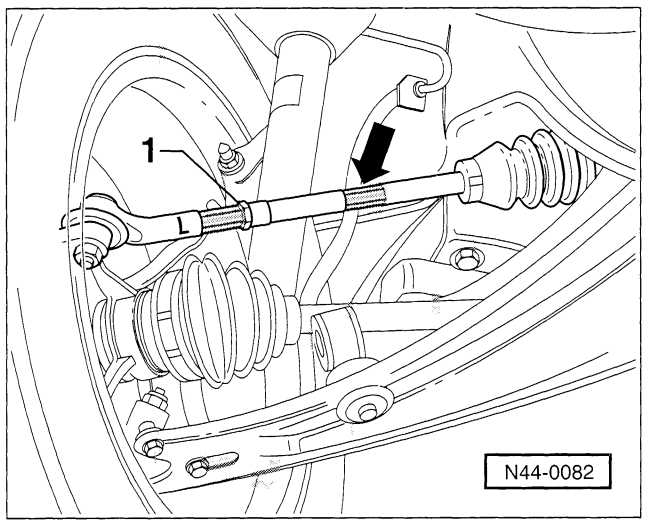
- *Caster may also change when moving subframe; when rechecking camber, be sure to recheck the caster.*
- *Always replace subframe bolts.*

Tightening torque

- Subframe to body
  always replace . . . . . 100 Nm (74 ft-lb)
  +¼ turn (90°)

Front axle toe, adjusting

Toe adjustment is by lengthening or shortening the tie rods by turning them.



Loosen lock nut (**1**). Adjust toe by turning tie rod with a wrench on the hex machined onto the tie rod (**arrow**).

NOTE —

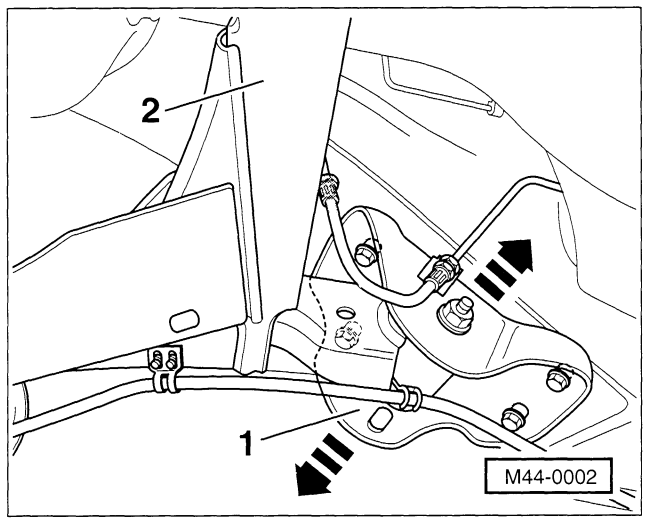
- *After turning tie rods, make sure that tie rod boots at steering rack are not twisted. Untwist to the natural position to prevent tearing and premature wear.*
- *Toe can change after tightening lock nut. Recheck and readjust if value has changed by more than 2 minutes from specification.*

Tightening torque

- Tie rod lock nut . . . . . 50 Nm (37 ft-lb)

Rear axle toe, adjusting

Individual toe values are not adjustable. Toe can, however, be equalized or balanced to a certain extent by moving the rear axle beam mounting brackets slightly.



Loosen bolts on bearing bracket (**1**) and slide bracket and axle beam (**2**) laterally (**arrows**).

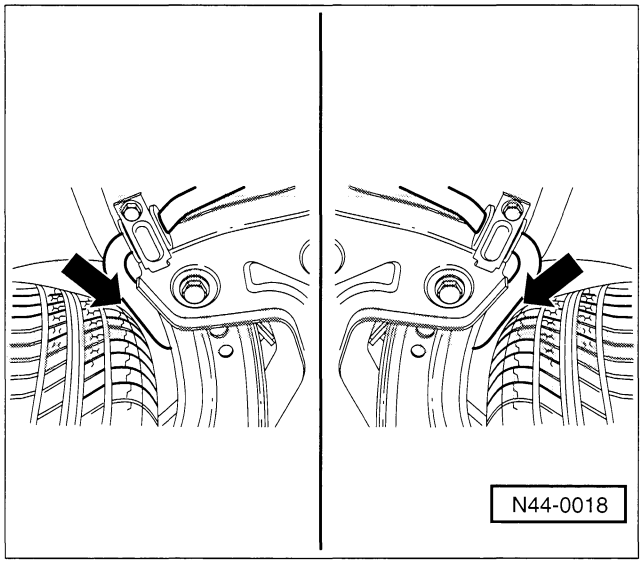
Tightening torque

- Rear axle beam mounting bracket to body always replace . . . . . 75 Nm (55 ft-lb)

Wheel lock, left and right, checking

This check is only necessary if any of the following conditions apply.

- The steering locks differ by more than 2° from one another and from the steering center point.
- One side has contact between the tire and a front axle component (usually stabilizer bar) or the body at full steering lock.
- Turning circles differ between left and right.



The distance between front axle components and tires (**arrows**) must be the same at full lock (steering turned fully to the left and right).

If the distances are not equal, correct this condition by turning one side tie rod in and the opposite side tie rod out an equal amount. It is advisable to check steering wheel and steering column center position.

45 Anti-lock Brakes (ABS)

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45

GENERAL

This repair group covers the following versions of the ITT (Teves) Mark 20 IE and Mark 60 IE electronic brake systems:

- Anti-lock Brake Systems, (ABS)
- ABS with Electronic Differential Lock (EDL)
- ABS/EDL with Automatic Slip Regulation (ASR)
- ABS/EDL/ASR with Electronic Stability Program (ESP)

These systems are found on the vehicles covered by this manual. All systems also include Electronic Brake pressure Distribution (EBD). This specially matched control module software regulates rear axle brake pressure and eliminates the need for an axle-mounted mechanical brake pressure regulator. ABS with EBD is minimum standard equipment on USA and Canadian specification Golf, GTI, and Jettas.

Brake pedal pressure for all versions is assisted pneumatically by a vacuum brake booster in these dual-diagonal systems.

The EDL system operates automatically and in conjunction with the ABS. At speeds up to 25 mph, if a difference of approx. 100 rpm is detected between the drive wheels (i.e. one drive wheel is on a slippery surface), that wheel will be braked in a controlled manner and more of the engine's power will be directed to the other wheel via the differential to achieve greater traction.

NOTE —

- *The ABS system features built-in diagnostic circuitry that detects and stores Diagnostic Trouble Code (DTC) information. When the system detects a fault, a DTC is generated and stored in the ABS control module's permanent memory. These fault codes can be accessed through the data link connector using scan tools such as the VAG 1551/1552, VAS 5051/5052 or equivalent. Scan tool computer programs can also be utilized*
- *If an ABS malfunction is stored, the ABS warning light comes on. ABS and EDL functions may be switched off depending on the nature of the fault. However, normal vacuum and hydraulic brake function is retained.*

WARNING —

- *ABS is a vehicle safety system; appropriate knowledge and special equipment are necessary to properly work on the system.*
- *The ABS system must be bled after repairs requiring opening of the brake hydraulic system. See **47 Brakes-Hydraulic System**.*
- *If you drive an ABS-equipped vehicle after a fault has been detected by the On-Board Diagnostics, keep in mind that the function of the brake system may be limited and there is a risk of accident. The brake pressure at the rear wheels is no longer controlled by the Electronic Brake Distribution (EBD) function. This can result in excessive braking at the rear, and the vehicle may skid unexpectedly under braking.*

Special precautions for ABS and ABS/EDL/ASR equipped vehicles

The ABS control module processes precise, low-level electronic signals and can be very sensitive to changes in the power supply and the environment. The following precautions apply to vehicles with ABS.

WARNING —

- *When driving or riding in an airbag-equipped vehicle, NEVER hold the scan tool or other test equipment in your hands or lap while in motion. Objects between you and the airbag increase the risk of injury in an accident.*
- *During a test drive in an air-bag equipped vehicle, test equipment must always be fastened to and operated from the rear seat by a helper.*
- *Keep brake fluid off of painted surfaces; it will remove paint.*
- *Brake fluid is poisonous!*

WARNING —

- *When working on the electrical sections of the ABS, only disconnect harness connectors with the ignition switched off.*
- *If the ABS warning light illuminates, there is a fault in the system. Determine the cause of the malfunction using the On-Board Diagnostic (OBD) program. Check the fault memory with a suitable scan tool such as Volkswagen scan tool VAG 1551/1552, VAS 5051/5052 or equivalent before disconnecting the battery. Scan tool computer programs can also be utilized.*
- *Before working on the ABS, disconnect the battery ground cable. Obtain the radio code prior to disconnecting the battery.*
- *Certain faults will only be detected and stored as DTCs at speeds greater than 20 kph (13 mph).*
- *The ABS and brake system warning lights are not capable of monitoring all brake system functions; visual inspections are still required for the system.*
- *Brake fluid must not contact any painted surfaces; it will remove paint.*
- *Brake fluid absorbs moisture from the surrounding air and must be replaced every two years. Use only new brake fluid that complies with Federal Motor Vehicle Safety Standards 116, DOT 4 Super or DOT 4 Plus.*
- *Do not use silicone-based brake fluids (DOT 5). This fluid is incompatible with the brake system and even the smallest trace can cause severe corrosion.*
- *Before doing any electric welding to the vehicle, disconnect the ABS control module.*
- *Absolute cleanliness is required when working on the ABS system. Do not use any products that contain mineral oil such as oil, grease, etc.*
- *Thoroughly clean all connections and the area immediately around them before loosening. Do not use aggressive cleaning agents such as brake cleaner, gasoline or thinners.*
- *Place removed parts on a clean surface and cover them. Only use clean plastic covering or paper. Do not use rags that may contain lint.*
- *Carefully seal or cover opened components if repairs cannot be completed immediately. Sealing plugs are contained in repair kit 1H0 698 331 A*
- *If the hydraulic system has been opened during the course of repairs, always bleed the system after completion of repairs.*
- *Upon completion of repairs, always road test the vehicle so that the ABS is felt to engage through the pulsing of the brake pedal.*

WARNING —

- *After separating the control module from the hydraulic unit, use the transportation protection for the valve dome.*
- *Only install replacement parts from original packaging. Only remove the parts from the package immediately before installation.*
- *Do not work with compressed air nearby whenever the hydraulic system is open. Do not move the vehicle with the hydraulic system open.*
- *Be very careful not to let any brake fluid enter any wiring harness connectors.*
- *Do not re-use fasteners that are worn or deformed from normal use.*

ABS COMPONENTS

Several versions of the ITT (Teves) Mark 20 IE and Mark 60 IE Anti-lock Brake Systems are available. The capabilities of these systems go beyond anti-lock braking (ABS) and include:

- **ABS/EDL** (Anti-Lock Brakes with Electronic Differential Lock).
- **ABS/EDL/ASR** (Anti-Lock Brakes with Electronic Differential Lock and Anti-Slip Regulation).
- **ABS/EDL/ASR/ESP** (Anti-Lock Brakes with Electronic Differential Lock, Anti-Slip Regulation and Electronic Stability Program)

All systems use electronic, electrical, hydraulic and mechanical components. System application depends on vehicle model year.

Table a. ABS applications

Vehicle	m.y. 1999	m.y. 2000	m.y. 2001	m.y. 2002	m.y. 2003	m.y. 2004	m.y. 2005
Jetta[2]	ITT[1] Mark 20 IE[3]	ITT Mark 20 IE[3]	ITT Mark 20 IE[3]	ITT Mark 60 IE[4]	ITT Mark 60 IE[4]	ITT Mark 60 IE[4]	ITT Mark 60 IE[4]
Golf and GTI[2]	ITT Mark 20 IE[3]	ITT Mark 20 IE[3]	ITT Mark 20 IE[3]	ITT Mark 60 IE[4]	ITT Mark 60 IE[4]	ITT Mark 60 IE[4]	ITT Mark 60 IE[4]

1 The company Alfred Teves became Teves Systems which was purchased by ITT Automotive. In 1998. The company name was changed to Continental Teves after purchase by Continental AG. Teves and ITT are used interchangeably to describe these systems and for designation purposes.

2 All vehicles also equipped with EBD (Electronic Brake pressure Distribution) used in place of the mechanical brake pressure proportioning or limiting valve at rear axle. EBD functions up to the point of ABS engagement.

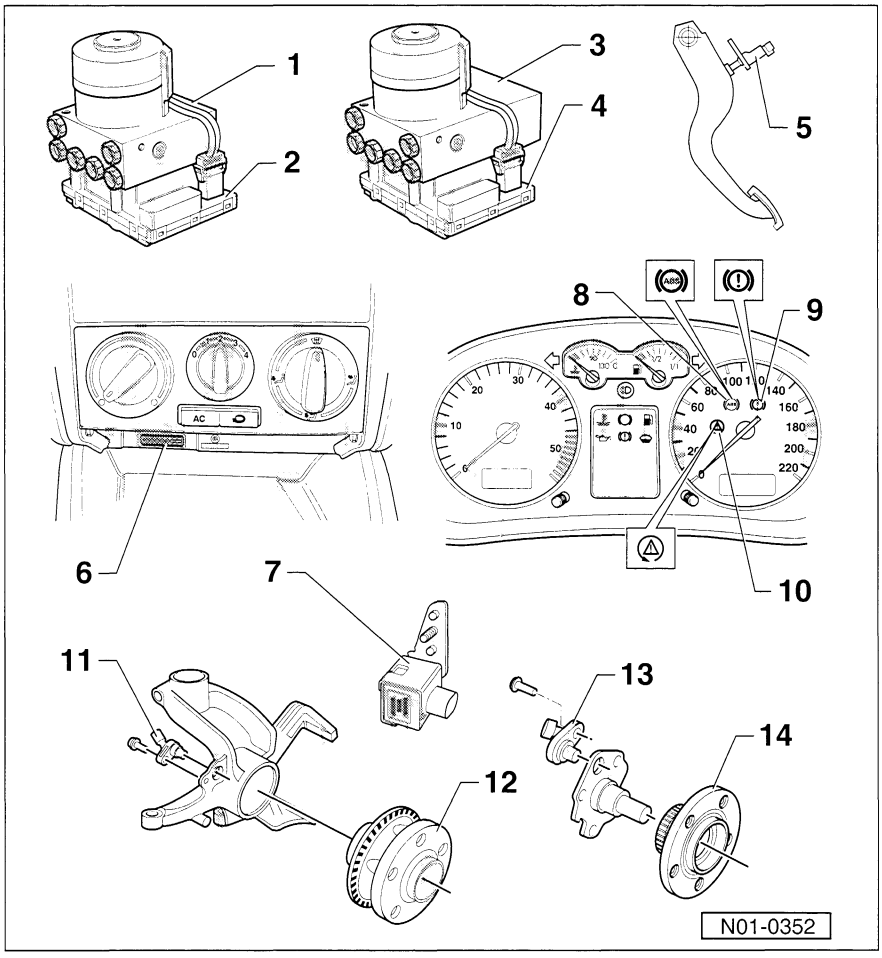
3 ITT Mark 20 IE available with optional EDL and ASR.

4 ITT Mark 60 IE available with optional EDL, ASR, and ESP.

NOTE —

*Volkswagen identifies electrical components by a letter and a number in most wiring diagrams. See **97 Wiring Diagrams, Fuses and Relays**. These electrical identifiers are listed in parentheses as an aid to electrical troubleshooting.*

Electrical/electronic components (ITT Mark 20 IE) ABS, ABS/EDL/ASR



1. **ABS hydraulic unit (N55)**
   - Located on left side of engine compartment
   - Hydraulic pump (V64) integral with valve block and inlet/outlet valves
   - Do not separate above components from each other
   - If exchanging, use plugs from new unit or repair set to seal openings
   - Distinguishing between ABS, ABS/EDL, and ABS/EDL/ASR units, see **ABS, hydraulic unit identification**
2. **ABS control module (J104)**
   - Located on hydraulic unit
   - Hydraulic unit and control module form one unit that can only be separated when removed from vehicle
   - New control modules (replacement parts) are not coded and must be coded after installation
   - Disconnect harness connector only with ignition switched off
   - Check for Diagnostic Trouble Codes (DTCs) with scan tool before disconnecting harness connector
3. **ABS/EDL, ABS/EDL/ASR hydraulic unit (N55)**
   - Located on left side of engine compartment
   - Hydraulic pump (V64) integral with valve block and inlet/outlet valves
   - Do not separate above components from each other
   - If exchanging, use plugs from new unit or repair set to seal openings
   - Distinguishing between ABS, ABS/EDL, and ABS/EDL/ASR units, see **ABS, hydraulic unit identification**
4. **ABS/EDL, ABS/EDL/ASR control module (J104)**
   - Located on hydraulic unit
   - Hydraulic unit and control module form one unit that can only be separated when removed from vehicle
   - New control modules (replacement parts) are not coded and must be coded after installation
   - Disconnect harness connector only with ignition switched off
   - Check for Diagnostic Trouble Codes (DTCs) with scan tool before disconnecting harness connector
5. **Brake light switch (F)**
   - Removing and adjusting, see **96 Lights, Accessories–Interior**
   - Checking resistance, see **Brake light switch, checking resistance**
6. **Data Link Connector (DLC)**
   - Located in left lower area of dash panel
7. **Longitudinal acceleration sensor (G251)**
   - Not applicable to this system
8. **ABS warning light (K47)**
   - Located in instrument cluster
   - Operation, see **Brake system warning lights**
9. **Brake system warning light (K118)**
   - Located in instrument cluster
   - Operation, see **Brake system warning lights**
10. **ASR warning lamp (K155)**
    - Located in instrument cluster
    - Only for vehicles with anti-slip regulation (ASR)
    - Warning light comes on and goes out when vehicle is started as a system self test
    - Light is on continuously when ASR not engaged (manually turned off or malfunction)
    - Light flashes when ASR is in operation while driving

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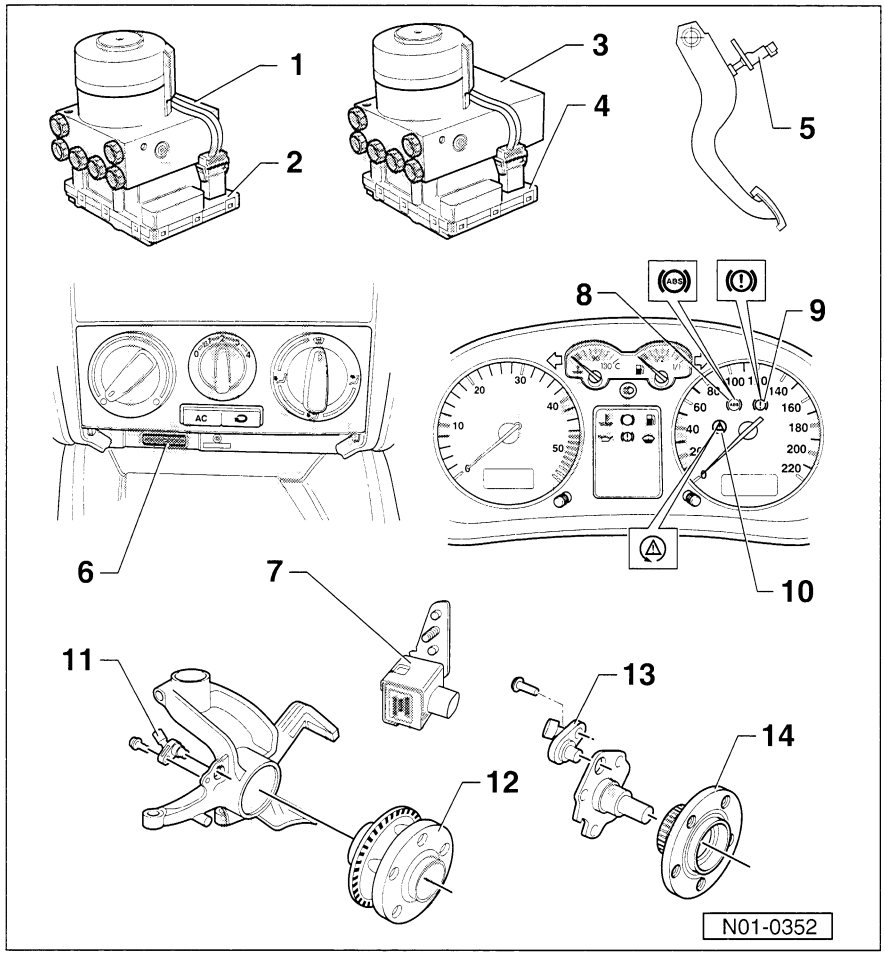
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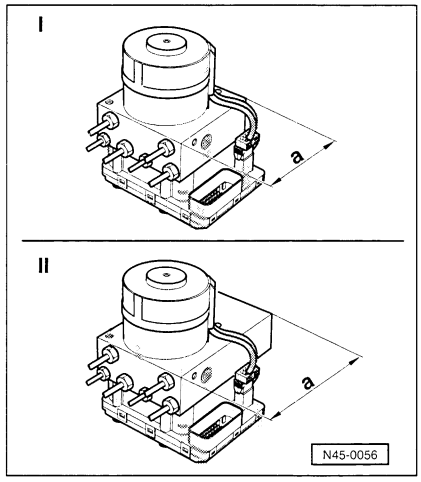
11. ABS wheel speed sensors, right front(G45), left front (G47)
- Clean inner surface in wheel bearing housing before installation and lubricate with special grease (VW G 000 650 or equivalent)
- Check to be sure wiring is not twisted in wheel well before connecting
- Tighten mounting bolt to 10 Nm (89 in-lb)

12. Wheel hub with ABS wheel speed sensor rotor, front
- Rotor and speed sensors for left and right rear sides are identical
- Rotor is integral with wheel hub

13. ABS wheel speed sensors, right rear (G44), left rear (G46)
- Clean inner surface in wheel bearing housing before installing and lubricate with grease (VW part no. G 000 650 or equivalent)
- Check to be sure wiring is not twisted in wheel well before connecting
- Tighten mounting bolt to 10 Nm (89 in-lb)

14. Wheel hub with ABS wheel speed sensor rotor, rear
- Rotor and speed sensors for left and right rear sides are identical
- Rotor welded to wheel hub



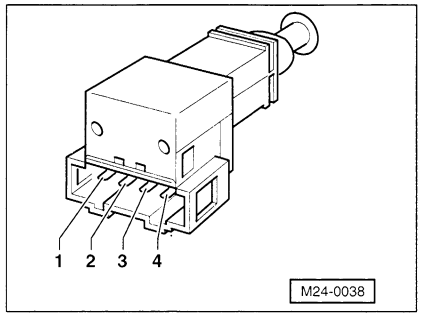


ABS hydraulic unit identification

I ITT Mark 20 IE ABS
dimension **a** = 100 mm (3.9 in.)

II ITT Mark 20 IE ABS/EDL
dimension **a** = 130 mm (5.1 In.)

II ITT Mark 20 IE ABS/EDL/ASR
dimension **a** = 130 mm (5.1 In.)

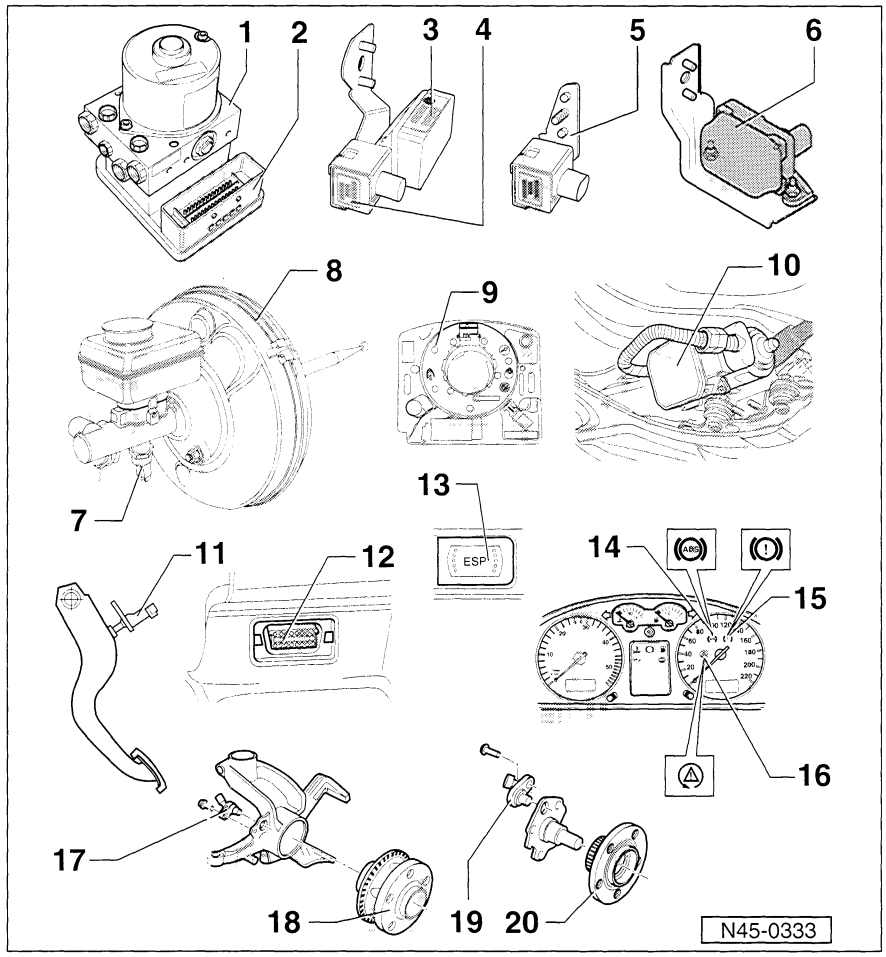


Brake light switch, checking resistance

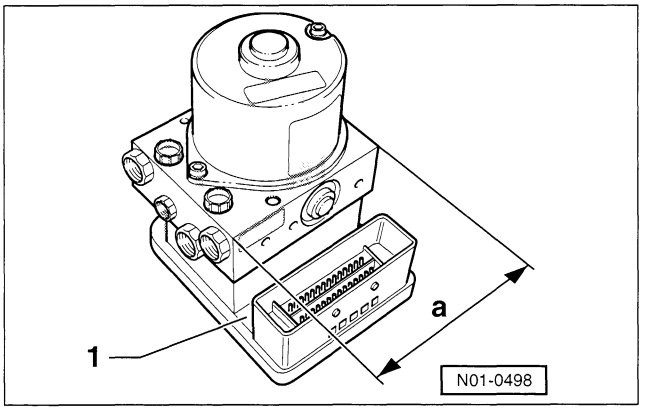
- Resistance at terminals **1** & **4**:
  Brake pedal depressed: max. 1.5Ω
  Brake pedal not depressed: ∞Ω
- Resistance at terminals **2** & **3**:
  Brake pedal depressed: ∞Ω
  Brake pedal not depressed: max.1.5Ω

Electrical/electronic components (ITT Mark 60 IE) ABS, ABS/EDL/ASR/ESP

1. **ABS hydraulic unit (N55)**
   - Located on left side of engine compartment
   - Hydraulic pump (V64) integral with valve block and inlet/outlet valves
   - Do not separate above components from each other
   - Identification, see **ABS, hydraulic unit identification**
2. **ABS control module (J104)**
   - Located on hydraulic unit
   - New control modules (replacement parts) are not coded and must be coded after installation
   - Disconnect harness connector only with ignition switched off
   - Tighten mounting bolt to hydraulic unit to 4 Nm (35 in-lb)
3. **Rotational rate sensor (G202)**
   - For vehicles with ESP
   - Located on steering column
4. **Transverse acceleration sensor (G200)**
   - For vehicles with ESP
   - Located on steering column
5. **Longitudinal acceleration sensor (G251)**
   - For vehicles with ESP
   - For all wheel drive vehicles with Haldex coupling only
   - On lower right side A pillar
6. **ESP sensor (G419)**
   - For vehicles with ESP from February 2002 production
   - Combines sensors G200, G202, and G251 (as applicable) in one housing
   - Located on steering column
7. **Brake pressure sender I (G201)**
   - Located under master cylinder
8. **Power brake booster**
9. **Steering angle sensor (G85)**
   - For vehicles with ESP
   - On steering column under wheel
10. **Brake system vacuum pump (V192)**
    - On lower left subframe
11. **Brake light switch (F)**



12. **Data Link Connector (DLC)**
    - In left lower area of dash panel
13. **ESP control switch (E256) or ASR control switch (E132)**
    - For vehicles with ESP or ASR
    - Located in center of dash panel
14. **ABS warning light (K47)**
    - Located in instrument cluster
15. **Brake system warning light (K118)**
    - Located in instrument cluster
16. **ASR/ESP control light (K155)**
    - Located in instrument cluster
17. **ABS wheel speed sensors, right front(G45), left front (G47)**
    - Clean inner surface in wheel bearing housing before installation and lubricate with special grease (VW G 000 650 or equivalent)
    - Check to be sure wiring is not twisted in wheel well before connecting
    - Tighten mounting bolt to 10 Nm (89 in-lb)
18. **Wheel hub with ABS wheel speed sensor rotor, front**
    - Rotor and speed sensors for left and right rear sides are identical
    - Rotor is integral with wheel hub
19. **ABS wheel speed sensors, right rear (G44), left rear (G46)**
    - Clean inner surface in wheel bearing housing before installing and lubricate with grease (VW part no. G 000 650 or equivalent)
    - Check to be sure wiring is not twisted in wheel well before connecting
    - Tighten mounting bolt to 10 Nm (89 in-lb)
20. **Wheel hub with ABS wheel speed sensor rotor, rear**
    - Rotor and speed sensors for left and right rear sides are identical
    - Rotor welded to wheel hub

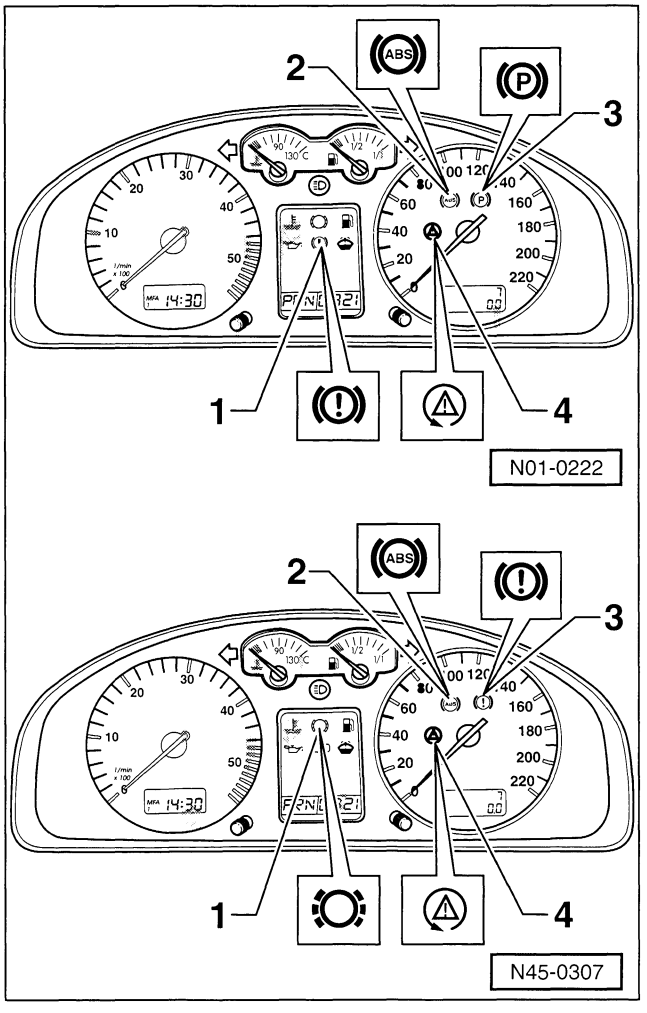


ABS hydraulic unit identification

ITT Mark 60 IE ABS:
dimension **a** = 100 mm (3.9 in.)
47-pin connection (**1**) has a wide contact at each end

Brake system warning lights, (ITT Mark 20 IE and Mark 60 IE)

Brake system operation is monitored by several warning and indicator lights in the instrument cluster. The number and type will vary with vehicle equipment, model year and market (USA or Canada).



The brake system warning lights in the instrument cluster are identified according to the following descriptions.

Item	Designation	Description
1	K32	Front brake pad wear indicator warning light (may not have exclamation point)
2	K47	ABS warning light (may only have word "**ABS**", no symbol)
3	K118	System and Parking brake warning light (may only have word "**BRAKE**", no symbol)
4	K155	ASR and/or ESP warning light

Note: Positions may vary slightly depending on equipment level, but symbols are consistent for each function.
Warning lights vary with vehicle equipment.
Some functions are also displayed on the Auto-Check System.

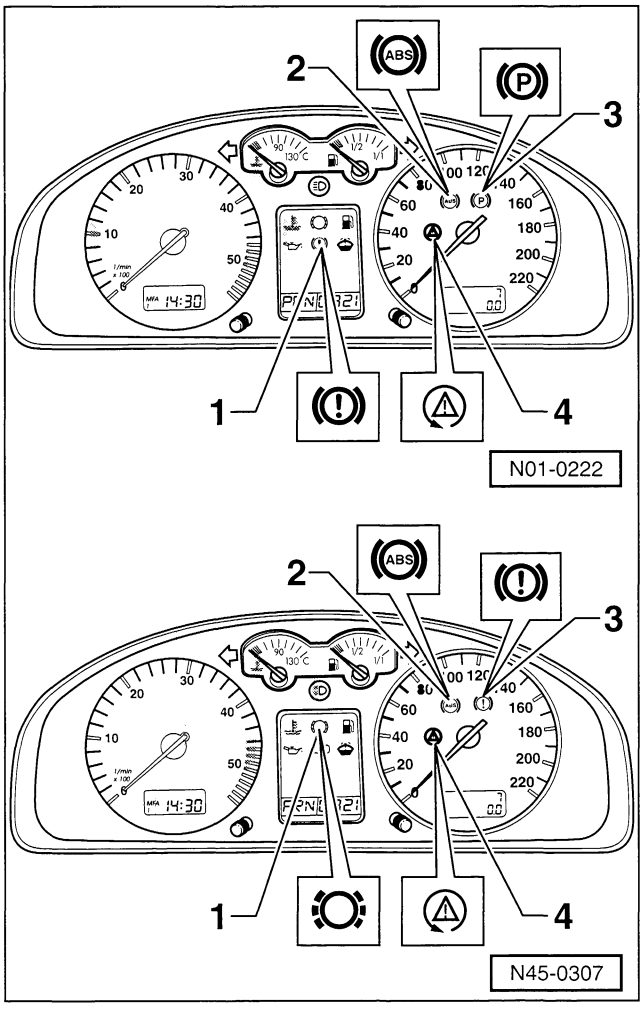
– Brake pad wear indicator K32, (1)

- Lights up when front disc brake pads are worn to minimums. Indicates need for front pad replacement.

NOTE —
Brake pad wear indicator is not installed on all vehicles.

– ABS warning light K47, (2)

- Lights up for a few seconds when the ignition is switched on and then goes out if all monitored functions pass the self-check.
- Light will remain on if any of the following exist:
  - If supply voltage drops below 10.0 volts.
  - If ABS system has a malfunction.
  - If EDL system is not functioning
- Light goes out (after restart) when vehicle speed exceeds 20 km/h (13 mph) to indicate wheel speed sensor malfunction.
- May light if instrument cluster or wiring malfunction is present.
- ABS malfunctions will also cause the ASR light (K155) to be illuminated.
- ABS system including EBD is automatically switched off if light is on.



– System and parking brake warning light K118, (3)

- Lights up for a few seconds when the ignition is switched on. Stays illuminated if hand brake is engaged. The light will go out when hand brake is released.
- Lights momentarily and goes out if key is switched on and parking brake is not applied (as a self test).
- Lights if key is switched on and parking brake is applied.
- Lights if parking brake switch is inoperative, incorrectly adjusted or if there is a malfunction if the wiring.
- Lights if key is switched on and parking brake is not applied if brake fluid level is low (may flicker)

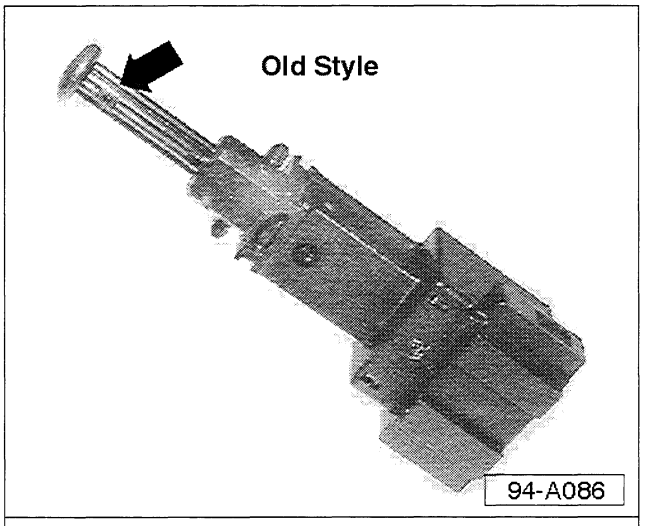
– ASR warning light K155, (4)

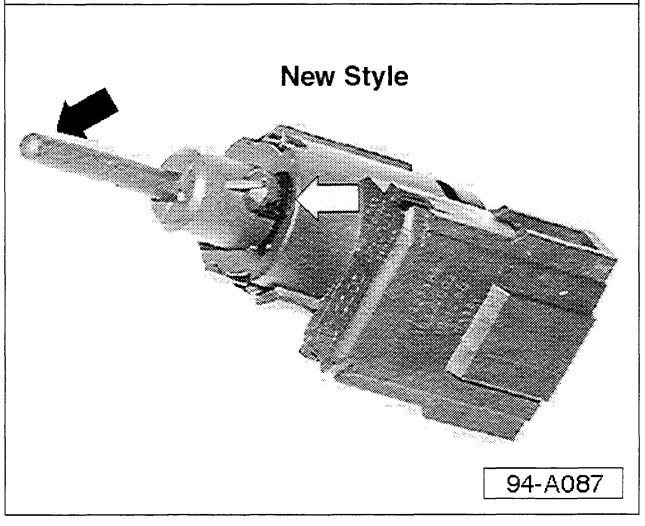
- Lights up for a few seconds when the ignition is switched on and then goes out if all monitored functions pass the self-check.
- Light will remain on if ASR is switched off manually via E132 or if there is a malfunction.
- The light will flash when ASR is activated if the vehicle is moving.
- ABS malfunctions will also cause the ASR light to be illuminated in conjunction with the ABS warning light (K47).
- ASR and ESP malfunctions that only affect ASR and ESP do not necessarily disable the ABS, EBD, and EDL systems.

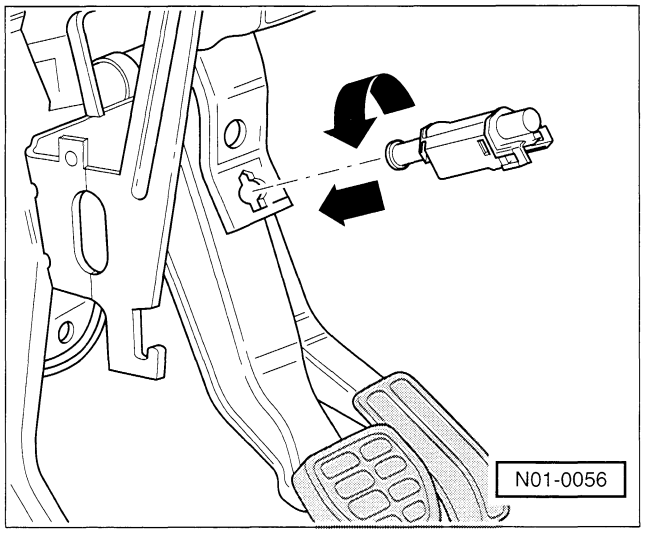
WARNING —

*• If ABS warning light (**2**) and brake warning light (**3**) light up together, it is possible rear wheels will lock-up early under hard braking. This could cause loss of vehicle control and may be due to the electronic brake pressure distribution (EBD) not functioning. Have your vehicle serviced immediately by an authorized Volkswagen dealer or a qualified independent repair shop.*

*• If the brake warning light (**3**) does not light up when the engine is cranking or the parking brake is applied, there may be a malfunction in the electrical system. Do not drive vehicle without diagnosing the problem.*







ABS COMPONENTS

Brake light switch, removing and installing

Two different styles of brake light switches are used on the vehicles covered by this manual. They will be referred to here as "old style" and "new style". The new style switch was implemented as a running production change in model year 2001. It is important to identify which style of switch is installed prior to servicing as each requires specific removal and installation/replacement procedures.

NOTE —

- *On Diesel models and gasoline models with cruise control, brake light switch (F) and brake pedal switch (cruise control/DFI) (F47) are integrated. The following procedures apply to all models regardless of switch.*
- *Only old style switches can be removed and reinstalled/adjusted.*
- *New style switches must NOT be reused after removal. Always replace.*
- *Should an old style brake light switch require replacement, only a new style switch is available (supersedes all previous part number versions) from Volkswagen. This switch requires that critical procedures be followed prior to and during installation as described below.*

– Remove driver's side footwell trim.

– Disconnect electrical connector from brake light switch.

➤ Identify style of switch installed:

- Old style switch is identified by large (approx. 10 mm) plunger tip button, and square plunger shaft.
- New style switch is identified by small (approx. 4 mm) plunger tip without button, and round plunger shaft.

Old style brake light switch, removing and installing/adjusting

NOTE —

The following applies only to an existing, functional old style switch that is removed and reinstalled/adjusted.

➤ Turn switch counter-clockwise 90°.

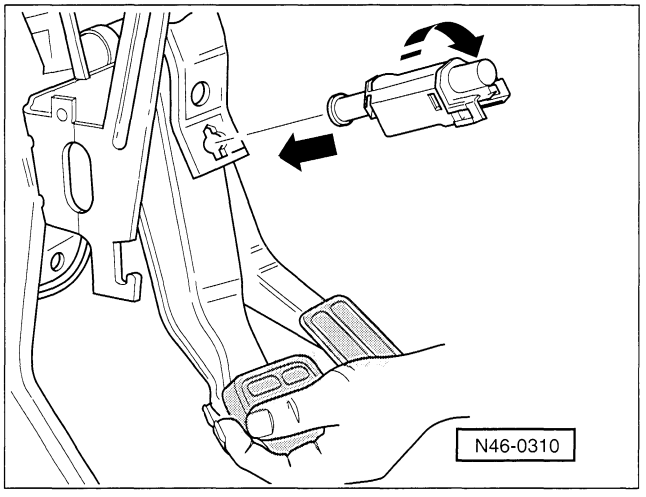
– Pull switch out from retainer mounting hole.

– Before installing, pull out plunger completely.

– Apply a light coat of lubricant (VW part No. G 052 142 A2) to end of plunger.

NOTE —

Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.



– Depress and hold brake pedal in down position.

– Note orientation of retainer tabs on switch and carefully insert switch into retainer mounting hole.

➤ Secure switch by turning clockwise 90.

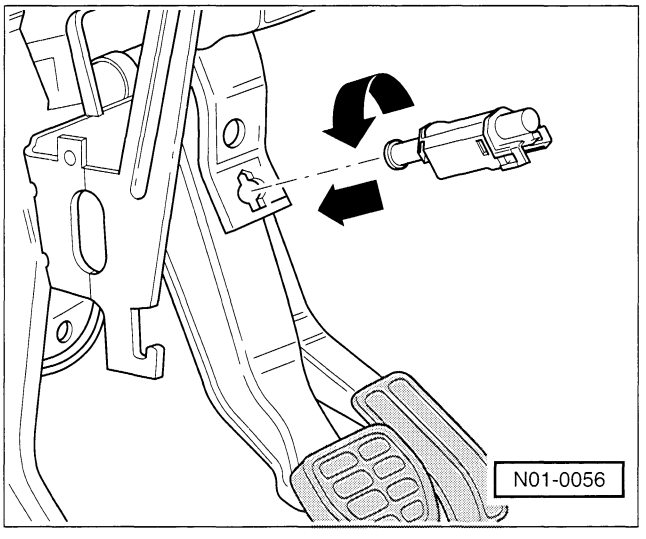
– Slowly release brake pedal to stop.

• The above action automatically adjusts the switch plunger travel.

– Reconnect electrical connector to switch and check function of brake light switch.

New style brake light switch, removing and installing

NOTE —
The following applies only to a new style switch that is removed and replaced.



➤ Turn switch counter-clockwise 45.

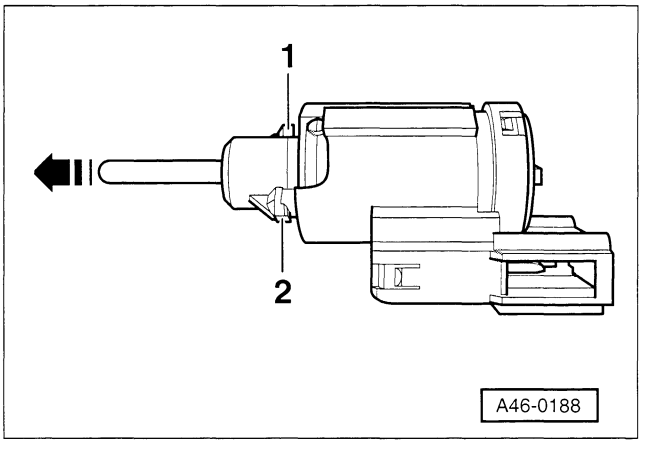
– Pull switch out from retainer mounting hole.

– Dispose of switch accordingly.

NOTE —
New style switches must NOT be reused after removal. Always replace.

WARNING —
New style switches have an internal switch mechanism that will be damaged if not installed and adjusted according to the following procedure.

- *DO NOT depress switch plunger or otherwise rotate the retaining collar of the switch prior to installation.*
- *Brake pedal must be held in the up position (not depressed) during switch installation.*



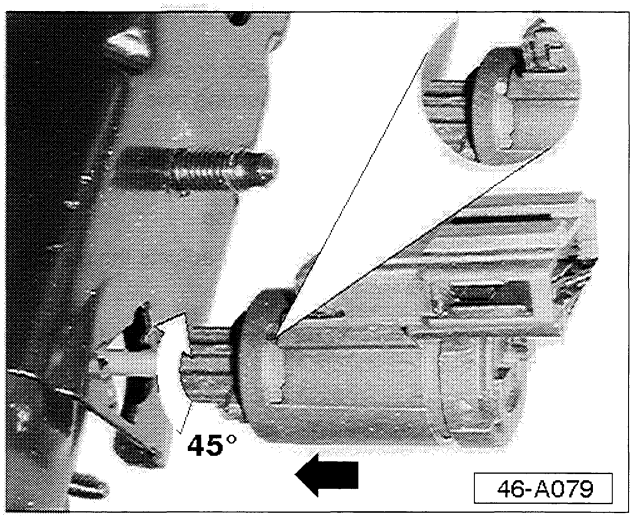
➤ Before installing, pull out plunger (**arrow**) completely.

– Apply a light coat of lubricant Part No. G 052 142 A2 to end of plunger.

– Hold brake pedal in up position (against stop).

– Note orientation of retainer tabs (**1**) and (**2**) on switch and carefully insert switch into retainer mounting hole.

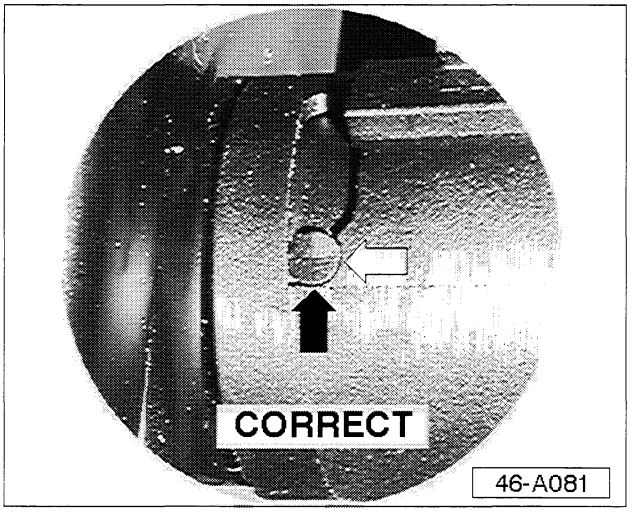
– Push switch in and seat fully into opening (pressing plunger against brake pedal to adjust).



- Once seated, secure switch by turning clockwise 45° (**white arrow**).

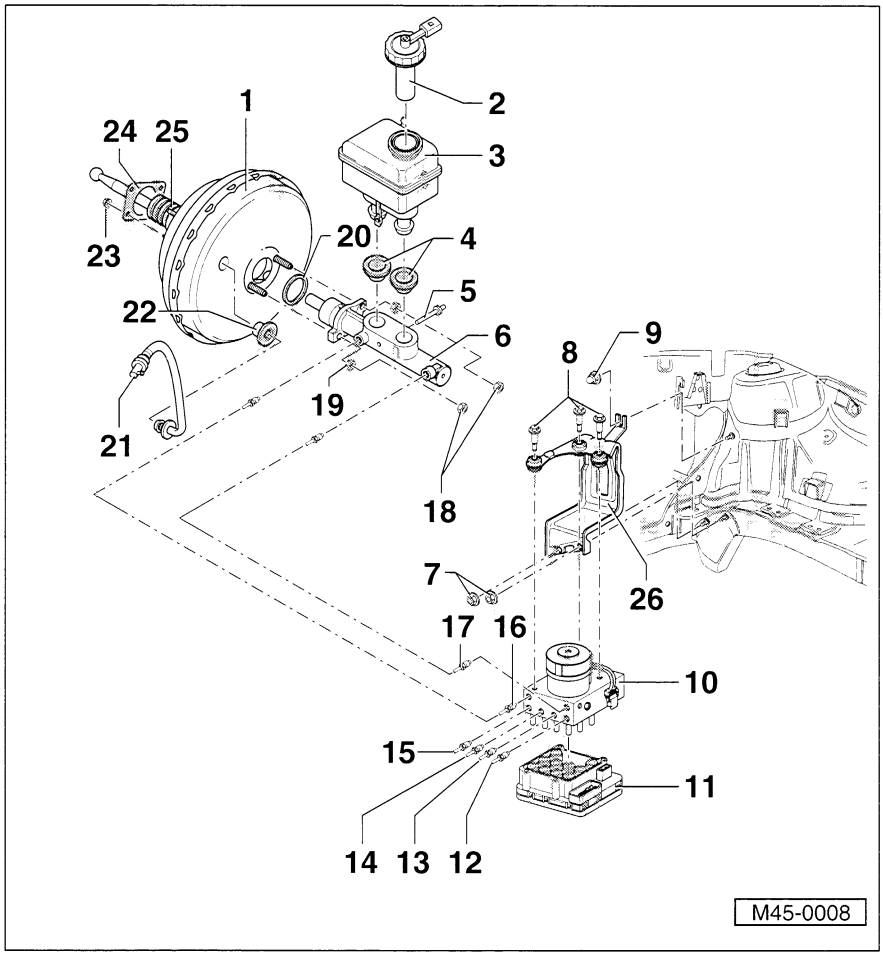
NOTE —
The above action turns the plunger shoe into the correct orientation to make electrical contacts in switch operate, as well as locks in the plunger adjustment against the brake pedal.

WARNING —
When installing, switch must be rotated until it is fully locked and the electrical connector is in the horizontal position.



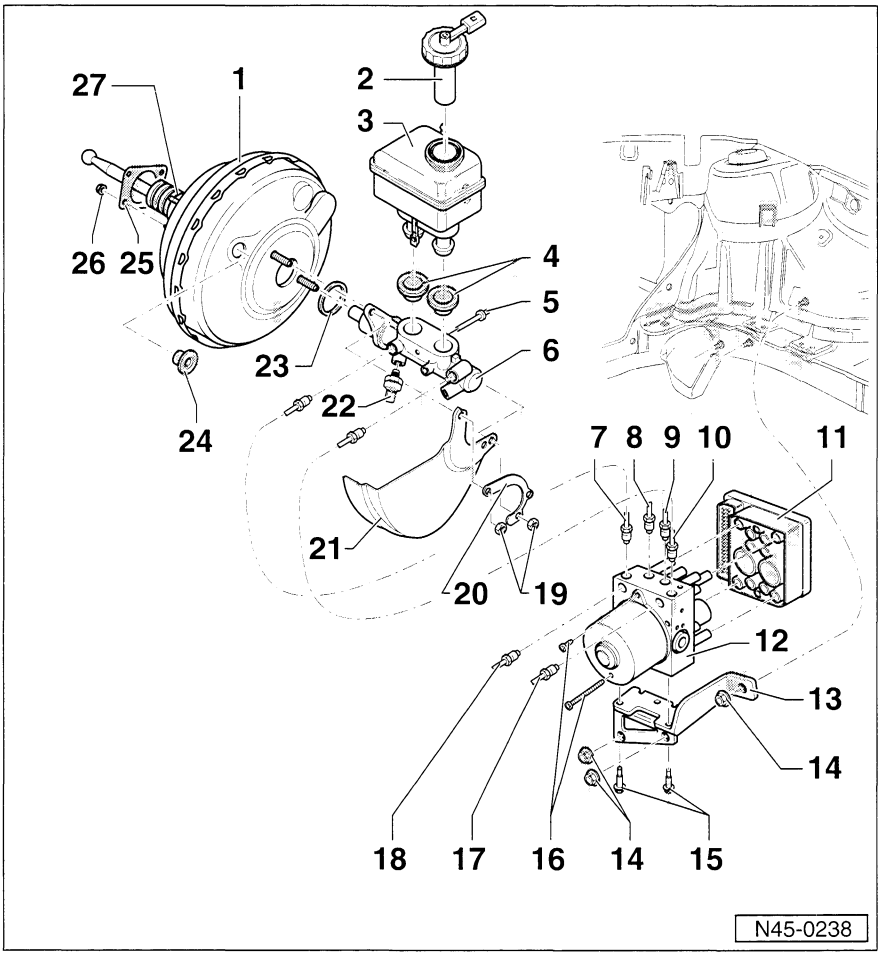
- Inspect to ensure internal stop pin on retaining collar is fully seated against outer shell (**arrows**).
- Reconnect electrical connector to switch.
- Check function of brake light switch.

Hydraulic/mechanical ABS components (ITT Mark 20 IE)



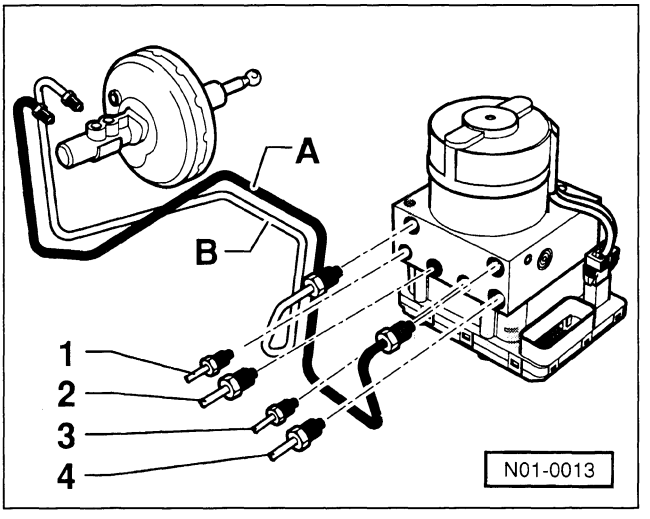
1. **Brake booster**
   - On gasoline engines vacuum is taken from intake manifold
   - Diesel engines have a vacuum pump to develop required vacuum
   - Complete master cylinders and brake boosters can be replaced separately
   - Functional check:
     With engine off, depress brake pedal several times to exhaust vacuum in the unit.
     Depress brake pedal and start engine. If booster is functioning properly, brake pedal should give noticeably underfoot.
     If pedal does not give, replace brake booster.
2. **Cap**
   - With fluid level sensor
   - Inspect gasket for proper seal
3. **Brake fluid reservoir**
   - Also supplies brake fluid to hydraulic clutch for manual transmission vehicles
4. **Sealing grommets**
   - Moisten with brake fluid and press into reservoir
5. **Retainer pin**
   - Insert through brake master cylinder
6. **Tandem brake master cylinder**
   - Cannot be repaired
   - If faulty, replace as complete unit
7. **Nut, self-locking hex**
   - Always replace
   - Tighten to 20 Nm (15 ft-lb)
8. **Bolt, hex**
   - Tighten to 8 Nm (70 in-lb)
9. **Nut, hex cap**
   - Tighten to 20 Nm (15 ft-lb)
10. **ABS/EDL hydraulic unit**
    - Hydraulic pump (V64) integral with valve block and inlet/outlet valves
    - Do not separate above components from each other
    - If exchanging, use plugs from new unit or repair set to seal openings
    - See: **Connecting lines, tandem master cylinder to hydraulic unit**
11. **ABS control module**
    - Hydraulic unit must be removed as an assembly before removing control module
12. **Brake line connection**
    - Hydraulic unit to left front brake caliper
13. **Brake line connection**
    - Hydraulic unit to right rear brake caliper
14. **Brake line connection**
    - Hydraulic unit to left rear brake caliper
15. **Brake line connection**
    - Hydraulic unit to right front brake caliper
16. **Brake line connection**
    - Brake master cylinder/primary piston circuit to hydraulic unit
17. **Brake line connection**
    - Brake master cylinder/secondary piston circuit to hydraulic unit
18. **Nut, self-locking hex**
    - Always replace
    - Tighten to 20 Nm (15 ft-lb)
19. **Nut, self-locking hex**
    - Always replace
    - Tighten to 20 Nm (15 ft-lb)
20. **Seal**
    - Always replace
21. **Vacuum pipe**
    - Insert into brake booster
    - With check valve
22. **Sealing grommet**
23. **Nut, self-locking hex**
    - Always replace
    - Tighten to 20 Nm (15 ft-lb)
24. **Seal**
    - For brake booster
25. **Boot**
    - Ensure proper seating
    - Prevents normal operating noises from entering passenger compartment.
26. **Mounting bracket**

Hydraulic/mechanical ABS components (ITT Mark 60 IE)



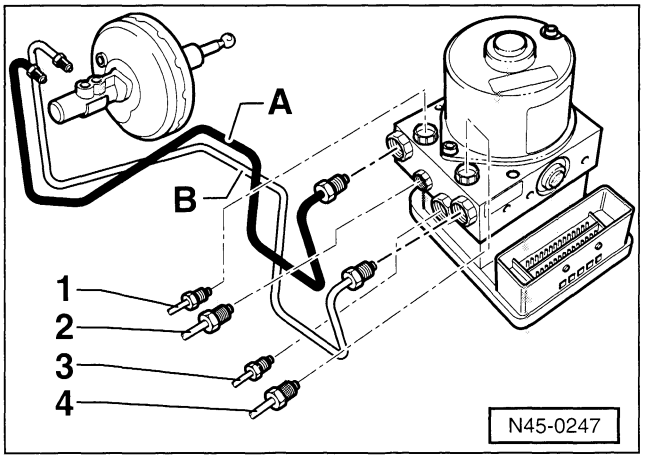
1. **Brake booster**
   - On gasoline engines vacuum is taken from intake manifold
   - Diesel engines have a vacuum pump to develop required vacuum
   - Some vehicles have additional electric vacuum pump V192
   - Complete master cylinders and brake boosters can be replaced separately
   - Functional check:
     With engine off, depress brake pedal several times to exhaust vacuum in the unit.
     Depress brake pedal and start engine. If booster is functioning properly, brake pedal should give noticeably underfoot.
     If pedal does not give, replace brake booster.
2. **Cap**
   - With fluid level sensor
   - Inspect gasket for proper seal
3. **Brake fluid reservoir**
   - Also supplies brake fluid to hydraulic clutch for manual transmission vehicles
4. **Sealing grommets**
   - Moisten with brake fluid and press into reservoir
5. **Retainer pin**
   - Insert through master cylinder
6. **Tandem brake master cylinder**
   - Cannot be repaired
   - If faulty, replace as complete unit
   - Some vehicles equipped with brake pressure sender I (G201) located under master cylinder
7. **Brake line connection**
   - Brake master cylinder/primary piston circuit to hydraulic unit
8. **Brake line connection**
   - Hydraulic unit to left front brake caliper
9. **Brake line connection**
   - Hydraulic unit to right front brake caliper
10. **Brake line connection**
    - Brake master cylinder/secondary piston circuit to hydraulic unit
11. **ABS control module**
    - Hydraulic unit must be removed as an assembly before removing control module
12. **ABS hydraulic unit**
    - Hydraulic pump (V64) integral with valve block and inlet/outlet valves
    - If exchanging, use plugs from new unit or repair set to seal openings
    - See: **Connecting lines, tandem master cylinder to hydraulic unit**
13. **Retaining bracket**
14. **Nut, hex cap**
    - Tighten to 20 Nm (15 ft-lb)
15. **Bolt, hex**
    - Tighten to 8 Nm (70 in-lb)
16. **Bolt, Torx® head E5**
    - Tighten to 4 Nm (35 in-lb)
17. **Brake line connection**
    - Hydraulic unit to left rear caliper
18. **Brake line**
    - Hydraulic unit to right rear caliper
19. **Nut, self-locking hex**
    - Always replace
    - Tighten to 20 Nm (15 ft-lb)
20. **Mounting bracket**
    - Secures wiring harness
21. **Heat shield**
    - Installation varies according to engine type
22. **Brake pressure sender I (G201)**
    - Located under master cylinder

Connecting lines, tandem master cylinder to hydraulic unit



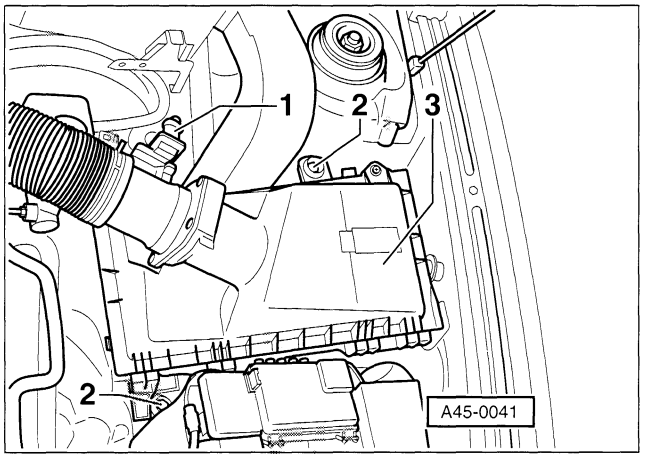
Mark 20 IE: connecting lines, tandem master cylinder to hydraulic unit

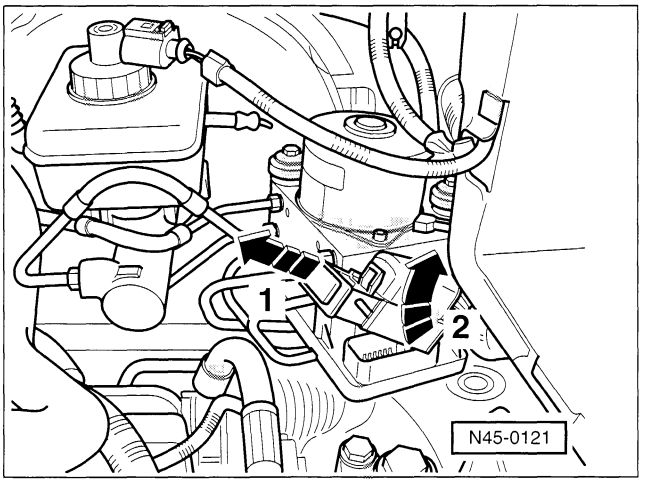
A - Secondary piston circuit
B - Primary piston circuit
1 - Hydraulic unit to right front caliper
2 - Hydraulic unit to left rear caliper
3 - Hydraulic unit to right rear caliper
4 - Hydraulic unit to left front caliper

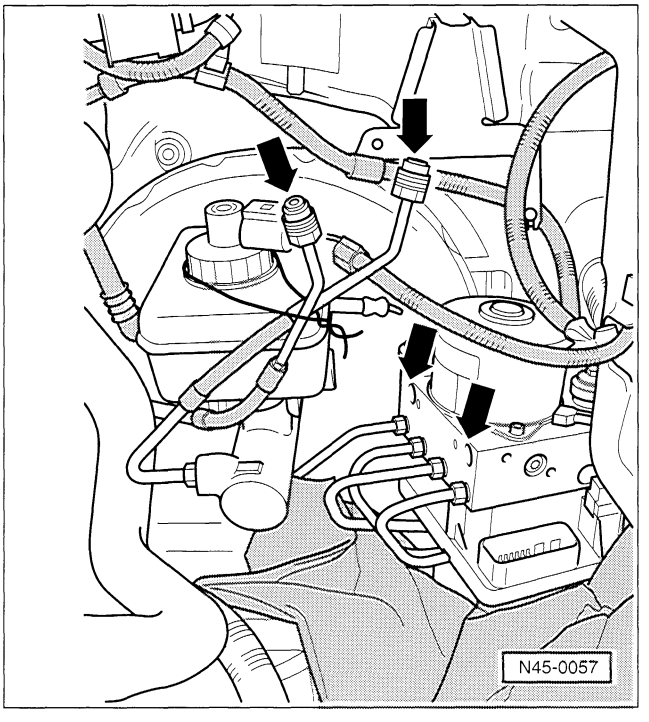


Mark 60 IE: connecting lines, tandem master cylinder to hydraulic unit

A - Secondary piston circuit
B - Primary piston circuit
1 - Hydraulic unit to left rear caliper
2 - Hydraulic unit to right front caliper
3 - Hydraulic unit to left front caliper
4 - Hydraulic unit to right rear caliper







Hydraulic unit, removing and installing (ITT Mark 20 IE)

The ABS control module will require coding with a scan tool upon completion of the replacement procedure.

– Disconnect battery ground (GND) strap from battery negative (–) terminal.

NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.

◀ Disconnect mass air flow sensor harness connector (**1**) at air filter tube.

– Remove air filter bolts (**2**) at filter housing (**3**) and move assembly aside.

– On 1.9L TDI engines, remove relay panel above brake booster.

– Remove as much brake fluid as possible from fluid reservoir using a brake bleeder bottle.

– Depress brake pedal several times and hold in position using VAG 1869/2 brake pedal actuator, or equivalent.

– Connect brake bleeder bottle hose to bleed screw of left front brake caliper and open bleed screw.

– Once fluid stops running out of bleed screw, close screw.

◀ Release ABS control module harness connector (**arrow 1**) and remove by tilting up (**arrow 2**).

– Place plastic covering under control module and hydraulic unit. Do not use rags.

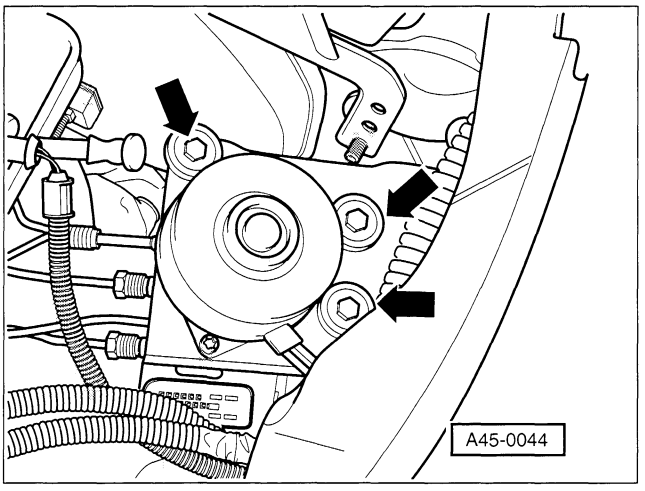
WARNING —
Do not let brake fluid enter electrical connectors.

◀ Disconnect brake lines (**arrows**) from hydraulic unit and suspend with wire.

– Disconnect remaining brake lines from hydraulic unit.

– Seal brake lines and threaded holes using plugs from repair kit, Volkswagen Part # 1H0 698 311A.

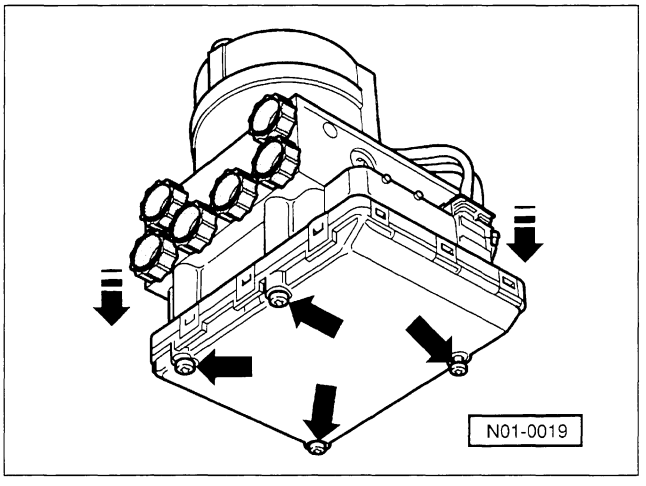
NOTE —
Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.



➢ Remove bolts (**arrows**) from bracket for hydraulic unit.

– Remove hydraulic unit with control module attached.

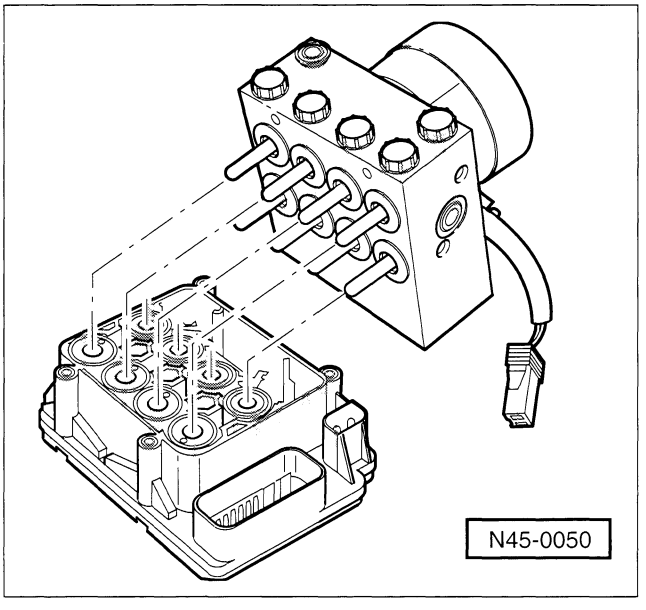
– To remove control module from hydraulic unit, first disconnect harness connector for hydraulic pump motor from control module.



➢ Remove bolts (**solid arrows**) from bottom of control module. Pull control module and hydraulic unit straight apart to separate (**dashed arrows**).

WARNING —

- *When removing or assembling the control module and hydraulic unit, be sure that the hydraulic unit valve dome is not tilted against the control module solenoid valves.*
- *Cover control module coils with plastic cover. Do not use rags.*
- *After separating the control module and hydraulic unit, use transportation protection for the valve dome.*
- *Only remove sealing plugs on the new hydraulic unit just before installing the corresponding brake line.*
- *If the sealing plugs are removed too early, brake fluid can escape. The unit may no longer be sufficiently filled or adequately bled.*



➢ After separating control module from hydraulic unit, use care to keep contamination out of hydraulic unit.

– When installing, use new bolts to attach control module to hydraulic unit. Tighten to specification listed below.

– Re-connect harness connector for hydraulic pump motor.

– Install ABS hydraulic unit onto mounting bracket.

– Hand tighten brake lines to hydraulic unit first. After tightening brake lines, then tighten hydraulic unit lines.

– Remaining installation is the reverse of removal.

– Fill brake fluid reservoir and bleed brake system as described in **47 Brakes–Hydraulic System**.

– Be sure to quality check your work, see **Quality Review** at the end of this repair group.

Tightening torques

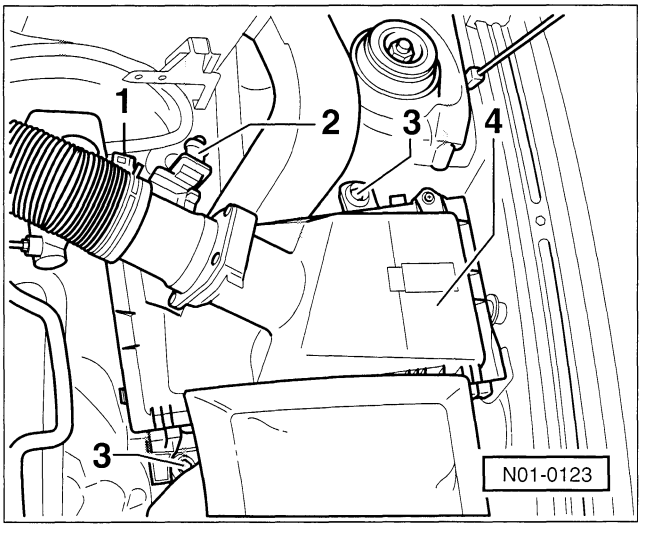
- Control module to hydraulic unit always replace . . . . . 4 Nm (35 in-lb)
- Hydraulic unit bolt to bracket . . . . . 8 Nm (71 in-lb)
- Master cylinder nut to booster . . . . . 20 Nm (15 ft-lb)
- Brake lines to ABS unit (M10/M12) . 14 Nm (10 ft-lb)
- Mounting bracket to body . . . . . 20 Nm (15 ft-lb)

Hydraulic unit, removing and installing (ITT Mark 60 IE)

The ABS control module will require coding and basic setting with a scan tool upon completion of the replacement procedure.

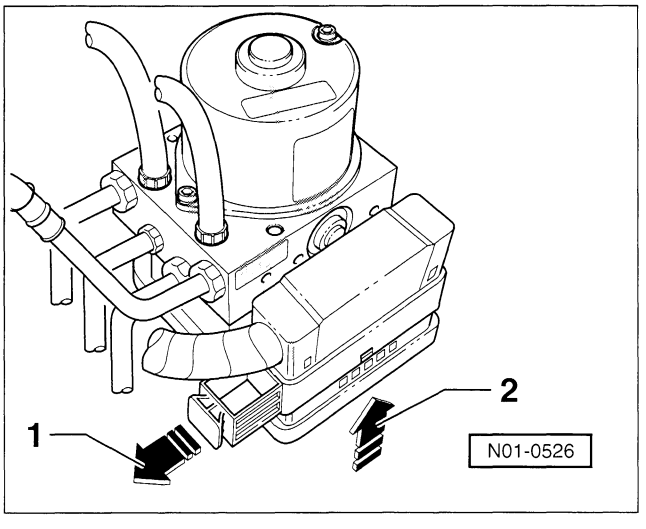
– Disconnect battery ground (GND) strap from battery negative (–) terminal.

NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.



➤ Disconnect mass air flow sensor harness connector (**2**) at air filter tube.

– Release spring clips (**1**) on air duct hose and pull off air cleaner.



➤ Release control module connector (**arrow 1**) and pull connector off (**arrow 2**)

– Remove air cleaner bolts (**3**) and take out air cleaner (**4**).

– Install VAG 1869/2 brake pedal actuator, or equivalent.

– Connect brake bleeder bottle hose to bleed screw of left front and left rear brake calipers and open bleed screw.

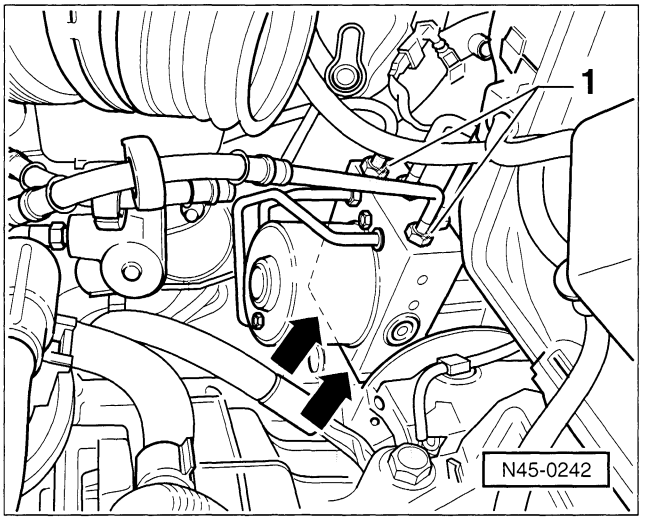
– Depress brake pedal at least 60 mm ($2\ ^3/_8$ in.) and hold in position using VAG 1869/2 brake pedal actuator, or equivalent.

– Once fluid stops running out of bleed screw, close bleeder screws on left front and left rear.

– Do not remove brake pedal actuator from pedal.

– Place a sufficient number of lint-free cloths under control module/hydraulic assembly to catch fluid spillage.

WARNING —
Do not let brake fluid enter electrical connectors.

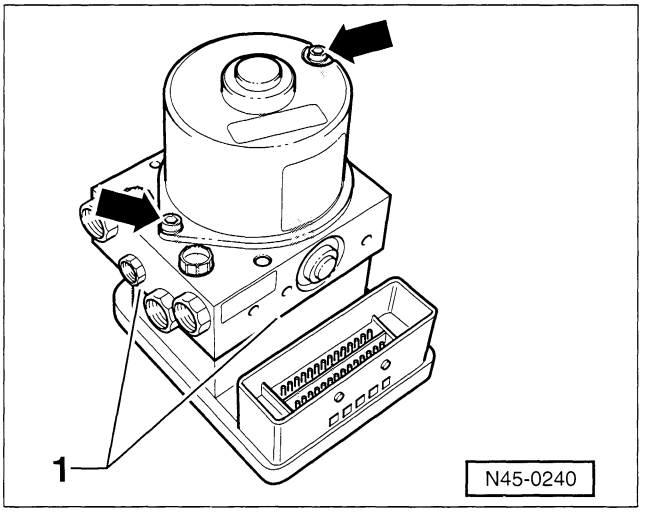


➢ Disconnect brake lines (**1**) from hydraulic unit to brake master cylinder and tie securely out of the way.

– Disconnect remaining brake line on hydraulic unit.

– Seal brake lines and threaded holes using plugs from repair kit, Volkswagen Part # 1H0 698 311A.

NOTE —
Volkswagen part numbers are given for reference only! Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.



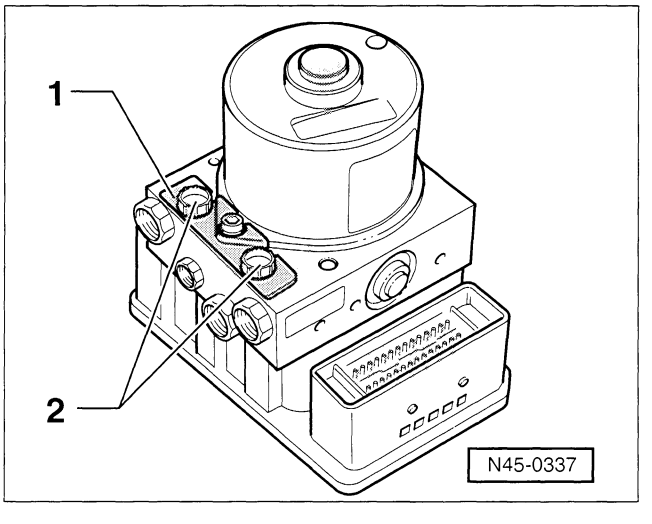
– Remove bolts (**arrows**) from hydraulic unit.control module bracket.

– Remove complete hydraulic unit with control module attached.

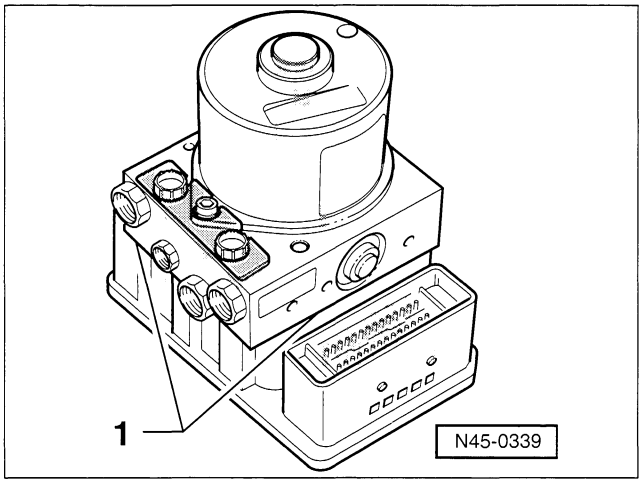
➢ To remove control module from hydraulic unit, place the complete unit (**1**) on a clean surface with the control module down.

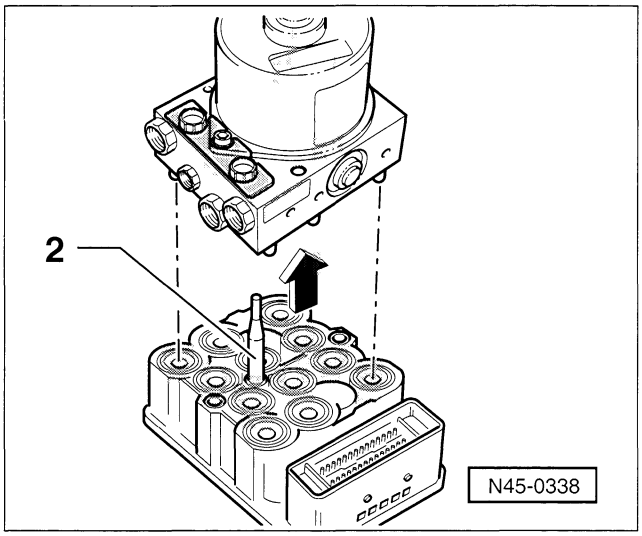
– Remove external Torx® (E5) bolts (**arrows**) from hydraulic pump.

WARNING —
Do not separate or remove the hydraulic pump from the rest of the hydraulic unit! Use parts from the repair kit to temporarily secure the motor to the unit.



➢ As noted in the caution above, secure the pump motor to the hydraulic unit using the red bracket (**1**) and two sealing plugs (**2**) from the repair kit.





➢ Separate hydraulic unit (with pump motor temporarily secured) from control module by carefully lifting off at parting joint (**1**).

➢ Pull control module and hydraulic unit straight apart (arrow).

– Contact pin (**2**) which is supplied as a part of the control module can only be clipped into place (used) one time. It cannot be removed without damage.

> ***WARNING —***
> - *When removing or assembling the control module and hydraulic unit, be sure that the hydraulic unit valve dome is not tilted against the control module solenoid valves.*
> - *Cover control module coils with plastic cover. Do not use rags.*
> - *After separating control module and hydraulic unit, use transportation protection for valve dome.*
> - *Only remove sealing plugs on new hydraulic unit just before installing corresponding brake line.*
> - *If the sealing plugs are removed too early, brake fluid can escape. The unit may no longer be sufficiently filled or adequately bled.*

– After separating control module from hydraulic unit, use care to keep contamination out of hydraulic unit.

– When installing, use new bolts to attach control module to hydraulic unit. Tighten to specification listed below.

– Loosely install ABS hydraulic unit onto mounting bracket to facilitate installation of brake lines.

– Hand tighten all brake lines to hydraulic unit.

– Fully tighten ABS hydraulic unit onto mounting bracket.

– Fully tighten all brake lines.

– Remaining installation is the reverse of removal.

– Fill brake fluid reservoir and bleed brake system as described in **47 Brakes–Hydraulic System**.

– Be sure to quality check your work, see **Quality Review** at the end of this repair group.

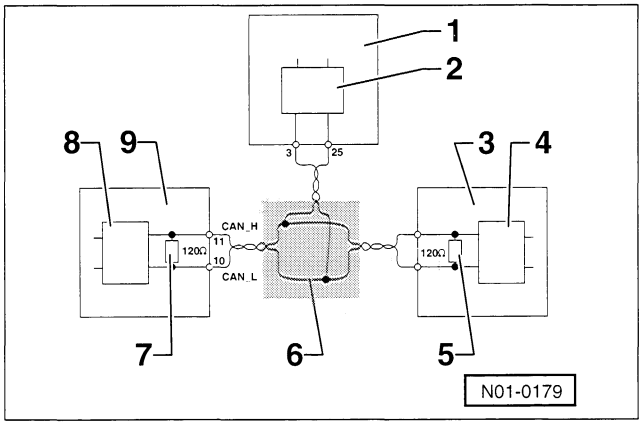
Tightening torques

- Control module to hydraulic unit always replace . . . . . 4 Nm (35 in-lb)
- Hydraulic unit bolt to bracket . . . . . 8 Nm (71 in-lb)
- Master cylinder nut to booster . . . . . 20 Nm (15 ft-lb)
- Brake lines to ABS unit (M10/M12) . 14 Nm (10 ft-lb)
- Mounting bracket to body . . . . . 20 Nm (15 ft-lb)

ABS CONTROL MODULE

The ABS control module is attached to the bottom of the ABS hydraulic unit located in the engine compartment. Control unit replacement is only possible if the hydraulic unit has been removed.

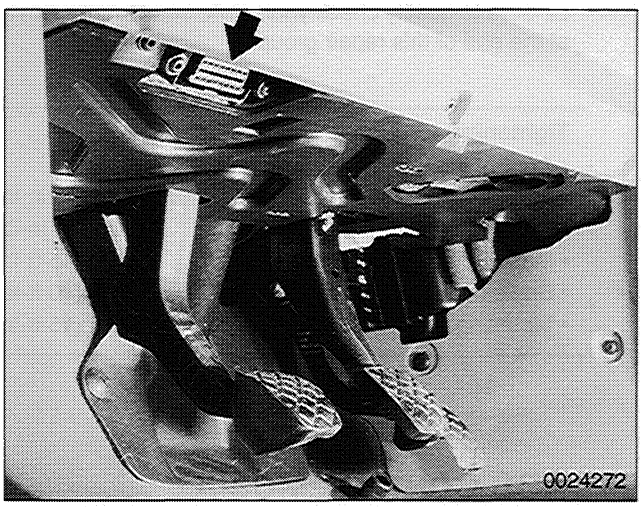
Vehicles equipped with ABS link the ABS control module to the engine control module and the automatic transmission control module (where applicable). Linking the systems allows certain types of vehicle data to be shared for functional and diagnostic purposes. Linking systems to share data is generally known as multiplexing. Volkswagen uses a 2-wire system called a CAN-bus.



Schematic view of linked control modules if all systems were installed in a given vehicle. Numbers identify various components.

1.Automatic transmission control module (TCM)
2.Communications circuitry
3.Engine control module (ECM)
4.Communications circuitry
5.Terminating impedance
6.CAN-bus multiplexing
7.Terminating impedance
8.Communications circuitry
9.Anti -lock brakes control module (ABS)

Most service and repair to the ABS system requires the use of a scan tool such as the Volkswagen VAG 1551/1552, VAS 5051/5052 or equivalent. Access is via the Data Link Connector (DLC) under the dashboard. This includes coding of replacement control modules. Replacement control modules are shipped uncoded and will not function properly when installed in an un-coded condition. Because of the specialized nature of these repairs, servicing should be referred to an authorized Volkswagen dealer or qualified independent repair shop. ABS control module coding numbers for the Teves Mark 20 IE system and the Teves Mark 60 IE system can be found at the back of this manual in the **Scan Tool** section.



➤ Data Link Connector (**arrow**) for scan tool connection.

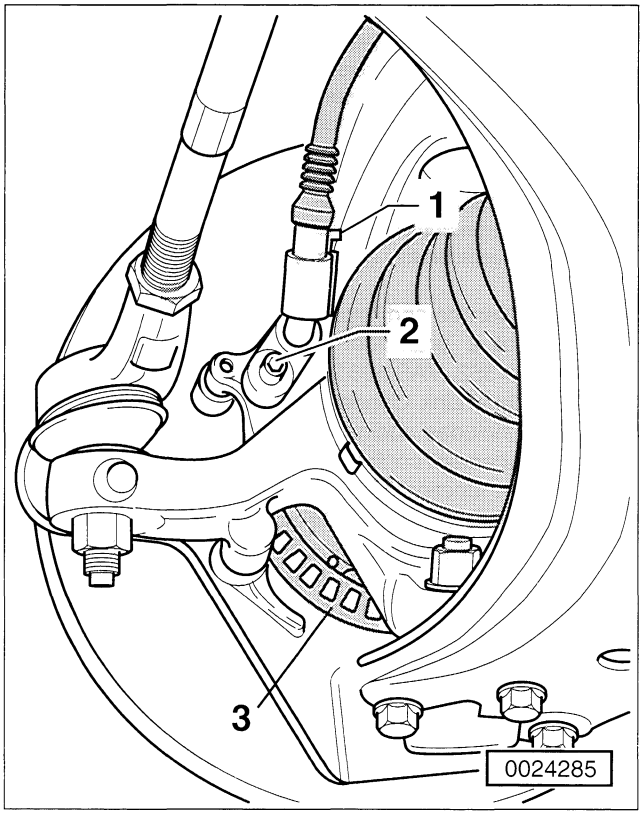
WHEEL SPEED SENSORS

Each wheel has a separate speed sensor to supply data to the ABS control module. Each sensor is also monitored by the control module and malfunctions will cause a DTC to be stored. The system checks the sensors for proper resistance when the ignition is first switched on and again for proper signal when the vehicle is in motion.

Front wheel speed sensor, replacing

– Raise car and support with jack stands or lift. See **0 Maintenance** for proper lifting procedure.

> ***WARNING —***
> *Observe all warnings and cautions associated with lifting vehicle in **0 Maintenance**.*



WHEEL SPEED SENSORS

➤ Disconnect harness connector (**1**) from wheel speed sensor. Rotor (**3**) is part of hub and cannot be replaced separately.

– Remove bolt (**2**) from wheel bearing housing.

– Remove sensor from bearing housing.

Specification

- ABS wheel speed sensor resistance, front and rear . . . . . 1,000 - 1,300 Ω

– Before installing sensor into bearing housing, clean mounting hole and lubricate with grease (VW part no. G 000 650 or equivalent).

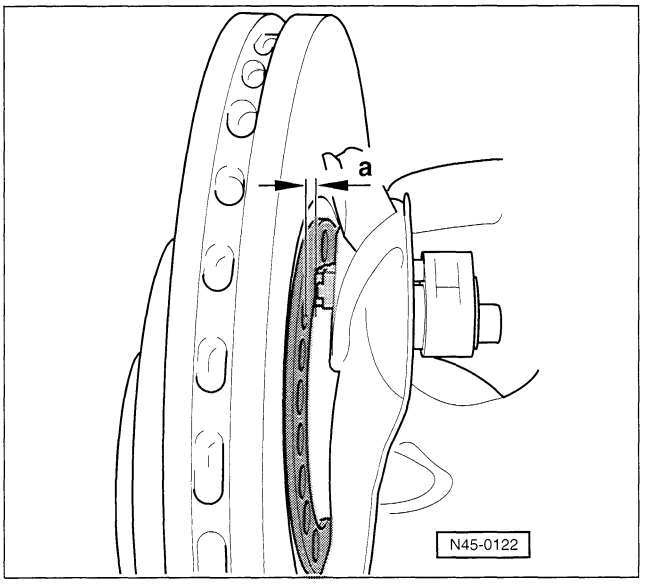
– Install sensor and bolt, reconnect harness connector.

Tightening torque

- Wheel speed sensor mounting bolt, front and rear, M6. . . . . 8 Nm (71 in-lb)

– Turn wheels fully to left and then to right. Check sensor wiring for interference and clearance.

Front ABS rotor, checking



– Raise car and support with jack stands or lift. See **0 Maintenance** for proper lifting procedure.

> ***WARNING —***
> *Observe all warnings and cautions associated with lifting vehicle in* **0 Maintenance**.

➤ Rotate brake disc and check whether wheel speed sensor is damaged or dirty. Check rotor runout by turning wheel hub and measure distance (**a**) between rotor and speed sensor at various places around the rotor.

ABS rotor runout

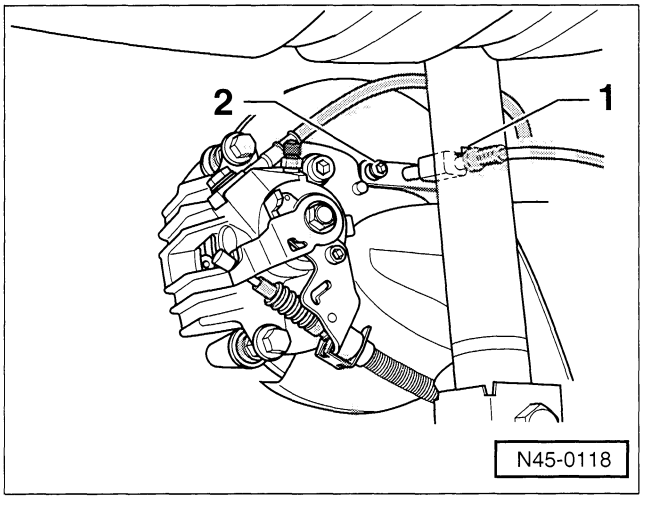
- Distance between ABS rotor and speed sensor . . . . . 0.3 mm (0.0118 in.)

– If rotor is damaged or runout is excessive, remove wheel hub with rotor and replace. See **40 Front Suspension and Drive Axles**.

Rear wheel speed sensor, replacing

– Raise car and support with jack stands or lift. See **0 Maintenance** for proper lifting procedure.

> ***WARNING —***
> *Observe all warnings and cautions associated with lifting vehicle in* ***0 Maintenance***.



➤ Disconnect harness connector (**1**) from wheel speed sensor.

– Remove ABS wheel sensor mounting bolt (**2**) from stub axle.

– Pull ABS wheel speed sensor out of stub axle.

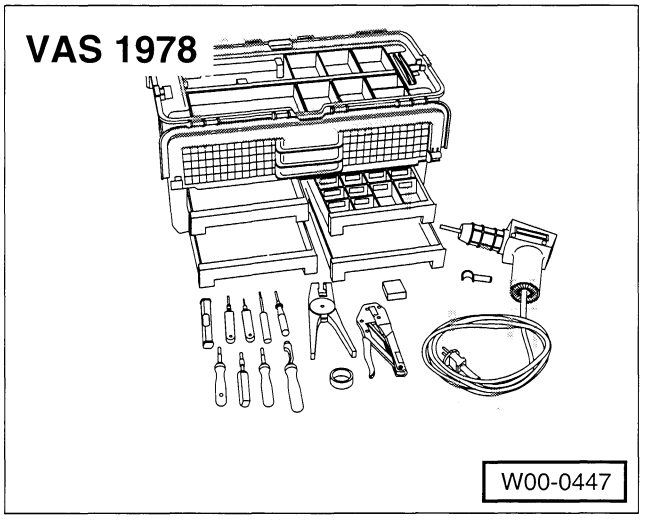
– Before installing sensor into bearing housing, clean mounting hole and lubricate with grease (VW part no. G 000 650 or equivalent).

– Install sensor and bolt, reconnect harness connector.

– Check sensor wiring for interference and clearance around suspension components.

Wheel speed sensor wiring

Wiring to individual wheel speed sensors can be repaired as needed rather than replacing a complete wiring harness. However, because of the low power signals involved, and the critical safety nature of the ABS system, only the Wiring Harness Repair Kit VAS 1978 must be used. Special tools to remove terminals from harness connectors without damage are also required and are part of the above mentioned kit.



➤ VAS 1978 Wiring Harness Repair Kit.

QUALITY REVIEW

When you have finished working under the hood and around other areas of the vehicle, it is advisable to take a moment to quality check or review your work. This helps to insure that the operation or repair has been completed properly with all affected systems functioning within normal parameters. These may include the following:

- Ensure that any coding and basic setting procedures requiring a scan tool or scan tool program have been properly concluded.
- During the final road test make at least one controlled brake test where the brake pedal is felt to pulsate (ABS operation).
- Ensure that all cable ties and clamps that were removed as part of the repair are replaced.
- Ensure that all fasteners and hardware were replaced and torqued as specified.
- Check and adjust brake fluid level.
- Make sure that all other components involved in the repair are positioned correctly, properly torqued and function properly.
- Make sure that all tools, shop cloths, fender covers and protective tapes are removed before closing the hood.
- Clean grease and fingerprints from painted surfaces, steering wheel and shifter.

46 Brakes–Mechanical Components

GENERAL 46-1

FRONT BRAKES 46-2
Front brake assembly (FS III caliper) 46-3
Front brake pads, removing and installing (FS III caliper) 46-4
Front brake assembly (FN 3 caliper) 46-6
Front brake pads, removing and installing (FN 3 caliper) 46-7

REAR BRAKES 46-9
Rear disc brake, assembly 46-9
Rear brake pads, removing and installing 46-10

PARKING BRAKE 46-13
Parking brake, adjusting 46-13
Parking brake cables, removing and installing 46-14
Parking brake lever assembly 46-16

GENERAL

This repair group covers service and repair to the brake friction components; brake pads and rotors. Also included here is parking brake service.

Vehicles covered by this manual are equipped with four wheel disc brakes and anti-lock brakes (ABS) as standard equipment.

NOTE —

- *For brake caliper and rear brake wheel cylinder repair information, see* **47 Brakes–Hydraulic System**.
- *For information on the ABS hydraulic unit and ABS service, see* **45 Anti-Lock Brakes (ABS)**.
- *Brake fluid should be flushed from the system every two years.* **See 47 Brakes–Hydraulic System**.

WARNING —

- *A properly functioning brake system is essential to safe driving. If the red brake/parking warning light or ABS warning light illuminates while driving, it is imperative that the system be given a thorough check, even if braking action still seems satisfactory. The brakes should be inspected regularly.*
- *Brake fluid is poisonous. Wear safety glasses when working with brake fluid, and wear rubber gloves to prevent brake fluid from entering the bloodstream through cuts or scratches. Do not siphon brake fluid by mouth.*
- *New brake pads and shoes require some break-in. Allow for slightly longer stopping distances for the first 100 to 150 miles of city driving, and avoid hard stops.*

WARNING —

- *All brake work must be done with cleanliness, careful attention to specifications, and proper working procedures. If you lack the skills, the tools, or a clean workplace for servicing the brake system, we suggest you leave these repairs to an authorized VW dealer or other qualified shop.*
- *After replacing brake components, depress the brake pedal firmly several times to seat the brakes in their normal operating position.The pedal should be firm and at its normal height, if not, further work is required before driving vehicle.*
- *Brake fluid is very damaging to paint. Immediately wipe up any brake fluid that spills on the vehicle.*

FRONT BRAKES

Two types of front discs are used on the cars covered by this manual. Repair procedures vary depending on caliper/rotor application. See the appropriate (FS III or FN 3) assembly view.

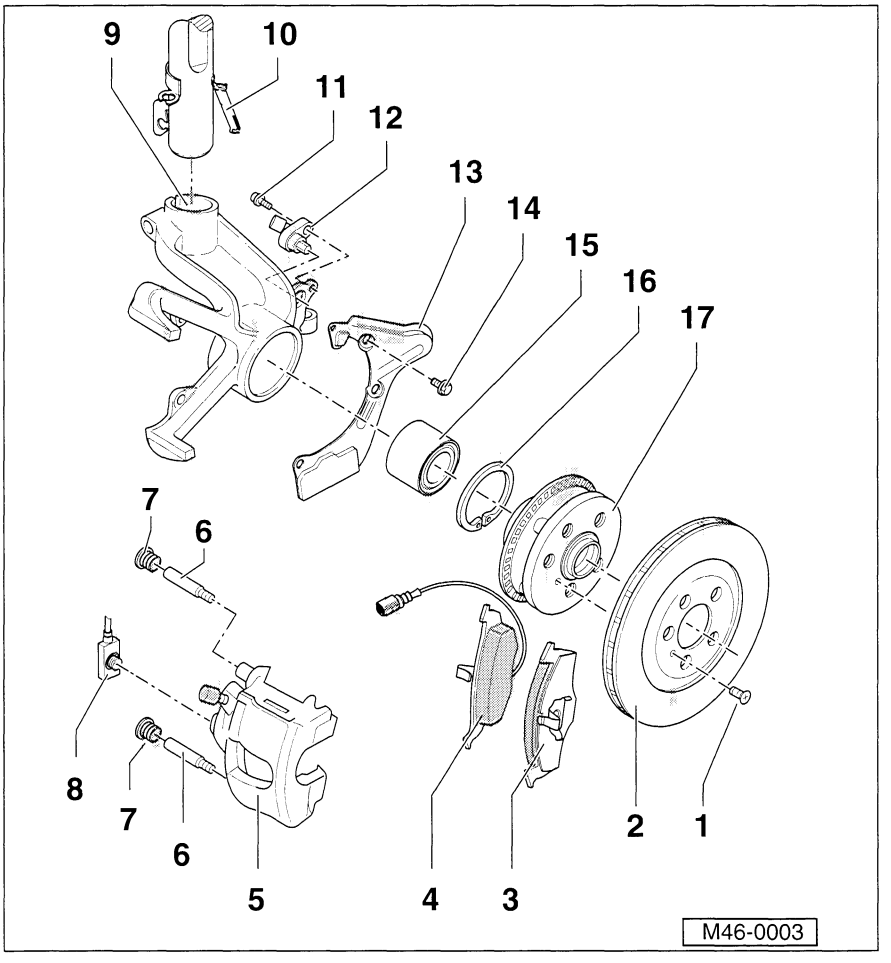
Caliper application	
• 1.8L	FN 3
• 1.9L	FS III
• 2.0L	FS III
• 2.8L	FN 3

Rotors should be inspected for cracks, scoring, glazing and warpage. Rotors must be replaced (in pairs) if either disc is worn below the minimum thickness specification or if any of the above listed defects are found.

NOTE —

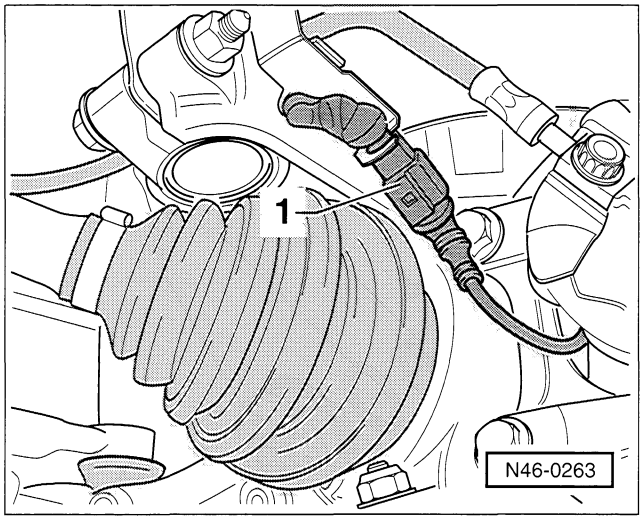
The minimum brake rotor thickness specification is stamped into the rotor's hub and also listed in the appropriate illustration.

Front brake assembly (FS III caliper)



1. **Screw**
   - Tighten to 4 Nm (35 in-lb)
2. **Brake disc (rotor), vented**
   - Diameter: 280 mm (11.02 in.)
   - Thickness: 22 mm (0.866 in.)
   - Wear limit: 19 mm (0.748 in.)
   - When worn always replace on both sides
   - Remove brake caliper before removing disc
   - Never remove brake discs from hub by using force. If necessary use penetrating fluid, otherwise brake discs can be damaged.
3. **Outer brake pad**
   - Thickness: 19.7 mm (0.775 in.) including backing plate
   - Checking thickness, see **0 Maintenance**
   - Wear limit: 7 mm (0.276 in.) including backing plate
   - Always replace all pads on one axle at same time
4. **Inner brake pad**
   - Thickness: 19.7 mm (0.775 in.) including backing plate
   - Checking thickness, see **0 Maintenance**
   - Wear limit: 7 mm (0.276 in.) including backing plate
   - Always replace all pads on one axle at same time
   - With wear limit indicator, as applicable
   - Warning lamp lights up on instrument panel when lining wear limit is reached, as applicable
5. **Brake caliper**
   - Do not loosen hydraulic line when replacing pads
6. **Guide pin**
   - Tighten to 30 Nm (22 ft-lb)
7. **Protective cap**
8. **Brake hose with union and banjo bolt**
   - Tighten to 35 Nm (26 ft-lb)
9. **Wheel bearing housing**
10. **Pad wear sensor connector bracket**
    - It is not necessary to remove harness connector from bracket when replacing brake pad wear indicator
11. **Socket-head bolt**
    - Tighten to 8 Nm (71 in-lb)
12. **ABS wheel speed sensor**
    - Before inserting sensor, clean hole inner surface and coat with grease (VW part no. G 000 650)
13. **Splash shield**
14. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
15. **Wheel bearing**
    - Replace each time after removing
    - Pressing out and in, see **40 Front Suspension and Drive Axles**
16. **Circlip**
17. **Wheel hub with rotor**
    - Removing and installing, see **40 Front Suspension and Drive Axles**

Front brake pads, removing and installing (FS III caliper)



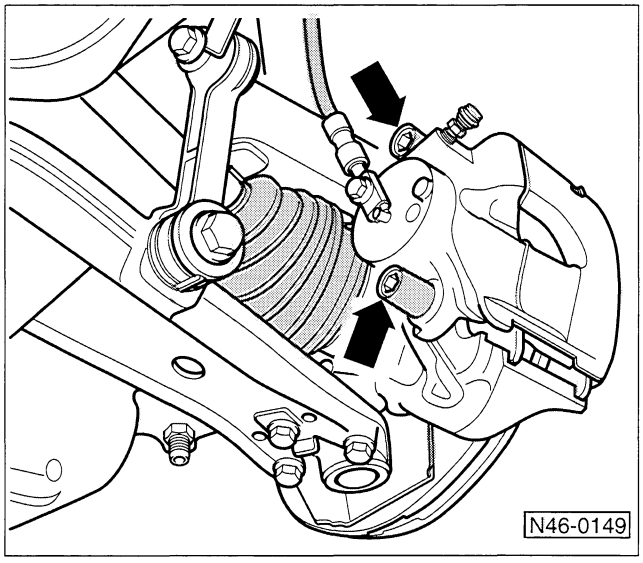
– Raise car and support with jack stands or lift. See **0 Maintenance** for proper lifting procedure.

> ***WARNING —***
> *Observe all warnings and cautions associated with lifting vehicle in* **0 Maintenance.**

– Remove front wheels.

– Remove guide pin protective caps.

◀ Disconnect harness connector (**1**) on vehicles with brake pad wear indicator.



◀ Remove both guide pins (**arrows**) from brake caliper.

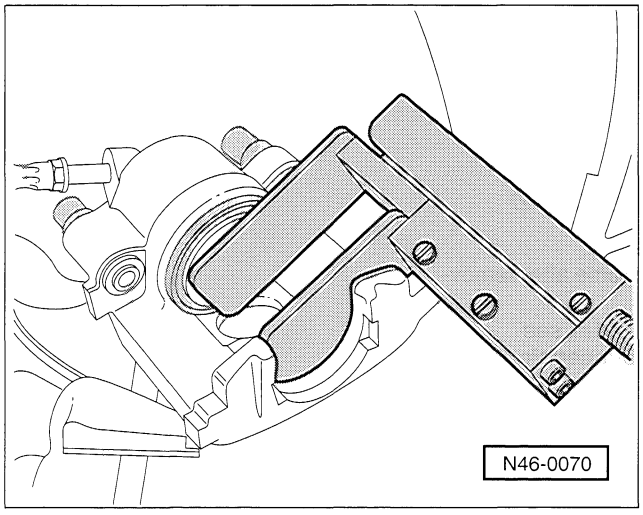
– Remove brake caliper housing and hang up with wire.

> ***WARNING —***
> • *Do not allow caliper to hang by the brake hose. The unsupported weight can stretch and damage the hose.*
>
> • *Do not disconnect the brake hose from the caliper when removing brake pads.*

– Remove brake pads from brake caliper housing.

– Before installing new pads extract some of the brake fluid from the brake fluid reservoir.

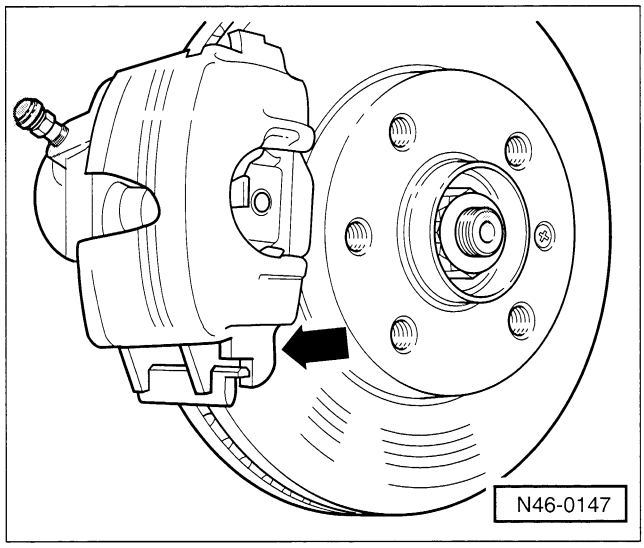
> ***WARNING —***
> *Brake fluid is poisonous. Never siphon by mouth.*



NOTE —
A full brake fluid reservoir may allow brake fluid to flow out and cause damage when pistons are pushed back.

◀ Press piston into caliper housing.

– Install brake pads with retaining spring in brake caliper housing.



➤ Install brake caliper back onto wheel bearing housing.
- Position lower brake caliper housing on first.
- The brake caliper housing tab (**arrow**) must be behind the wheel bearing housing guide.

– Mount brake caliper housing to brake carrier with both guide pins and install guide pin protective caps.

– Connect harness connector on vehicles with brake pad wear indicator.

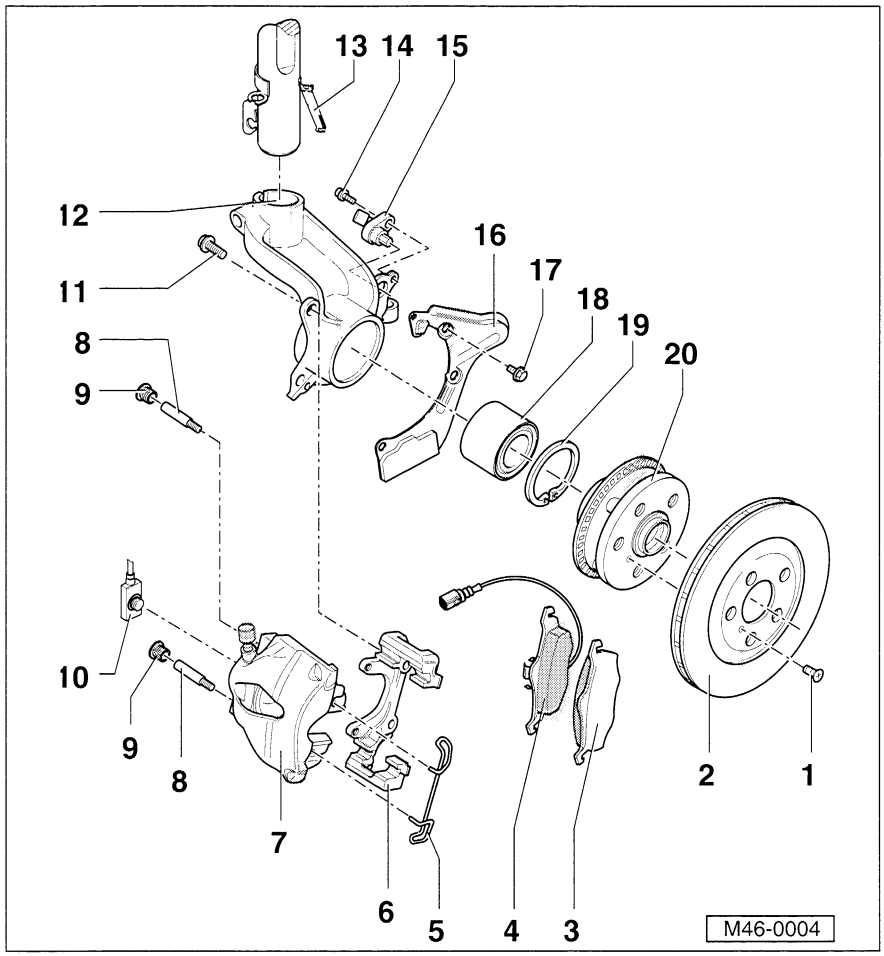
– Install wheels and lower vehicle.

Tightening torques
- Brake caliper to bearing housing . . . 30 Nm (22 ft-lb)
- Wheel bolt to hub . . . . . 120 Nm (89 ft-lb)

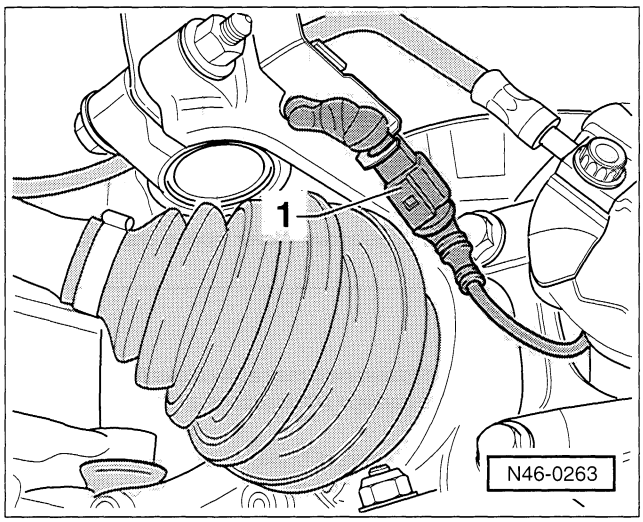
– Depress brake pedal firmly several times to seat brake pads to brake disc. Check brake fluid level.

– Repeat for the brakes on the other side of the vehicle as required.

Front brake assembly (FN 3 caliper)



1. **Screw**
   - Tighten to 4 Nm (35 in-lb)
2. **Brake disc (rotor), vented**
   - Diameter: 288 mm (11.34 in.)
   - Thickness: 25 mm (0.984 in.)
   - Wear limit: 22 mm (0.866 in.)
   - When worn always replace brake disc pairs on both sides
3. **Outer brake pad**
   - Thickness: 19.7 mm (0.775 in.) including backing plate
   - Checking thickness, see **0 Maintenance**
   - Wear limit: 7 mm (0.276 in.) including backing plate
   - Always replace all pads on one axle at same time
4. **Inner brake pad**
   - Thickness: 19.7 mm (0.775 in.) including backing plate
   - Checking thickness, see **0 Maintenance**
   - Wear limit: 7 mm (0.276 in.) including backing plate
   - Always replace all pads on one axle at same time
   - With wear limit indicator, as applicable
   - Warning lamp lights up on instrument panel when lining wear limit is reached, as applicable
5. **Retaining spring**
   - Insert in both brake caliper housings
6. **Brake carrier**
   - Supplied as replacement part
   - If protective caps are damaged, use repair kit
   - Use grease packet supplied to lubricate guide pins
7. **Brake caliper housing**
   - Do not disconnect brake hose when changing brake pads
8. **Guide pins**
   - Tighten to 28 Nm (21 ft-lb)
9. **Protective cap**
10. **Brake hose with union and banjo bolt**
    - Tighten to 35 Nm (26 ft-lb)
11. **Ribbed bolt**
    - Tighten to 125 Nm (92 ft-lb)
12. **Wheel bearing housing**
13. **Pad wear sensor connector bracket**
    - It is not necessary to remove harness connector from bracket when replacing brake pad wear indicator
14. **Socket-head bolt**
    - Tighten to 8 Nm (70 in-lb)
15. **ABS wheel speed sensor**
    - Before inserting sensor, clean hole inner surface and coat with grease (VW part no. G 000 650)
16. **Splash shield**
17. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
18. **Wheel bearing**
    - Replace each time after removing
    - Removing and installing, see **40 Front Suspension and Drive Axles**
19. **Circlip**
20. **Wheel hub with rotor**
    - Removing and installing, see **40 Front Suspension and Drive Axles**



Front brake pads, removing and installing (FN 3 caliper)

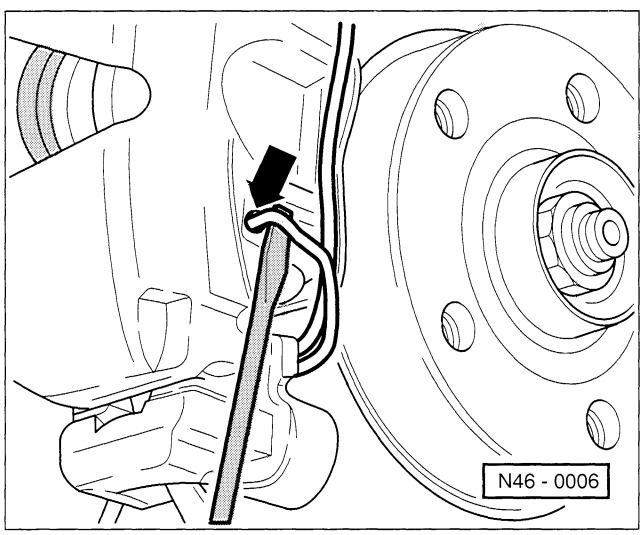
– Raise car and support with jack stands or lift. See **0 Maintenance** for proper lifting procedure.

> ***WARNING —***
> *Observe all warnings and cautions associated with lifting vehicle in* **0 Maintenance**.

– Remove front wheels.

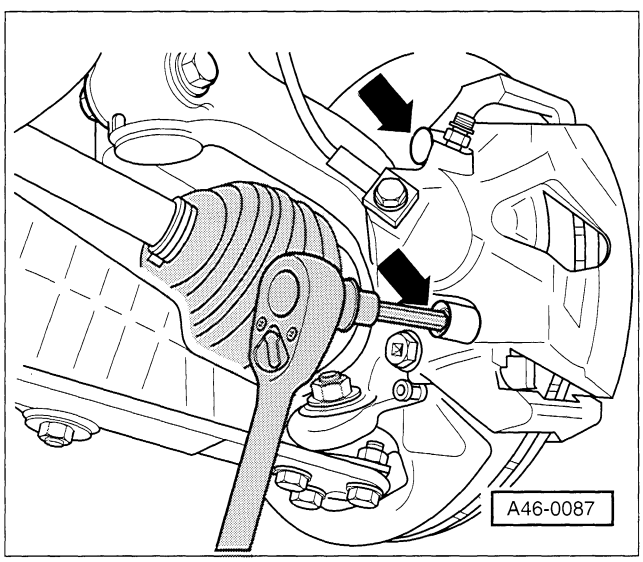
– Remove guide pin protective caps.

➤ Disconnect harness connector (**1**) on vehicles with brake pad wear indicator.



➤ Using a screwdriver, pry brake pad retaining spring (**arrow**) out of brake caliper housing and remove.

> ***WARNING —***
> *Wear appropriate eye protection when removing retaining spring.*



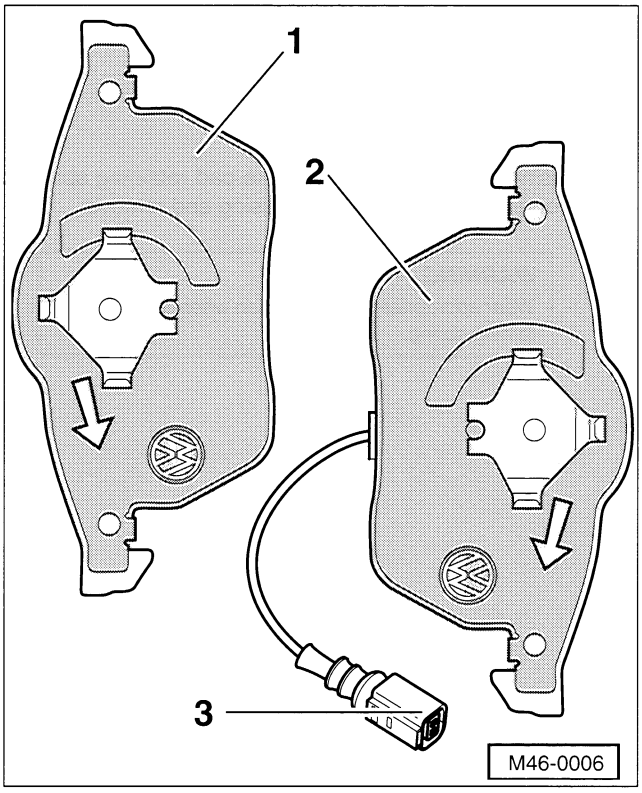
➤ Remove both caliper guide pins (**arrows**) from brake caliper.

– Remove brake caliper housing and hang up with wire.

> ***WARNING —***
> • *Do not allow caliper to hang by the brake hose. The unsupported weight can stretch and damage the hose.*
>
> • *Do not disconnect the brake hose from the caliper when removing brake pads.*

– Remove brake pads.

– Clean brake caliper housing, especially bonding surface for brake pad. Surfaces must be free of adhesive or grease residue.



– Before installing new pads:
  • Remove protective foil from adhesive on pad backing plate if equipped.
  • Extract some of the brake fluid from the brake fluid reservoir.

> ***WARNING —***
> *Brake fluid is poisonous. Never siphon brake fluid by mouth.*

NOTE —
A full brake fluid reservoir may allow brake fluid to flow out and cause damage when pistons are pushed back.

➢ Be sure to install correct brake pads into left (**2**) and right (**1**) calipers. Install pad with wear indicator (**3**), as applicable, in the inside position. If pad has an arrow on the backing plate (as shown), it must point DOWN.

– Press piston into caliper housing and install brake pads.

– Install outer brake pad in brake caliper.

– Install brake caliper housing with both guide pins to brake carrier.

– Install guide pin protective caps.

– Connect harness connector on vehicles with brake pad wear indicator.

– Insert retaining spring into brake caliper housing.

– Install wheels and lower vehicle.

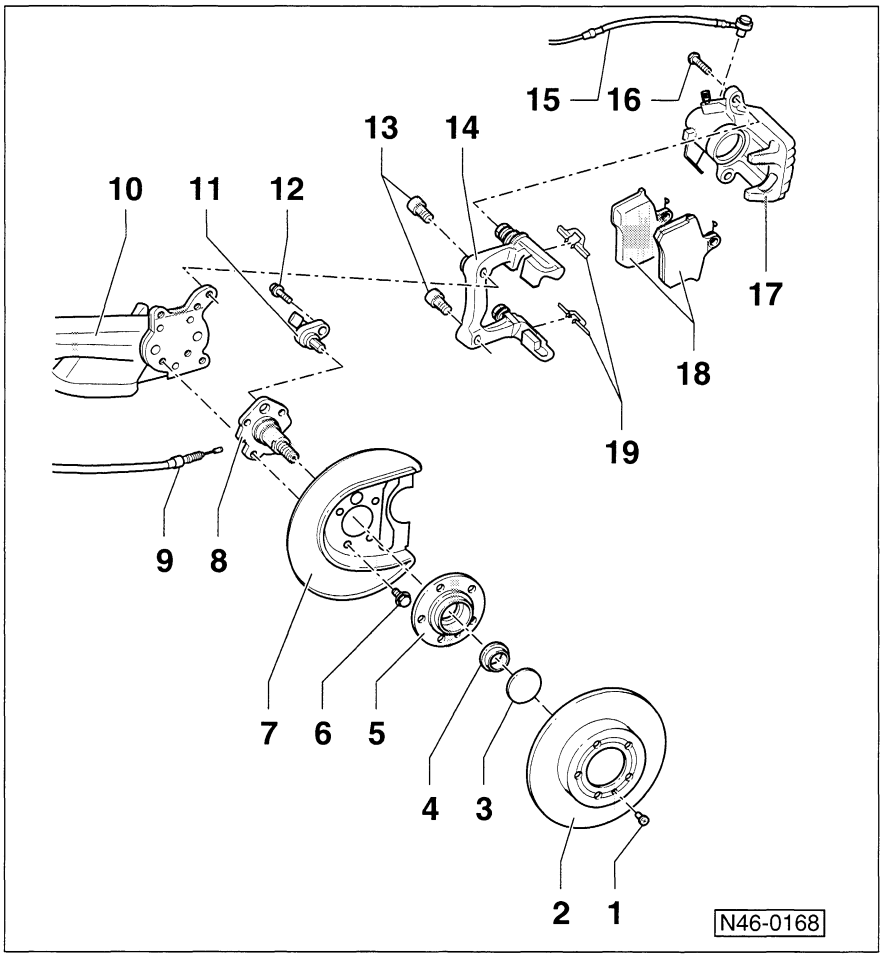
Tightening torques
- Brake caliper to bearing housing . . . 28 Nm (21 ft-lb)
- Wheel bolt to hub . . . . . 120 Nm (89 ft-lb)

– Depress brake pedal firmly several times to seat brake pads to brake disc. Check brake fluid level and add as necessary.

– Repeat for the brakes on the other side of the vehicle as required.

REAR BRAKES

Rear disc brake assembly



1. **Screw**
   - Tighten to 4 Nm (35 in-lb)
2. **Brake disc (rotor)**
   - Solid:
     Diameter: 232 mm (9.13 in.)
     Thickness: 9 mm (0.354 in.)
     Wear limit: 7 mm (0.275 in.)
   - Vented
     Diameter: 256 mm (10.79 in.)
     Thickness: 22 mm (0.866 in.)
     Wear limit: 20 mm (0.787 in.)
   - When worn, always replace on both sides.
3. **Cap**
   - Removing and installing, see **42 Rear Suspension**
4. **Self-locking nut**
   - Tighten to 175 Nm (129 ft-lb)
   - Always replace after removing
5. **Wheel hub with wheel bearing and ABS rotor**
   - Always replace after removing
   - Only replace as complete unit
   - Removing and installing, see **42 Rear Suspension**
6. **Bolt**
   - Tighten to 60 Nm (44 ft-lb)
   - With dished spring washer
7. **Splash shield**
8. **Stub axle**
9. **Parking brake cable**
10. **Axle beam**
11. **ABS wheel speed sensor**
    - Before inserting sensor, clean installation hole inner surface and coat with grease (VW part no. G 000 650)
12. **Socket-head bolt**
    - Tighten to 8 Nm (71 in-lb)
13. **Socket-head bolt**
    - Tighten to 65 Nm (48 ft-lb)
14. **Brake carrier with guide pins and protective cap**
    - Supplied as replacement part assembled with sufficient grease on guide pins
    - If protective caps or guide pins are damaged use repair kit
    - Use grease packet supplied to lubricate guide pins.
15. **Brake hose with union and banjo bolt**
    - With seals
    - Tighten to 38 Nm (28 ft-lb)
    - Do not disconnect brake hose when changing brake pads
16. **Self-locking bolt**
    - Tighten to 35 Nm (26 ft-lb)
    - Always replace
17. **Brake caliper**
    - Adjust parking brake cable after maintenance or replacement.
    - Do not pull parking brake before adjusting it
18. **Brake pads**
    - Thickness: 16.9 mm (0.665 in.) including backing plate
    - Wear limit (includes backing plate): 7.5 mm (0.295 in.)
    - Checking thickness, see **0 Maintenance**
    - Always replace all pads on one axle at same time
19. **Pad retaining springs**
    - Always replace springs when changing pads

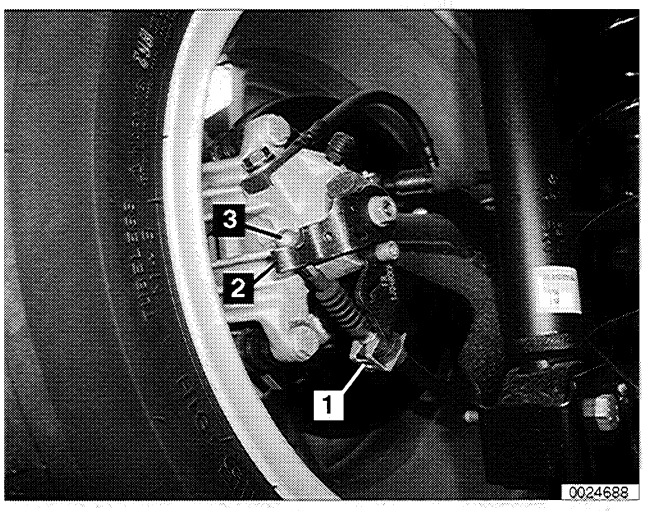
Rear brake pads, removing and installing

NOTE —
If re-using brake pads, mark pad position before removing. Reinstall brake pads in their original position to prevent uneven braking.

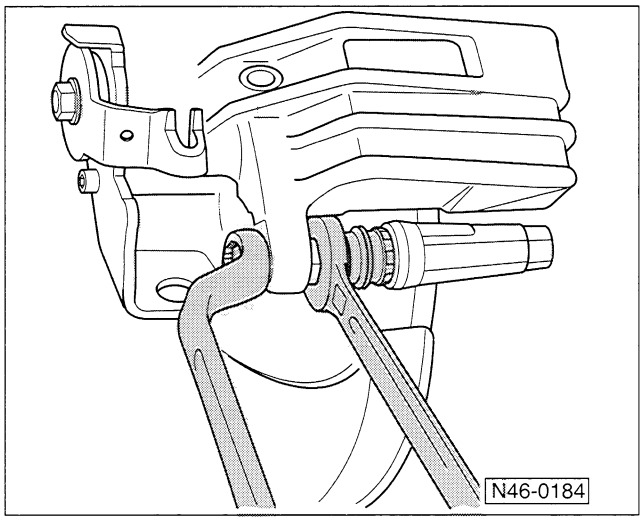
– Raise car and support with jack stands or lift. See **0 Maintenance** for proper lifting procedure.

> ***WARNING —***
> *Observe all warnings and cautions associated with lifting vehicle in* **0 Maintenance.**

– Remove rear wheels.

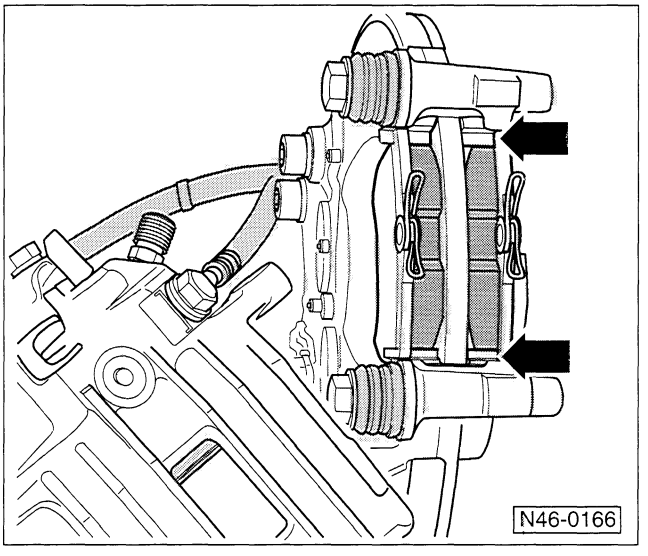


➤ Remove retaining clip (**1**) for parking brake cable. Press brake lever (**2**) downward and unhook parking brake cable (**3**) from lever (**2**).



➤ Remove bolts from brake caliper housing while counterholding guide pins. Remove brake caliper and hang up with wire.

> ***WARNING —***
> • *Do not allow caliper to hang by the brake hose. The unsupported weight can stretch and damage the hose.*
>
> • *Do not disconnect the brake hose from the caliper when removing brake pads.*



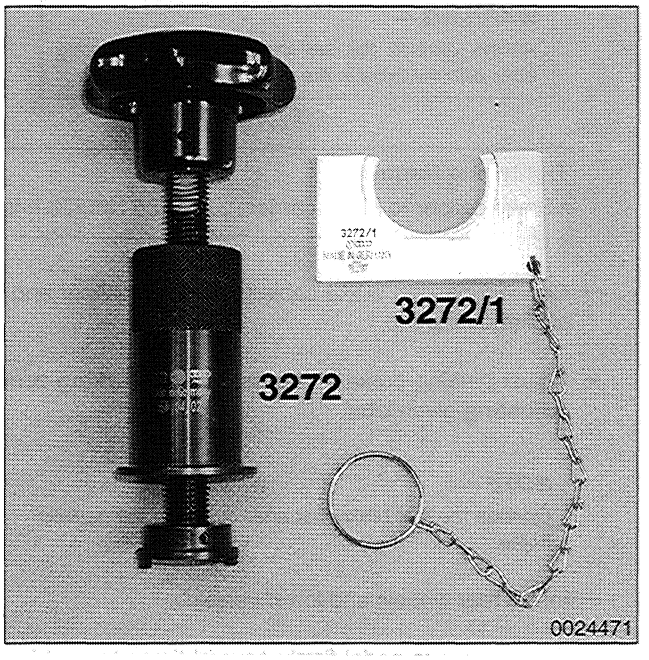
➤ Remove brake pads and pad retaining springs (**arrows**).

– Clean brake caliper housing, especially bonding surface for brake pad. Bonding surfaces must be free of adhesive and grease residues.

– Before installing new pads:
  - Remove protective foil from adhesive on pad backing plate if equipped.
  - Extract some of the brake fluid from the brake fluid reservoir.

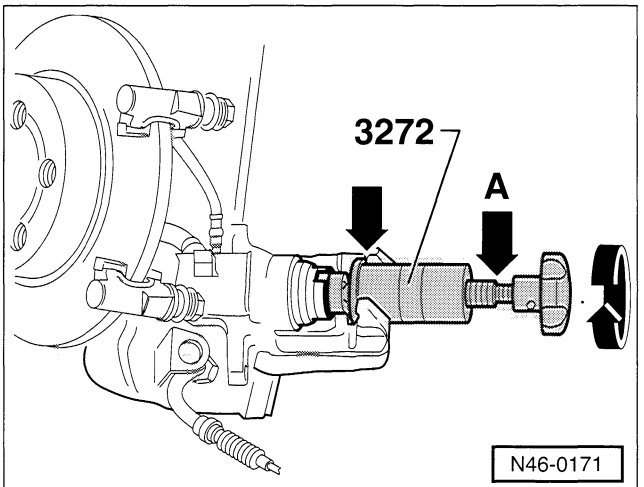
> ***WARNING —***
> *Brake fluid is poisonous. Never siphon brake fluid by mouth.*

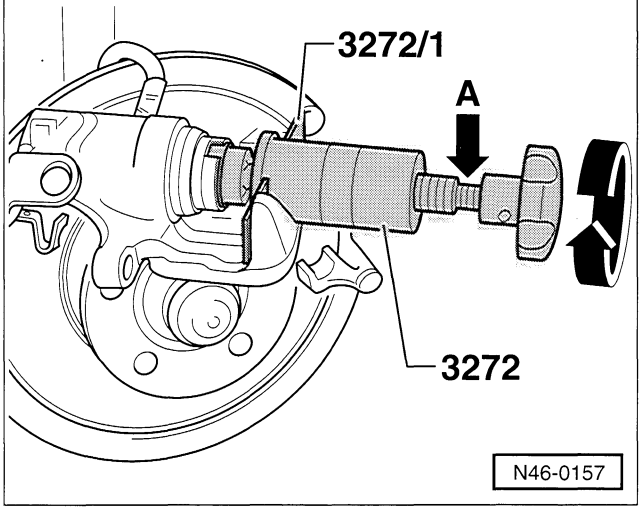
NOTE —
- *A full brake fluid reservoir may allow brake fluid to flow out and cause damage when pistons are pushed back.*
- *Use a bleeder bottle or plastic bottle which is used only for brake fluid.*



➤ Rear brake caliper piston *must* be pushed in while simultaneously being turned. Use of a dual purpose tool such as Volkswagen special tool **3272** is highly recommended. Some larger calipers will require an adapter plate **3272/1**, to bridge the span of the caliper frame.

NOTE —
A newer version of tool 3272 has been released under the number T10165. This new tool supersedes 3272 and can be used on vehicles covered by this manual.





➢ Reset caliper's automatic adjustment mechanism using Volkswagen special tool 3272 or equivalent by turning piston clockwise (**rotational arrow**) while pushing in. An open-ended 13 mm wrench can be used on flats (**A**) if necessary. It may also be necessary to use adapter plate 3272/1 if caliper frame is too large (see lower illustration at left).

> ***WARNING —***
> *• If the piston is not reset correctly, or if the brake pedal is operated with the caliper removed, the automatic adjustment mechanism will be destroyed.*
>
> *• Always remove some brake fluid from the reservoir before resetting and pushing the caliper piston in. When the piston is pushed in, fluid is forced up into the reservoir.*

– Insert brake pads and brake pad retaining springs into brake carrier.

– Install brake caliper housing with new self-locking bolts.

> ***WARNING —***
> *Always replace the self-locking caliper mounting bolts with the ones in the repair kit.*

Tightening torque

• Brake caliper to brake carrier . . . . . 35 Nm (26 ft-lb)

– Connect parking brake cable to lever on caliper and install retaining clip.

– Adjust parking brake if necessary, see **Parking brake, adjusting** given later.

> ***NOTE —***
> *Operate the foot brake first after adjusting the parking brake.*

– Install rear wheels and lower vehicle.

– Depress brake pedal firmly several times to seat brake pads to brake disc. Check brake fluid level and add as necessary.

– Repeat for the brakes on the other side of the vehicle as required.

PARKING BRAKE

The cable-operated parking brake mechanically actuates the rear caliper pistons independent of the hydraulic brake system. Because of the automatic rear wheel brake adjustment there is normally no need to adjust the parking brake. The parking brake must be adjusted only if the parking brake cables, brake calipers or brake discs are replaced.

Parking brake, adjusting

– Remove center console extension, see **70 Trim-Interior**.

– Raise car and support with jack stands or lift. See **0 Maintenance** for proper lifting procedures.

> ***WARNING —***
> *Observe all warnings and cautions associated with lifting vehicle in* **0 Maintenance**.

– Firmly depress brake pedal three times.

– Pull parking brake up firmly three times and then fully release.

– With parking brake lever in full off (at rest) position, tighten adjusting nut on cable at lever (**upper arrow**) until parking brake lever on caliper lifts off the stop (**lower arrow**).

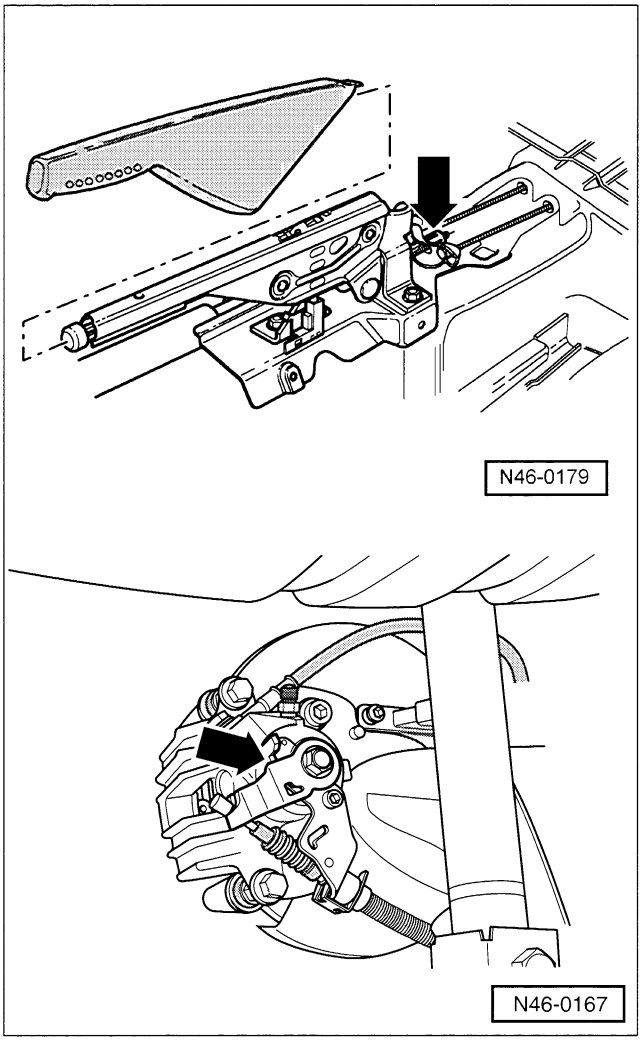
– Adjust nut on cable at lever (**upper arrow**) until a gap (**lower arrow**) of at least 1.0 mm (.039 in.) but no more than 3.0 mm (.118 in.) is present on each side.

– Check that both wheels turn freely. Adjust (back off) the adjustment nut if necessary.

– Apply and release parking brake and re-check that both wheels turn freely. Readjust as necessary.

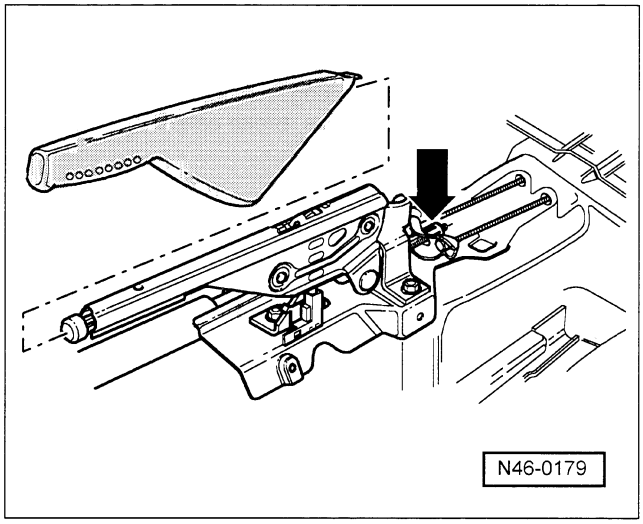
– Install center console extension.

– Lower vehicle.


N46-0179

N46-0167

Parking brake cables, removing and installing



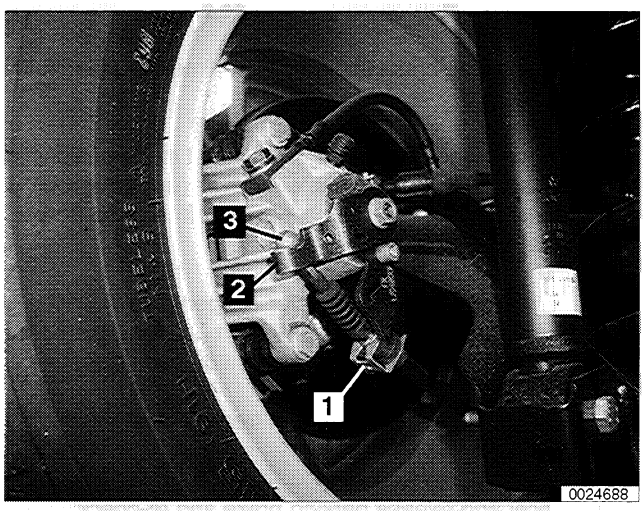
– Remove center console extension, see **70 Trim-Interior**.

– Fully release parking brake.

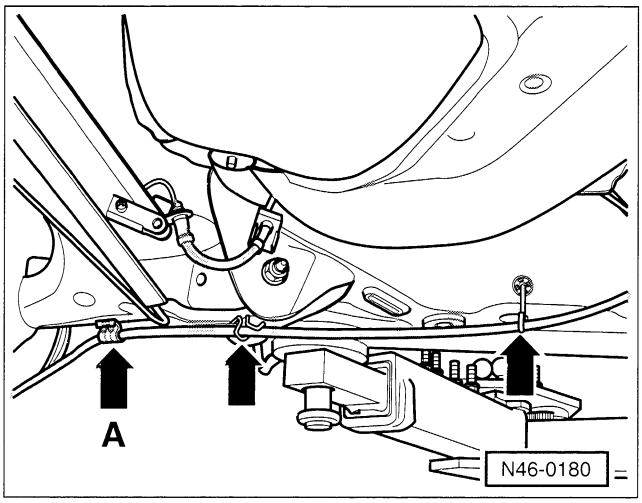
➢ Loosen parking brake adjustment nut (**arrow**) until parking brake cable can be unhooked from compensator (yoke).

– Raise car and support with jack stands or lift. See **0 Maintenance** for proper lifting procedures.

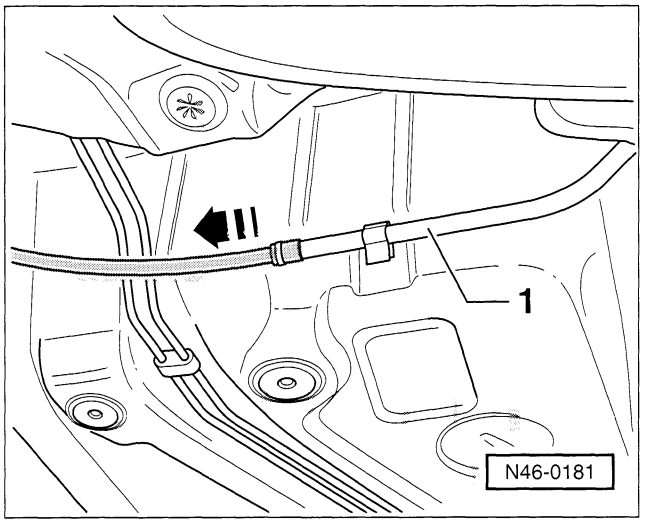
> ***WARNING —***
> *Observe all warnings and cautions associated with lifting vehicle in* **0 Maintenance**.



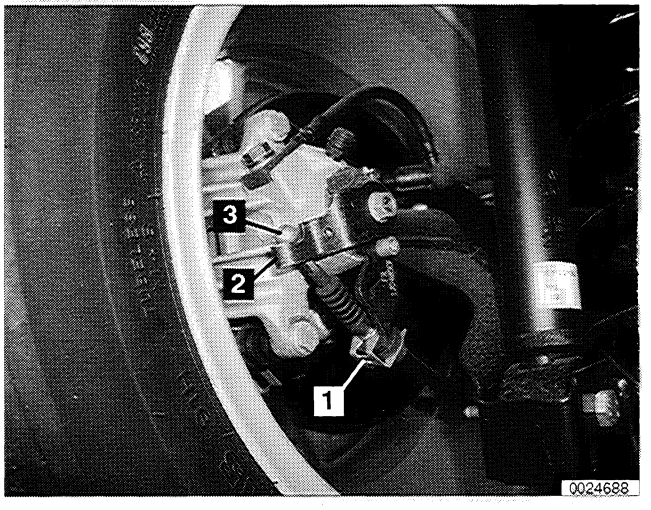
➢ Remove retaining clip (**1**) for parking brake cable. Press brake lever (**2**) downward and unhook parking brake cable (**3**) from lever (**2**).



➢ Unclip parking brake cable from retainers on rear axle (**arrow A**) and additional retainers (**arrows**) on underbody.



- Pull parking brake cable out of guide tube (**1**) in direction of **arrow**.
- Begin installation by sliding parking brake cable into guide tube.



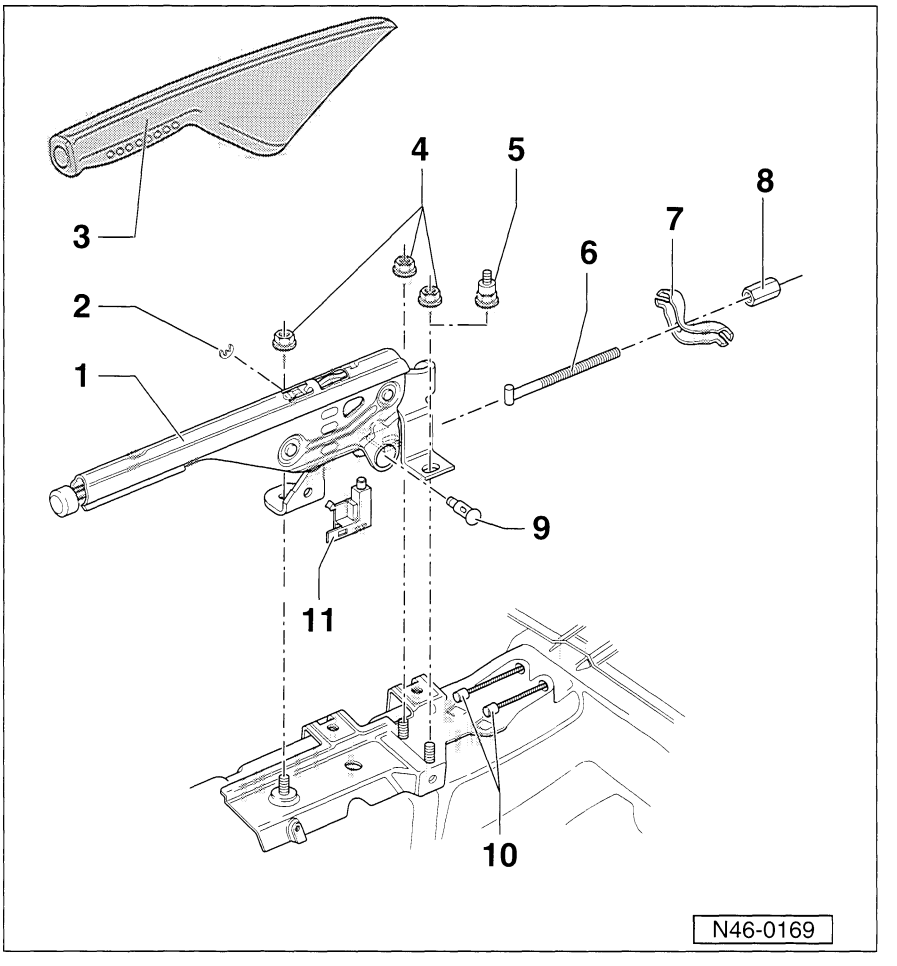
- Slide parking brake cable (**3**) and boot through hole in mounting bracket on caliper. Push lever (**2**) on caliper down, attach cable (**3**) to lever (**2**), and install retaining clip (**1**).
- Clip parking brake cable into retainer on rear axle.

NOTE —
Parking brake cable clamp ring must lie in middle of clip.

- Attach parking brake cable to retainers on underbody.
- Hook parking brake cable into compensator (yoke) at parking brake lever.
- Slide compensator (yoke) onto pull rod and install adjustment nut.
- Adjust parking brake, see **Parking brake, adjusting** given earlier.
- Lower vehicle.
- Install center console extension.

Parking brake lever assembly

1. **Parking brake lever**
   - Before removing remove center console
2. **Circlip**
3. **Parking brake lever trim**
   - Several different versions installed, removal is the same
   - Pry up release tab in rear lower area of trim with a small screwdriver
   - Pull off toward front
4. **Nuts**
   - Tighten to 25 Nm (18 ft-lb)
5. **Adapter**
   - For vehicles with center armrest
6. **Pull rod**
7. **Compensator (yoke)**
8. **Adjusting nut**
   - Adjustment for parking brake
9. **Fulcrum (pivot) pin**
   - Pull rod (item 6) passes through fulcrum pin which holds both in place
10. **Parking brake cables**
11. **Parking brake warning light switch (F9)**



47 Brakes–Hydraulic System

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Brake service precautions. 47-1

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GENERAL

This repair group covers service and repair to the hydraulic and vacuum-assist brake system components. Also included here is brake bleeding. Cars covered by this manual are equipped with front and rear disc brakes. Some cars are also equipped with anti-lock brakes (ABS).

NOTE —
This repair group does not cover the anti-lock braking system hydraulic unit (with integral master cylinder). For information on the ABS system see **45 Anti-Lock Brakes (ABS)**.

Brake service precautions

The following warnings and cautions should be read before servicing the brake hydraulic system:

> ***WARNING —***
> *A properly functioning brake system is essential to safe driving. If the red brake/parking warning light or the ABS warning light illuminates while driving, it is imperative that the system be given a thorough check, even if braking action still seems satisfactory. The brakes should be inspected regularly.*

WARNING —

- *Brake fluid is poisonous. Wear safety glasses and rubber gloves when working with brake fluid. Prevent brake fluid from entering the bloodstream through cuts or scratches. Do not siphon brake fluid by mouth.*
- *Brake fluid absorbs moisture from the air and must be replaced every two years. Use only new, approved brake fluid that complies with MVSS 116 DOT 4. Do not use silicone-based brake fluid (DOT 5). Even the smallest traces can cause severe corrosion in the brake system.*
- *Always disconnect battery negative (–) cable when working at or near pedal cluster.*
- *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using a VAG 1551/1552 or equivalent scan tool.*
- *Before disconnecting the battery be sure to obtain the anti-theft radio code.*
- *After replacing brake components, depress the brake pedal firmly several times to seat the brakes in their normal operating position. The pedal should be firm and at its normal height, if not, further work is required before driving vehicle.*
- *Brake fluid is very damaging to paint.*

FRONT BRAKE CALIPER

Two types of front calipers are used on the cars covered by this manual. Repair procedures vary depending on caliper application. See the appropriate (FS III or FN 3) assembly view.

Caliper application	
• 1.8L	FN 3
• 1.9L	FS III
• 2.0L	FS III
• 2.8L	FN 3

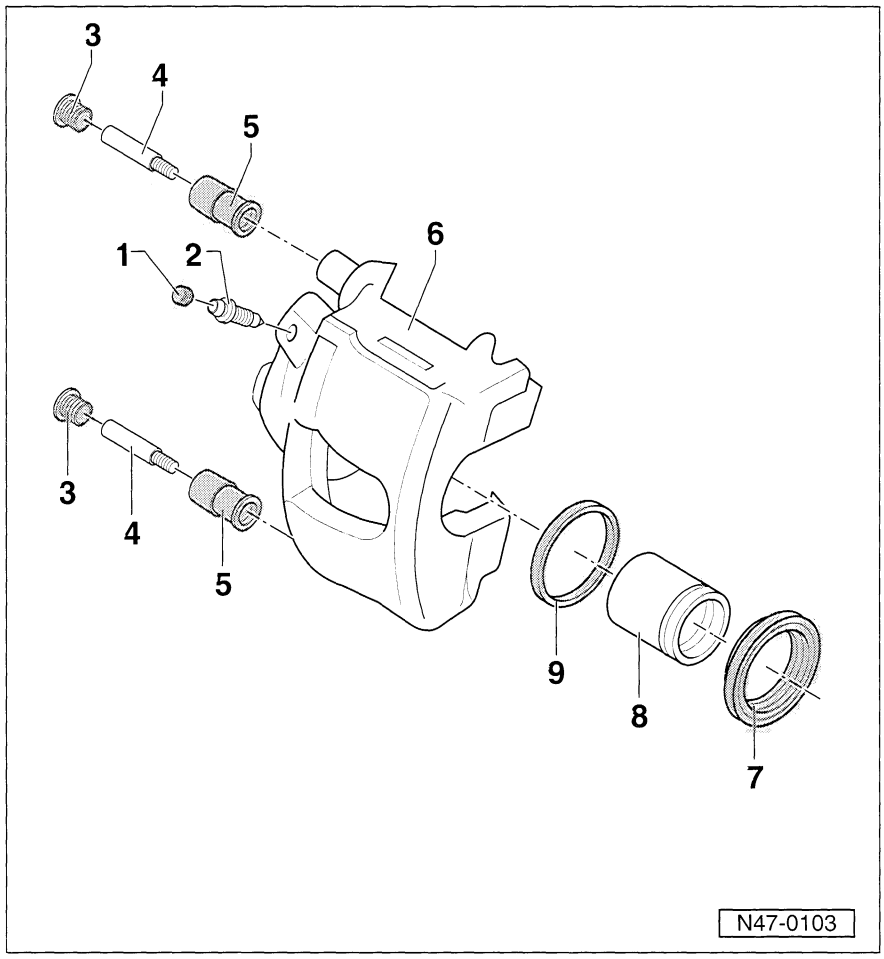
NOTE —

- *Install all parts in repair kit.*
- *New brake calipers are filled with brake fluid and are pre-bled.*
- *When assembling, apply a thin coat of grease (VW part no. G052 150 A2) to brake cylinders, pistons and seals.*

FRONT BRAKE CALIPER

Front brake caliper (FS III) assembly

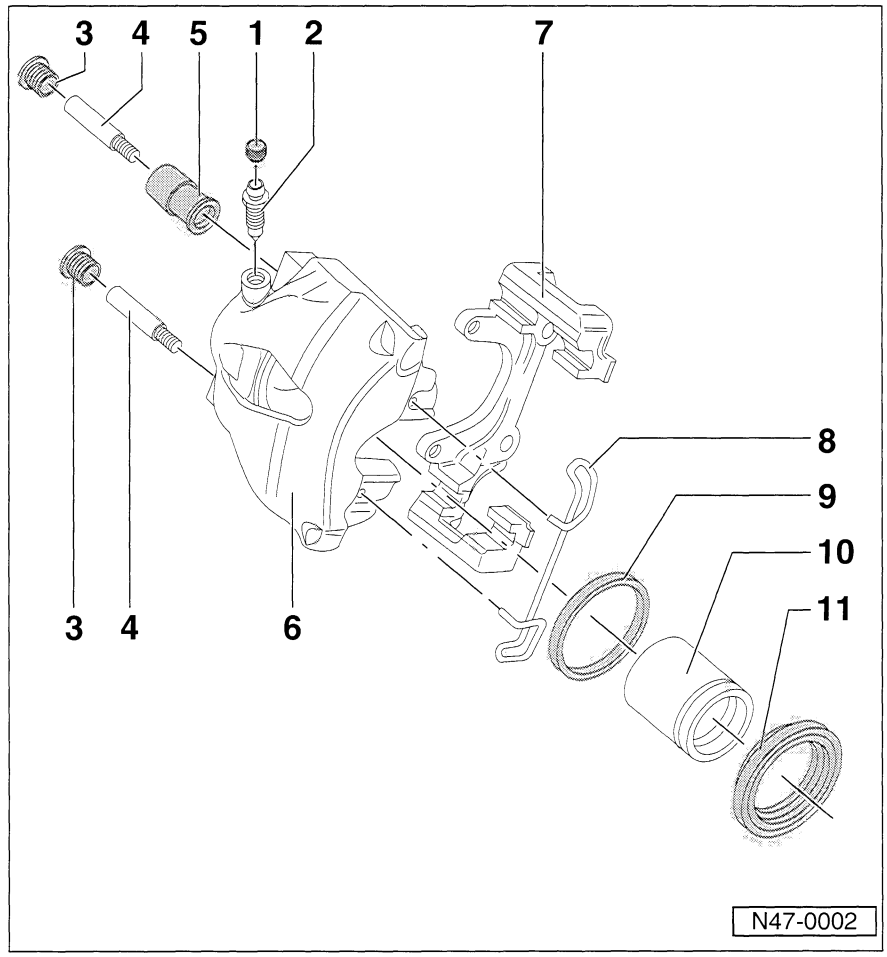
1. **Dust cap**
   - Always reinstall after bleeding brakes
2. **Bleeder valve**
   - Apply thin coating of assembly lubricant G 052 150 A2 to threads prior to installation
3. **Cap**
   - Snap into mounting bushing
4. **Guide pins**
   - Tighten to 30 Nm (22 ft-lb)
5. **Mounting bushing**
   - Insert into brake caliper housing
6. **Brake caliper housing**
7. **Piston seal (outer seal)**
   - Do not damage when servicing caliper or pads
8. **Caliper piston**
   - Apply thin coating of assembly lubricant G 052 150 A2 to threads prior to installation
   - See **Front caliper piston, removing and installing (FS III and FN 3)**
9. **Piston seal (inner seal)**



NOTE —

- *Install all parts in repair kit.*
- *When assembling, apply a thin coat of grease (VW part no. G052 150 A2) to brake cylinders, pistons and seals.*

Front brake caliper (FN 3) assembly



1. **Dust cap**
   - Always reinstall after bleeding brakes
2. **Bleeder valve**
   - Apply thin coating of assembly lubricant G 052 150 A2 to threads prior to installation
3. **Cap**
   - Snap into mounting bushing
4. **Guide pin**
   - Tighten to 30 Nm (22 ft-lb)
5. **Mounting bushing**
   - Insert into brake caliper housing
6. **Brake caliper housing**
7. **Brake carrier (frame)**
8. **Retaining spring**
   - Insert with both ends in holes in brake caliper housing
9. **Piston seal (inner seal)**
10. **Caliper piston**
    - Apply thin coating of assembly lubricant G 052 150 A2 to threads prior to installation
    - Piston diameter: 54 mm (2.125 in.)
    - See **Front caliper piston, removing and installing (FS III and FN 3)**
11. **Piston seal (outer seal)**
    - Do not damage when servicing caliper or pads

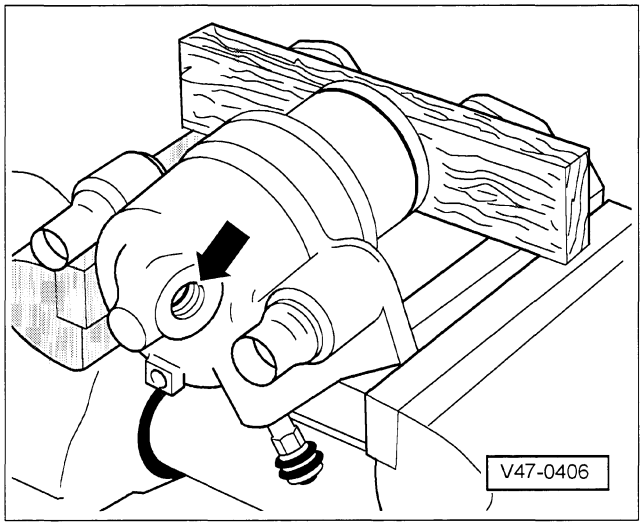
NOTE —

- *Install all parts in repair kit.*
- *New brake calipers are filled with brake fluid and are pre-bled.*
- *When assembling, apply a thin coat of grease (VW part no. G052 150 A2) to brake cylinders, pistons and seals.*

Front caliper piston, removing and installing (FS III and FN 3)

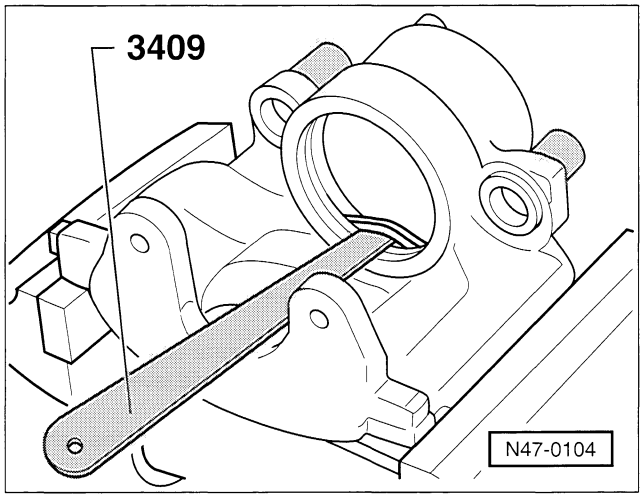
– Remove brake caliper and pads as described in **46 Brakes–Mechanical Components**.

NOTE —
If reusing brake pads, mark pad position before removing. Reinstall brake pads in their original position to prevent uneven braking.



➢ Force piston out of brake caliper housing using compressed air at brake hose inlet (**arrow**). Use a block of wood to keep piston from shooting out.

WARNING —
- *Place a piece of wood in the recess to prevent damaging the piston.*
- *Use only enough air pressure to force piston out.*
- *Always wear safety goggles when working with compressed air.*



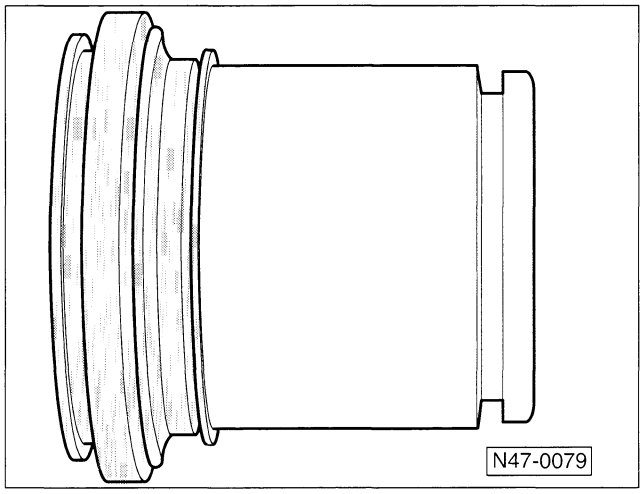
➢ Carefully remove inner piston seal using a plastic wedge such special tool **3409** or a "glass stick".

WARNING —
When removing, use care to ensure that the cylinder bore is not damaged.

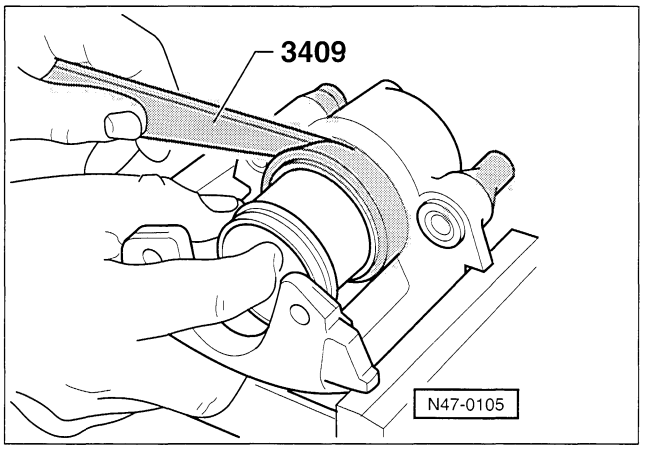
– Clean caliper and piston with special cleaners designed specifically for the purpose and then dry.

– Lubricate piston, cylinder bore, and new inner seal lightly with VW assembly grease G052 150 A2 or equivalent.

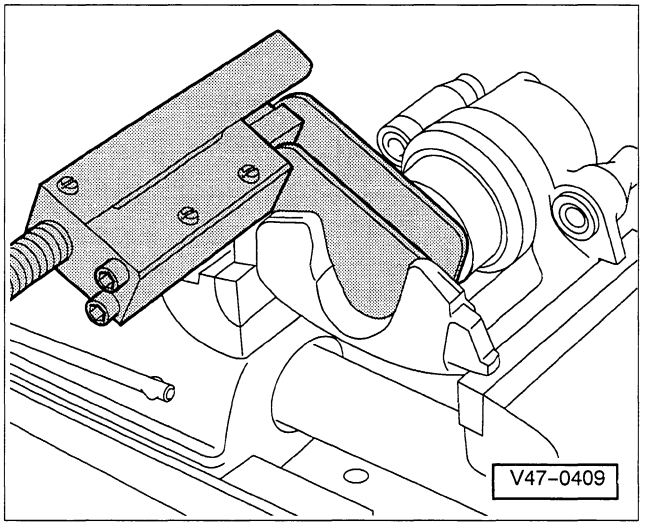
– Install new piston seal in caliper.



➢ Install new outer piston seal with outer sealing lip on lower end of piston as shown.



Hold piston in front of caliper housing and work inner sealing lip of outer piston seal into grove in cylinder bore using a plastic wedge or **3409**.



Carefully press piston into brake caliper housing using piston resetting tool. Outer piston seal should slide on piston and slip into the piston groove.

NOTE —
The outer sealing lip of the outer piston seal must slip into the piston groove.

– Install brake pads. If reusing original pads, note position marks made before removing.

– Install brake caliper(s) and bleed system.

– Install wheels and lower vehicle.

Tightening torque
• Wheel bolt to hub . . . . . 120 Nm (89 ft-lb)

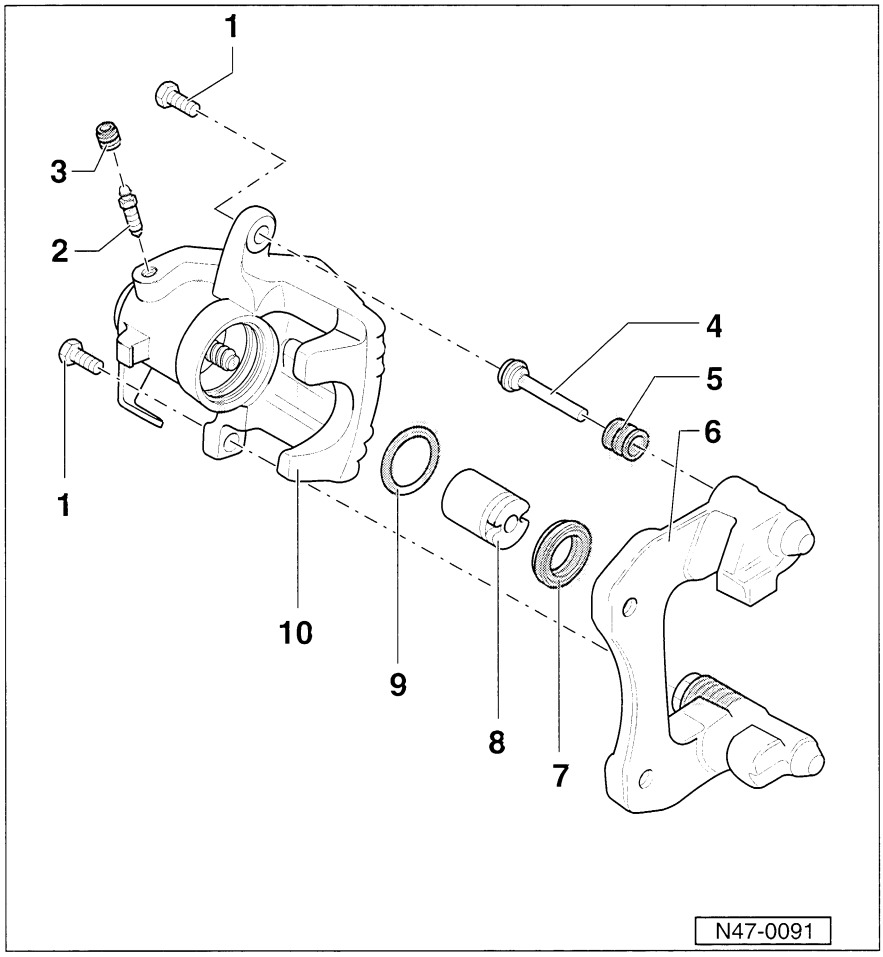
– Depress brake pedal firmly several times to seat brake pads to brake disc. Check brake fluid level.

– Repeat for the brakes on the other side of the vehicle as required.

– Be sure to quality check your work.

REAR BRAKES

Rear brake caliper assembly

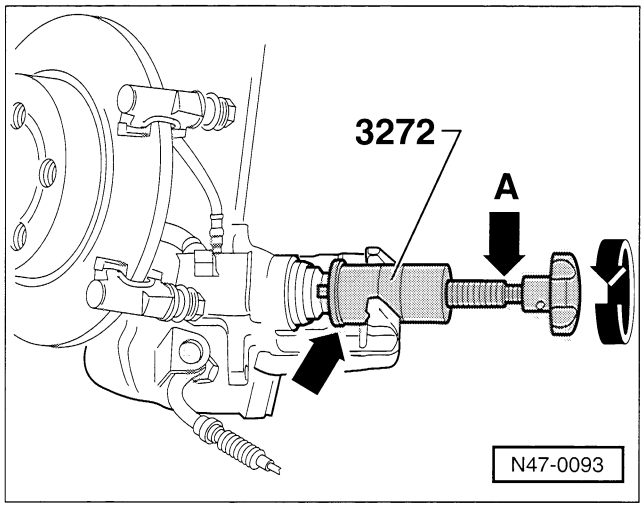


1. **Bolt, self-locking hex**
   - Tighten to 35 Nm (26 ft-lb)
   - Always replace
   - When loosening and tightening, counter-hold on guide pin
2. **Bleeder screw**
   - Tighten to 11 Nm (97 in-lb)
   - Apply thin coating of assembly lubricant G 052 150 A2 to threads prior to installation
3. **Dust cap**
   - Always reinstall after bleeding brakes
4. **Guide pins**
   - Apply thin coating of assembly lubricant G 052 150 A2 to threads prior to installation of protective cap
5. **Protective boot**
   - Pull onto brake carrier and guide pin
6. **Brake carrier (frame) with guide pin and protective boot**
   - Replacement part is assembled with sufficient grease on guide pins.
   - If protective boots or guide pins are damaged, install repair kit. Use grease packet supplied to lubricate guide pins.
7. **Piston seal (outer seal)**
   - Pull outer sealing lip onto piston
8. **Caliper piston with automatic adjustment**
   - Do not force into bore of brake caliper housing, must be turned (threaded) to install
   - Apply thin coating of assembly lubricant G 052 150 A2 to threads prior to installation
9. **Piston seal (inner seal)**
10. **Brake caliper housing**
    - With parking brake cable lever
    - If fluid is leaking at parking brake cable lever, replace brake caliper housing
    - After repairing, pre-bleed caliper housing, see **Rear caliper piston, removing and installing**

NOTE —

- *Install all parts in repair kit.*
- *New brake calipers are filled with brake fluid and are pre-bled*
- *When assembling, apply a thin coat of grease (VW part no. G052 150 A2) to brake cylinders, pistons and seals.*
- *When repairing, be sure to pre-bleed brake calipers (without brake pads) before installing, see **Rear caliper piston, removing and installing**.*

Rear caliper piston, removing and installing

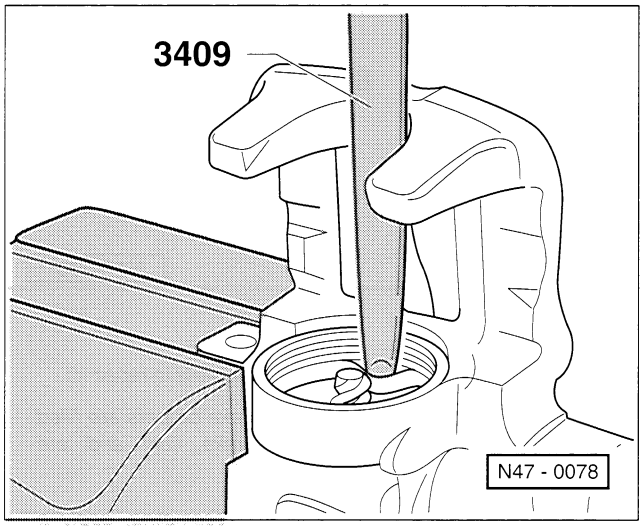


– Remove brake caliper and pads as described in **46 Brakes–Mechanical Components**.

NOTE —

- *If reusing brake pads, mark pad position before removing. Reinstall brake pads in their original position to prevent uneven braking.*
- *Brake tool **T10165** is a newer version of tool **3272.** Either tool may be used on vehicles covered by this manual. Repair procedures apply to both versions.*

➢ Remove piston from brake caliper housing using special tool **3272** or equivalent. It may be necessary to use adapter **3272/1** if caliper frame is too large. Turn knob on piston resetting and removal tool counter-clockwise. Install tool with collar (**arrow**) positioned before the piston as shown. If knob is difficult to turn, use 13 mm wrench on flat spots (**arrow A**) of tool.



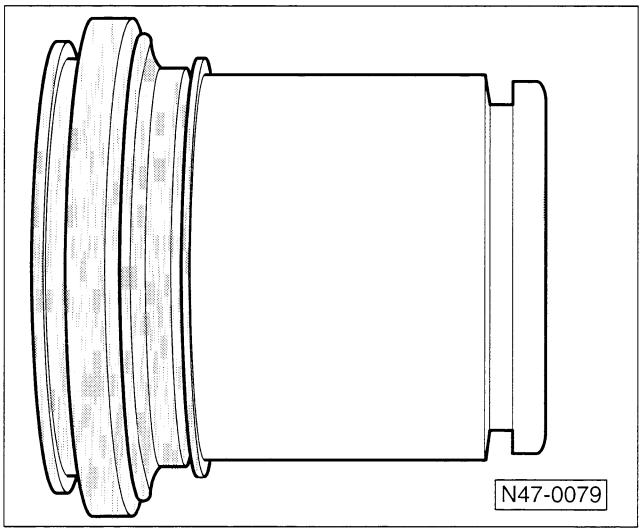
➢ Carefully remove inner piston seal using a plastic wedge such special tool **3409** or a "glass stick".

WARNING —
When removing, use care to ensure that the cylinder bore is not damaged.

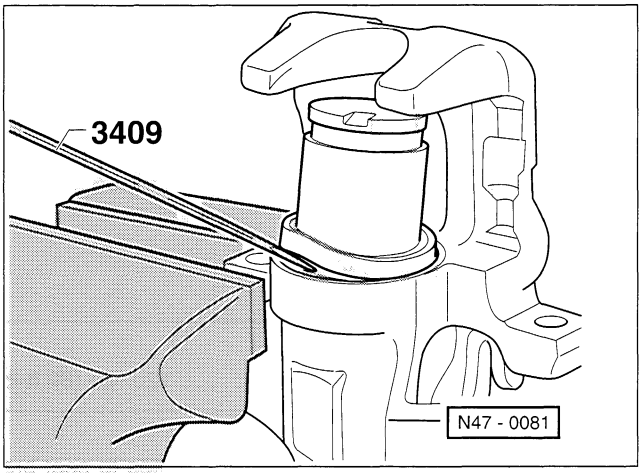
– Clean caliper and piston with special cleaners designed specifically for the purpose and then dry.

– Lubricate piston, cylinder bore, and new inner seal lightly with VW assembly grease G052 150 A2 or equivalent.

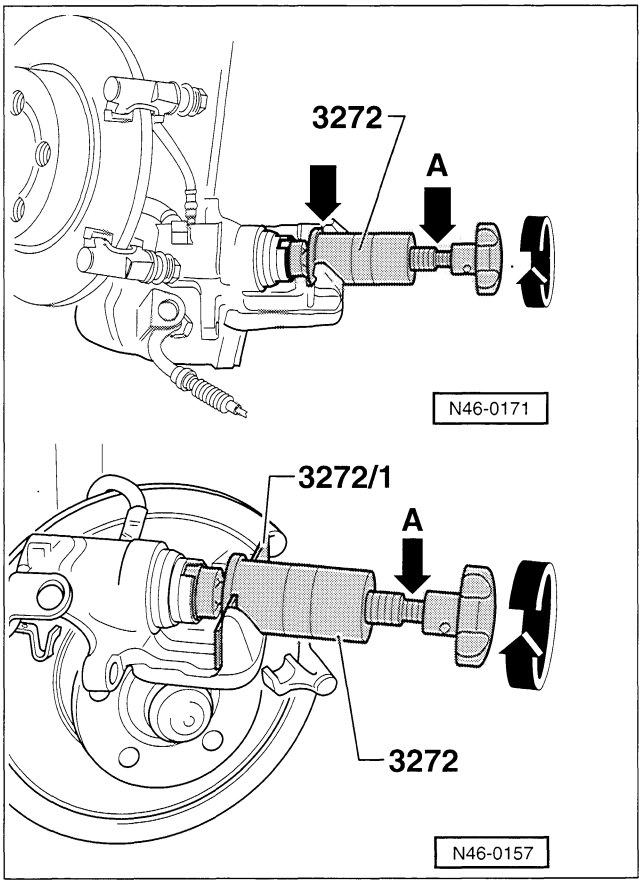
– Install new piston seal in caliper.



➢ Install new outer piston seal with outer sealing lip on lower end of piston as shown.



➤ Hold piston in front of caliper housing and work inner sealing lip of outer piston seal into grove in cylinder bore using a plastic wedge or **3409**.



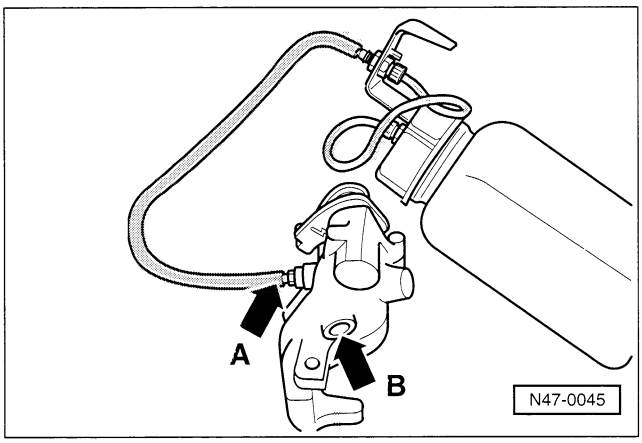
➤ Reset caliper's automatic adjustment mechanism using Volkswagen special tool **3272** or equivalent by turning piston clockwise (**rotational arrow**) while pushing in. An open-ended 13 mm wrench can be used on flats (**A**) if necessary. It may be necessary to use adapter **3272/1** if caliper frame is too large (see lower illustration at left).

WARNING —

- *If piston is not reset correctly, or if brake pedal is operated with caliper removed, the automatic adjustment mechanism will be destroyed.*
- *Always remove some brake fluid from reservoir before resetting and pushing caliper piston in. When piston is pushed in, fluid is forced up into reservoir.*

– Install brake pads. If reusing original pads, note position marks made before removing.

– In most cases it will be necessary to pre-bleed the rear brake caliper. This is done to eliminate the possibility of air being trapped in the upper brake fluid chamber of the caliper. See **Rear caliper, pre-bleeding**.



Rear caliper, pre-bleeding

- Pre-bleed caliper by opening bleeder screw (**arrow A**) and fill bleeder bottle with brake fluid until bubble-free fluid flows from brake hose connection (**arrow B**).
- Close bleeder screw and install brake caliper(s) and fully bleed system.
- Install wheels and lower vehicle.

Tightening torque

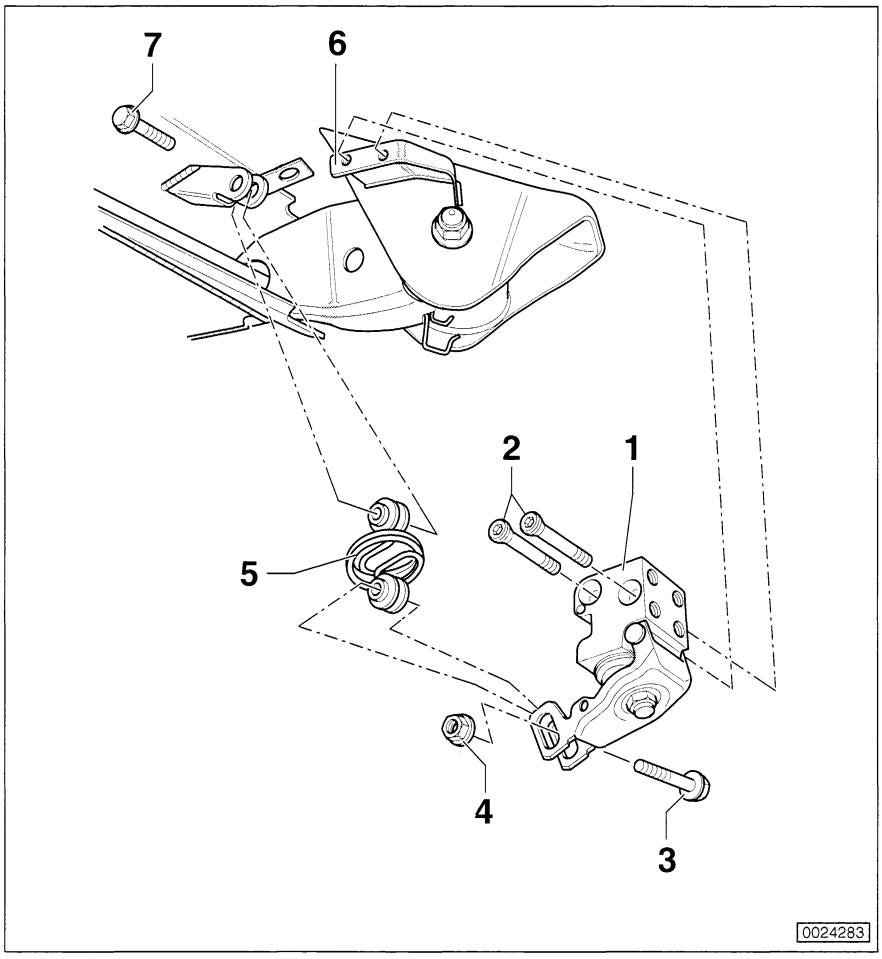
- Wheel bolt to hub . . . . . 120 Nm (89 ft-lb)

- Depress brake pedal firmly several times to seat brake pads to brake disc. Check brake fluid level.
- Repeat for the brakes on the other side of the vehicle as required.
- Be sure to quality check your work.

Brake pressure regulator assembly

NOTE —
Golfs and Jettas with USA and Canadian specifications have ABS as standard equipment. This brake pressure regulator is not installed on vehicles with anti-lock brake systems. The ABS system includes electronic brake pressure distribution (EBD) which is an electronic equivalent of this mechanical/hydraulic system.

1. **Brake pressure regulator**
   • Load sensing
2. **Bolt, socket hex head**
   • Tighten to 21 Nm (15 ft-lb)
3. **Bolt, hex**
   • Tighten to 16 Nm (12 ft-lb)
4. **Nut, hex**
   • Tighten to 21 Nm (15 ft-lb)
5. **Spring**
6. **Mounting bracket**
7. **Bolt, hex**
   • Tighten to 16 Nm (12 ft-lb)

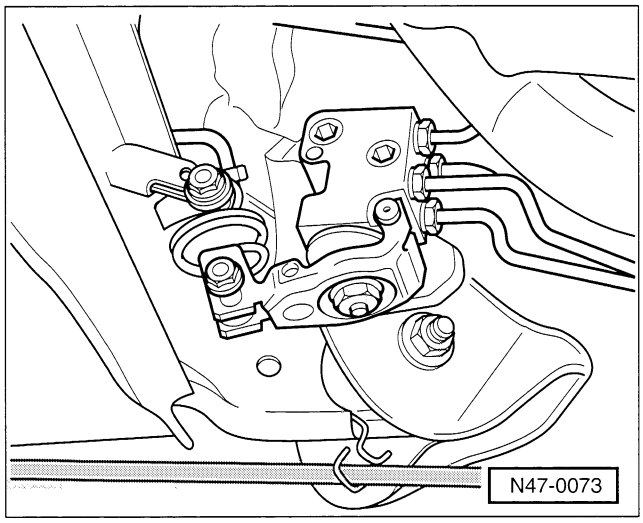


Brake pressure regulator, checking

Cars without ABS have a brake pressure regulator mounted on a bracket attached to the rear axle. This load-sensing regulator is controlled from the rear axle by a spring. When the axle changes position, due to a heavy load or during hard braking, the pressure regulator limits the pressure to the rear brakes.

NOTE —

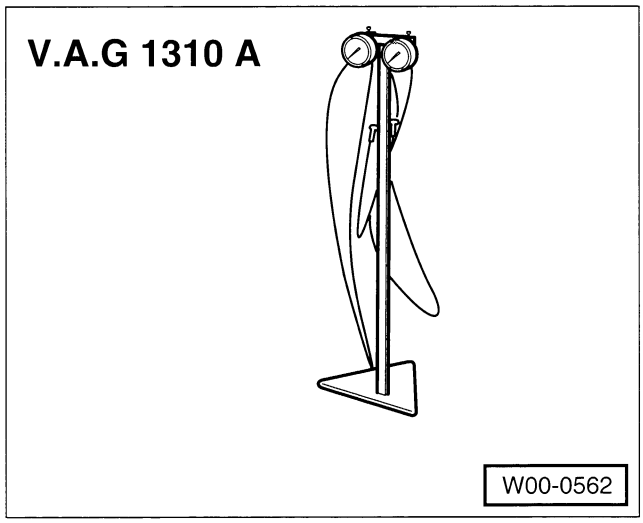
The brake pressure regulator should be checked and if necessary adjusted following repairs to the rear suspension, or when there is excessive rear brake wear.



➤ With the car resting on all four wheels and the fuel tank full, observe the pressure regulator while a helper depresses and quickly releases the brake pedal. The regulator should move slightly when the brake is quickly released. If not, the regulator is faulty and should be replaced.

NOTE —

For this check to be accurate, the car should be emptied of all cargo and occupants, except driver.



➤ Testing and adjusting the pressure-regulating function requires measuring brake system pressure at each wheel caliper using two pressure gauges. Because of the need for this specialized equipment, we recommend having this test performed by an authorized Volkswagen dealer.

BRAKE FLUID

Brake fluid readily absorbs moisture from the atmosphere. This moisture can cause brake system corrosion and adversely affect braking performance. Therefore, the brake should be flushed out of the system and new, fresh fluid added at least every 2 years, regardless of mileage. See **Brake fluid, replacing**.

The brake system can be bled using a pressure bleeder or manually using a helper. Pressure bleeding, if the equipment is available, is the fastest and most complete way of bleeding the system and is the factory preferred method. Manual bleeding requires a helper, but is relatively simple and requires a minimum of special tools. Only use brake fluid meeting factory specifications.



Brake fluid specifications

- DOT 4 Super (Volkswagen B 000 700 A1, B 000 700 A7, or B 000 700 A8)
  Minimum wet boiling point . . . . . 329°F (165°C)
  Dry boiling point (exceeds) . . . . . 500°F (260°C)

WARNING —

- *Use only new, approved brake fluid that complies with MVSS 116 DOT 4. Do not use silicone-based brake fluid (DOT 5). Even the smallest traces can cause severe corrosion in the brake system.*
- *Brake fluid is poisonous. Wear safety glasses and rubber gloves when working with brake fluid. Prevent brake fluid from entering the blood-stream through cuts or scratches. Do not siphon brake fluid by mouth.*
- *Brake fluid is very damaging to paint. Immediately wipe up any brake fluid that spills on the vehicle.*
- *The brake fluid level in the reservoir must not fall below the MIN mark during bleeding.*

NOTE —

- *On non-ABS cars, the brake pressure regulator lever must be pressed toward the rear during rear brake bleeding.*
- *Depress the brake pedal several times during the bleeding operation.*

If the ABS hydraulic unit has been replaced, or if one chamber of the brake fluid reservoir is completely empty, the hydraulic unit will have to be pre-bled after installation, but before the rest of the system is bled. This procedure requires the use of scan tools such as the VAG 1551/1552, diagnostic testers such as the VAS 5051/5052, or their equivalent. The scan tool is used in the basic setting mode in display group 001 to bleed the

hydraulic unit only. Specific instructions will vary slightly with the individual scan tool, but generally, the ABS electronic control unit will communicate with the scan tool and display instructions on screen in the appropriate order. Upon completion of the pre-bleed sequence, the brake system will need to be bled separately. The specific instructions required for this operation vary slightly and are therefore, outside the scope of this manual.

Bleeding manually

– Connect hose from bleeder collection bottle to first brake bleeder valve at caliper.

> ***WARNING —***
> *The brake fluid level in the reservoir must not fall below the MIN mark during bleeding.*

– Have a helper pump the brake pedal several times and then hold pedal down firmly.

– Open bleeder screw at the caliper and allow fluid to run out into collection bottle.

– Close bleeder screw and then release brake pedal. Repeat operation until brake fluid runs clear and flows without air bubbles.

– Repeat the above procedure at each remaining wheel. Observe the correct sequence for each system type:

ITT Mark 20 IE Systems:

- Right rear caliper
- Left rear caliper
- Right front caliper
- Left front caliper

ITT Mark 60 IE Systems:

- Left front caliper
- Right front caliper
- Left rear caliper
- Right rear caliper

NOTE —
To determine which brake system the vehicle has see **45 Anti-Lock Brakes (ABS)**.



Bleeding with pressure bleeder

Pressure bleeding using Volkswagen special tool VAS 5234 or equivalent is the preferred method of removing air from the brake system because it does a more thorough purge.

➢ Connect pressure bleeder with regulated compressed air supply to fluid reservoir according to equipment manufacturer's instructions.

> ***WARNING —***
> *Do not exceed filling pressure of 1 bar (14.5 psi) when filling brake fluid using pressure bleeder VAS5234. The brake system will not be completely bled if excessive pressure is used.*

– Connect hose from bleeder bottle to caliper bleeder valve and bleed brakes in following sequence:

ITT Mark 20 IE Systems:

- Right rear caliper
- Left rear caliper
- Right front caliper
- Left front caliper

ITT Mark 60 IE Systems:

- Left front caliper
- Right front caliper
- Left rear caliper
- Right rear caliper

> ***NOTE —***
> *To determine which brake system the vehicle has see* **45 Anti-Lock Brakes (ABS)**.

– Brake fluid should be allowed to flow from the bleeder valve/screw until it runs clear.

– Remove bleeder equipment, check and adjust brake fund level and road test vehicle.

Vehicles with ITT Mark 60 IE system

– Perform a zero compensation of the brake pressure sender 1 (G201) with a scan tool.

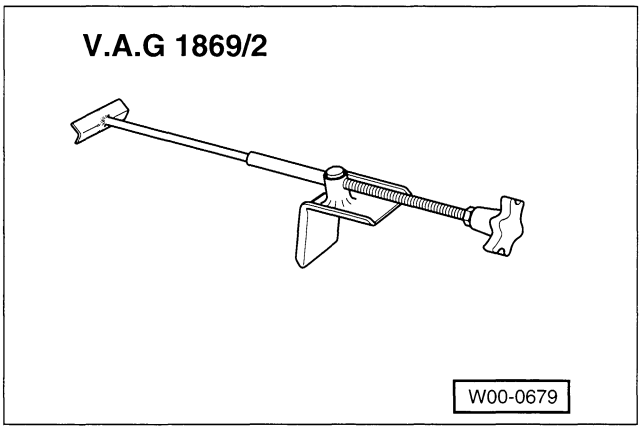
- Connect scan tool
- Select Rapid Data Transfer
- Select Basic Settings 04
- Select Display Group 066 (ABS warning light will flash)
- Display should indicate compensation is OK
- If display indicates compensation is not OK, make sure scan tool is properly coded, brake pedal is not depressed during compensation, and/or brake pressure sender 1 is functioning properly
- Disconnect scan tool

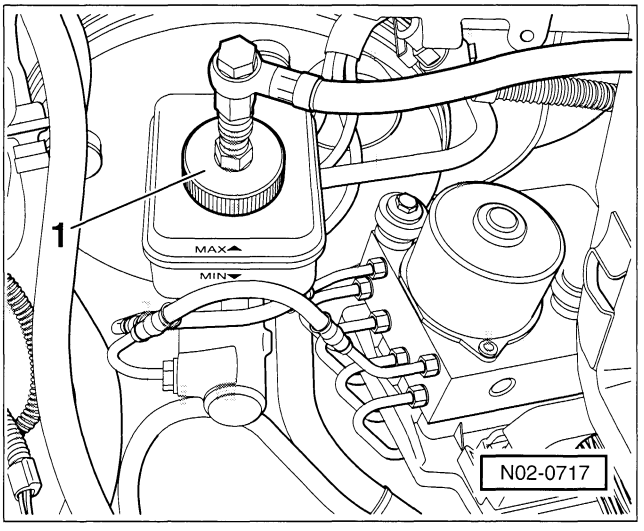
Continued for all vehicles

– Upon completion of repairs, always road test the vehicle so that the ABS is felt to engage through pulsing of brake pedal.

Brake fluid, replacing

Brake fluid readily absorbs moisture from the atmosphere. This moisture can cause brake system corrosion and adversely affect braking performance. Therefore, the brake should be flushed out of the system and new, fresh fluid added at least every 2 years, regardless of mileage.





– Remove brake fluid reservoir cap. Extract as much brake fluid from the reservoir as possible using suction hose from brake filler and bleeder unit VAS 5234, V.A.G. 1869, or with a suction bottle.

NOTE —
Make sure no brake fluid runs through strainer after completing extraction sequence (brake fluid level in reservoir must stop at lower edge of strainer).

WARNING —
Do not re-use extracted (used) brake fluid.

➤ Install and extend brake pedal depressor V.A.G. 1869/2, or equivalent, between driver seat and brake pedal.

➤ Install adapter (**1**), supplied with brake filler and bleeder unit, to brake fluid reservoir.

– Connect filling hose from brake filler and bleeder unit VAS 5234 or V.A.G 1869/ to adapter on top of brake fluid reservoir.

Vehicles with manual transmission

– Pull cover cap off clutch slave cylinder bleed screw.

– Connect bleeder bottle hose to bleeder screw of clutch slave cylinder. Open bleeder screw and allow approximately 0.1 liter of fluid to flow out. Close bleeder screw and install cover cap.

– Operate clutch pedal several times.

Continued for all vehicles

– Remove caps from brake caliper bleeder screws.

– Connect bleeder bottle hose to right rear caliper bleeder screw. Open bleeder screw and allow approximately 0.25 liters of brake fluid to flow out. Close bleeder screw.

– Repeat procedure for left rear, right front, and left front brake calipers. Install cover caps on brake caliper bleeder screws.

– Close filler lever on brake filler and bleeder unit.

– Remove filler hose and adapter from top of brake fluid reservoir.

– Check brake fluid level and correct if necessary. Install cap on brake fluid reservoir.

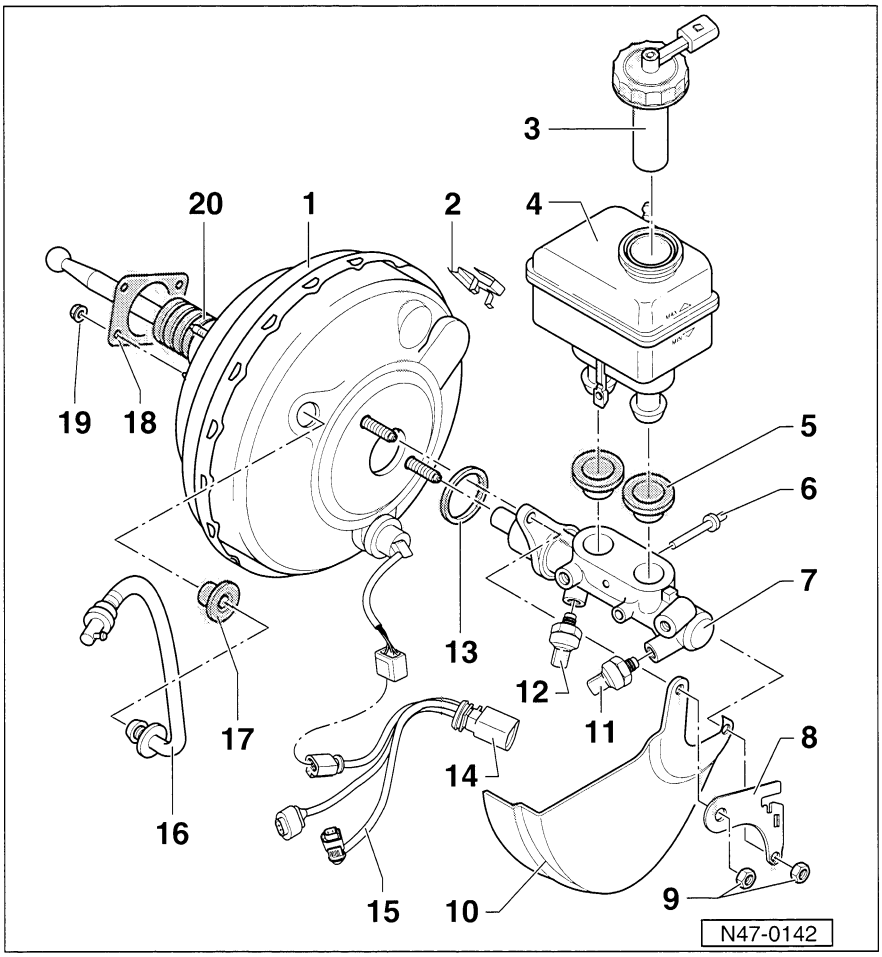
– Remove brake pedal depressor. Check pedal pressure and brake pedal free play.

• Free play: MAX. 1/3 of pedal travel

MASTER CYLINDER AND BRAKE BOOSTER

The complete brake master cylinder and the power brake booster can be replaced independently of each other. ITT Mark 20 IE and Mark 60 IE are similar in configuration.

Master cylinder/brake booster assembly (through 10/2000 production)

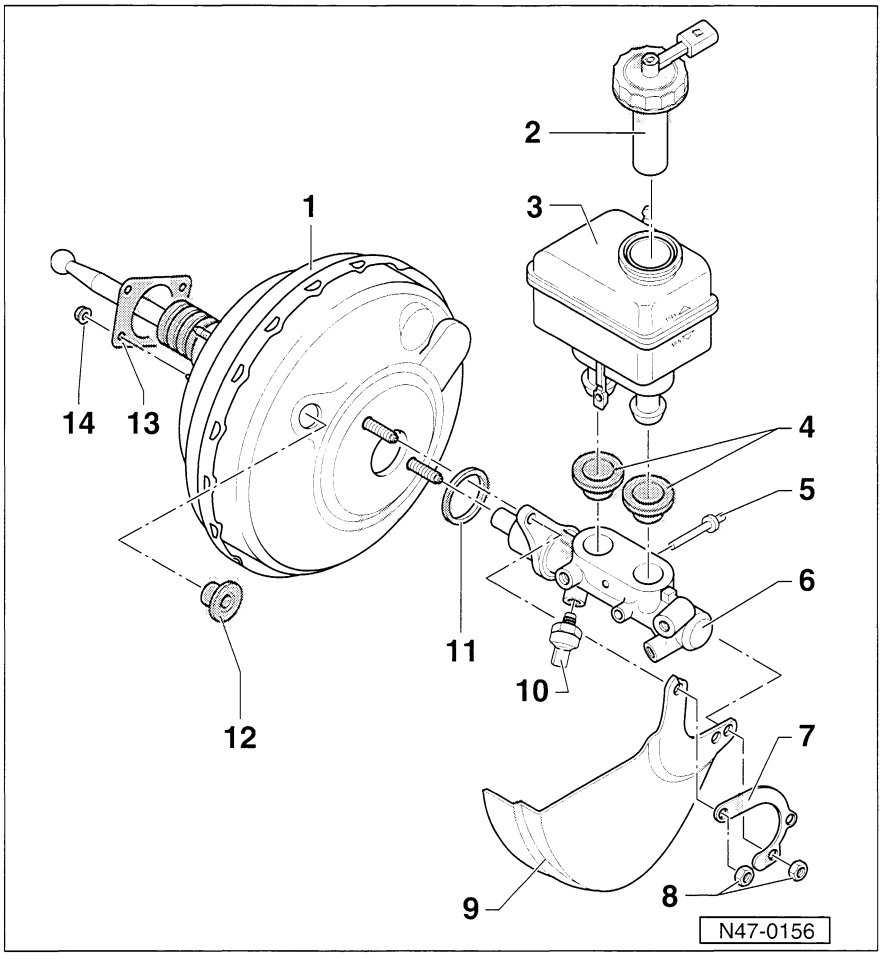


1. **Brake Booster**
   - Can be replaced separately from master cylinder
   - Gasoline engine: vacuum supplied by intake manifold
   - Diesel (1.9L engine): pump supplies vacuum, see **Vacuum pump for brake booster (1.9L engine), removing and installing**
   - Some vehicles also have an electric vacuum pump (V192) to provide additional vacuum
   - Functional check:
     With engine off, depress brake pedal firmly several times (to reduce vacuum in unit).
     Depress brake pedal with average foot pressure, hold and start engine. If brake booster is working properly, pedal will give slightly under foot.
   - If booster is not functioning replace complete brake booster
   - Checking vacuum check valve (1.9L engine), see **Vacuum check valve, checking (1.9L engine)**
2. **Bracket**
   - Mounted on edge of brake booster
   - Used to hold wiring connector (item 14)
3. **Cap**
   - With fluid level sensor
   - Inspect gasket for proper seal
4. **Brake fluid reservoir**
   - Also supplies brake fluid to hydraulic clutch for manual transmission
5. **Sealing grommet**
   - Moisten with brake fluid and press into reservoir
6. **Retainer pin**
   - Install through brake master cylinder
7. **Brake master cylinder**
   - Cannot be repaired. If faulty, replace as complete unit
8. **Mounting bracket**
   - Used to retain wiring harness (item 15)
9. **Nut, self locking**
   - Tighten to 20 Nm (15 ft-lb)
   - Always replace
10. **Heat shield**
    - May not be installed in some vehicles
11. **Sender 1 for brake booster (G201)**
12. **Sensor 2 for brake booster (G214)** (as applicable)
13. **Sealing ring**
    - Always replace
14. **Connector housing**
15. **Wiring harness**
16. **Vacuum pipe**
    - Insert into brake booster
    - With check valve
17. **Sealing grommet**
18. **Gasket**
    - For brake booster
19. **Nut, self locking**
    - Tighten to 20 Nm (15 ft-lb)
    - Always replace
20. **Boot**
    - Ensure proper seating
    - Prevents normal operating noise from entering passenger compartment

NOTE —

*Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See **97 Wiring Diagrams, Fuses and Relays**. These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*

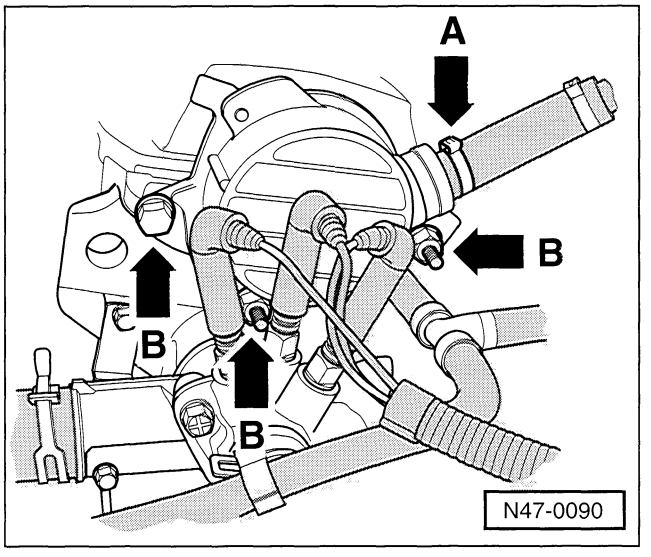
Master cylinder/brake booster assembly (from 11/2000 production)



1. **Brake Booster**
   - Can be replaced separately from master cylinder
   - Gasoline engine: vacuum supplied by intake manifold
   - Diesel (1.9L engine): pump supplies vacuum, see **Vacuum pump for brake booster (1.9L engine), removing and installing**
   - Some vehicles also have an electric vacuum pump (V192) to provide additional vacuum
   - Functional check (through 01.02 production):
     With engine off, depress brake pedal firmly several times (to reduce vacuum in unit).
     Depress brake pedal with average foot pressure, hold and start engine. If brake booster is working properly, pedal will give slightly under foot.
   - Functional check (from 02.02 production):
     With engine running, depress brake pedal firmly to ensure full vacuum boost.
     When brake pedal is depressed, a "click" must be heard so that mechanical brake assist is activated. The brake pedal can now be partially released and pressed again with less effort.
   - If booster is not functioning replace complete brake booster
   - Checking vacuum check valve (1.9L engine), see **Vacuum check valve, checking (1.9L engine)**
2. **Cap**
   - With fluid level sensor
   - Inspect gasket for proper seal
3. **Brake fluid reservoir**
   - Also supplies brake fluid to hydraulic clutch for manual transmission
4. **Sealing grommet**
   - Moisten with brake fluid and press into reservoir
5. **Retainer pin**
   - Install through brake master cylinder
6. **Brake master cylinder**
   - Cannot be repaired. If faulty, replace as complete unit
7. **Mounting bracket**
   - Used to retain wiring harness
8. **Nut, self locking**
   - Tighten to 20 Nm (15 ft-lb)
   - Always replace
9. **Heat shield**
   - May not be installed in some vehicles
10. **Sender 1 for brake booster (G201)**
    - Tighten to 25 Nm (18 ft-lb)
11. **Sealing ring**
    - Always replace
12. **Sealing grommet**
    - Inserted into brake servo unit
13. **Gasket**
    - For brake booster
14. **Nut, self locking**
    - Tighten to 20 Nm (15 ft-lb)
    - Always replace

NOTE —

*Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See **97 Wiring Diagrams, Fuses and Relays**. These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*



Vacuum pump for brake booster (1.9L TDI engine), removing and installing

– Remove retainer for wiring harness from vacuum pump.

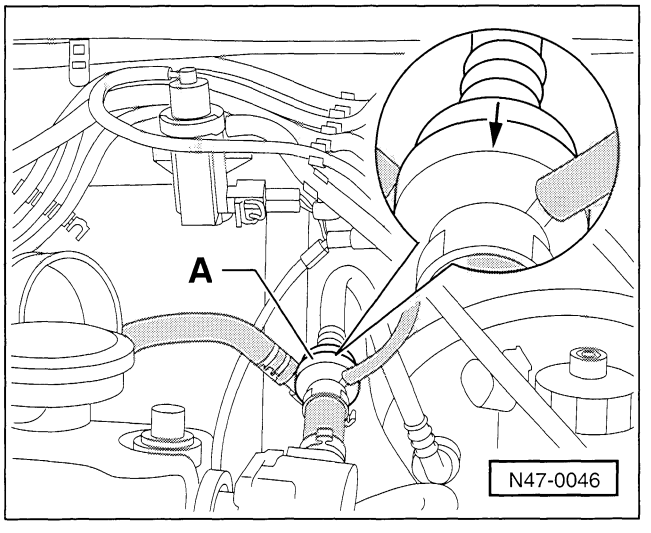
➤ Loosen vacuum hose clamp (**arrow A**) and remove hose from pump.

– Remove bolts (**arrow B**) on flange and remove pump.

– When installing vacuum pump be sure that follower engages correctly with camshaft.

– Install bolts (**arrows B**) on cylinder head flange and secure vacuum hose with clamp (**arrow A**).

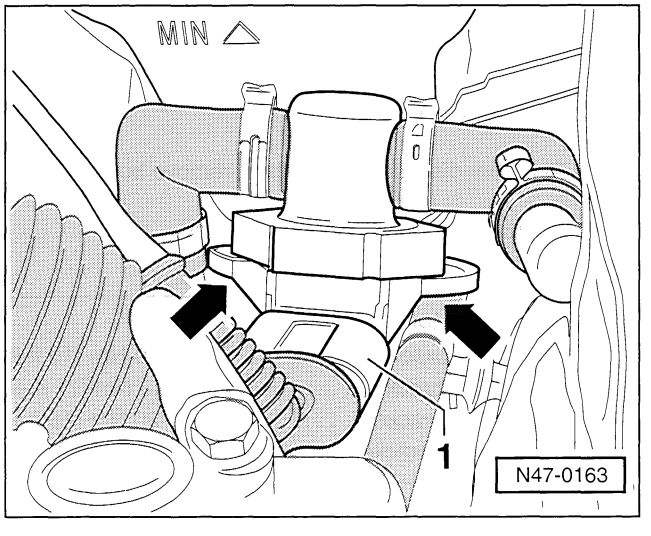
NOTE —
The 1.9L PD engine has a tandem pump (fuel and vacuum). For more information see **20 Fuel Storage and Supply**.



Vacuum check valve, checking (all engines)

➤ Air must pass through in direction of **arrow**.

– Check valve (**A**) must stay closed (no air passes through) if supplied from opposite direction.



Brake booster pressure sensor (G294), removing and installing

➤ Disconnect brake booster pressure sensor (G294) harness connector (**1**).

– Remove mounting bolts (**arrows**).

– Remove brake booster pressure sensor.

– Installation is the reverse of removal.

Electric vacuum pump (V192) (gasoline engines with automatic transmission and ITT Mark 60 IE, through 05/2002 production)

Checking

During the engine startup sequence, the electric brake vacuum pump (V192) must run briefly. Operation is confirmed by touch. The electric vacuum pump is located in the lower left front subframe on applicable vehicles.

– Securely position vehicle on a lifting platform, such as an alignment rack.

– Have a helper in the vehicle start the engine.

– Check by touch that the brake system vacuum pump (V192) runs for a period of time after engine start.

– If the vacuum pump is not felt to run, check ABS for DTCs with a diagnostic scan tool.

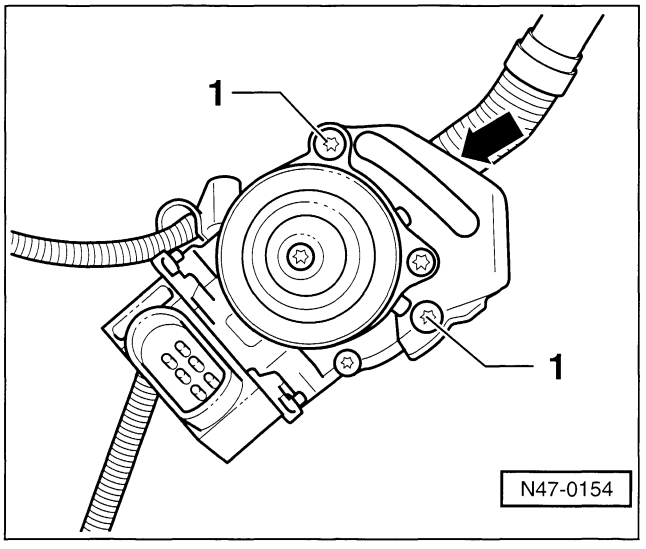
Removing and installing

– Disconnect vacuum pump harness connector

➢ Remove bolts (**1**) on bracket for brake system pump.

– Pull off hose (**arrow**) on vacuum pump.

– Remove pump. There are no service parts for this component. If a malfunction is detected, the complete pump must be replaced.



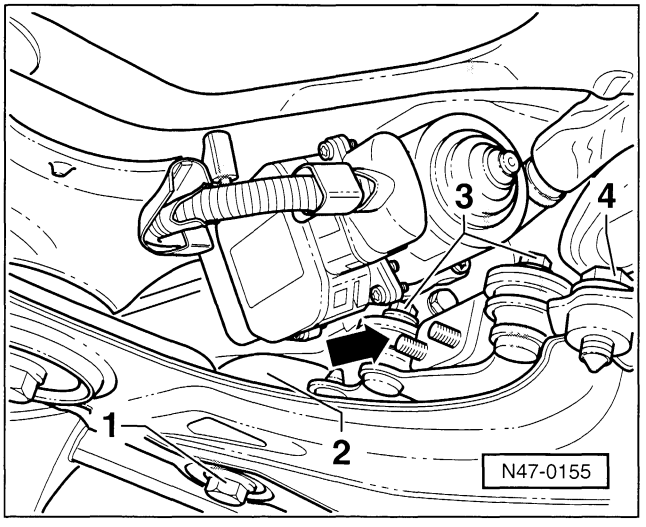
➢ Remove bracket (**arrow**) for brake system pump.

– Remove lock nut (**2**) from bolt (**1**). Remove bolt (**4**).

– Remove bracket.

– To further disassemble bracket, remove bolts (**3**).

– Installation is the reverse of removal.



Tightening torque

- Nut (**2**) to bracket . . . . . 20 Nm (15 ft-lb)
- Bolt (**3**) to bracket . . . . . 8 Nm (71 in-lb)
- Bolt (**4**) to bracket . . . . . 20 Nm (15 ft-lb)
- Torx bolt to bracket . . . . . 8 Nm (71 in-lb)

Brake master cylinder, removing and installing

– Disconnect battery ground (GND) strap from battery negative (–) terminal. See the **Warnings** at the beginning of this repair group regarding battery disconnection.

NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.

– Spread sufficient lint-free cloths on engine and transmission to catch any escaping brake fluid.

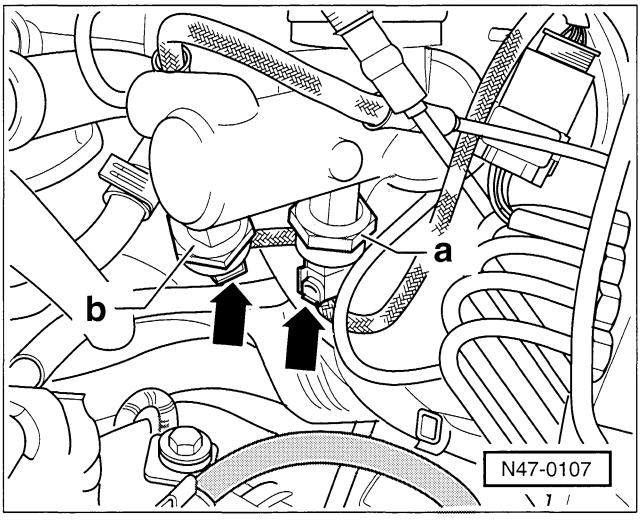
> ***WARNING —***
> *Brake fluid is poisonous! When drawing off brake fluid from the reservoir, use a bleeder bottle which is used only for brake fluid. Never siphon brake fluid by mouth.*

– Using bleeder bottle, draw off as much brake fluid as possible from brake fluid reservoir.

– Clamp off clutch master cylinder supply hose with a suitable tool, VW 3094 or equivalent.

– Remove clutch master cylinder supply hose from brake fluid reservoir.

– Disconnect brake fluid level sensor wiring connector.



– Disconnect wiring connectors from master cylinder pressure sensors (**a** and **b**) as applicable.

– Disconnect brake lines on brake master cylinder and seal with plugs from repair kit VW part 1H0 698 311 A.

NOTE —
Volkswagen part numbers are given for reference only. Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.

– Remove nuts holding brake master cylinder to brake booster.

– Remove heat shield if installed.

– Carefully pull brake master cylinder out from power brake booster.

– Install master cylinder in reverse order of removal, noting the following:

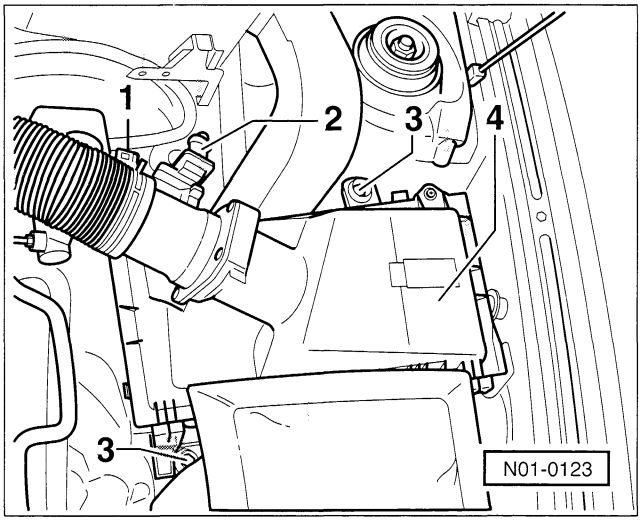
- When installing brake master cylinder into brake booster, be sure that the push rod is correctly located in the master cylinder.
- After installing, bleed brakes as described earlier.
- Bleed clutch, see **30 Clutch**.
- Initiate basic settings and zero compensation of brake pressure sender 1 (G201) and brake pressure sender 2 (G214) as required.
- Re-bleed brakes as required.

– Be sure to quality check your work.

Brake booster, removing and installing

– Disconnect battery ground (GND) strap from battery negative (–) terminal. See the **Cautions** at the beginning of this repair group regarding battery disconnection.

NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.



➤ Pull connector (**2**) off mass air flow sensor.

– Release spring clip (**1**) on air duct hose with pliers VAG 1921 or equivalent and pull hose off air cleaner.

– Remove air cleaner bolts (**3**) and take out air cleaner (**4**).

Vehicles with manual transmission

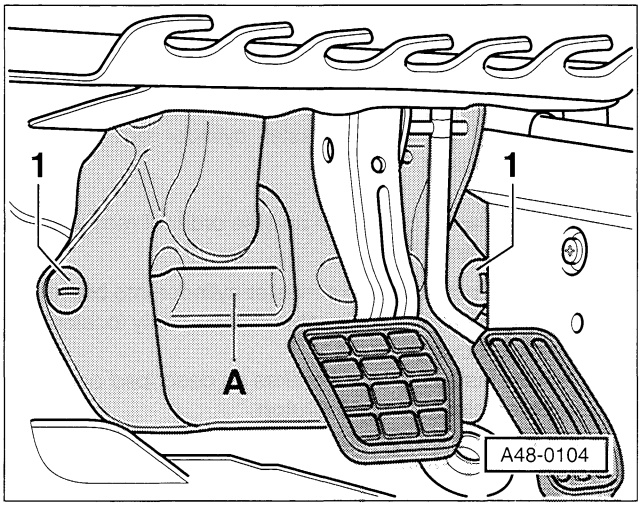
– Clamp off clutch master cylinder supply hose with a suitable tool, VW 3094 or equivalent.

– Remove clutch master cylinder supply hose from brake fluid reservoir.

Continued for all vehicles

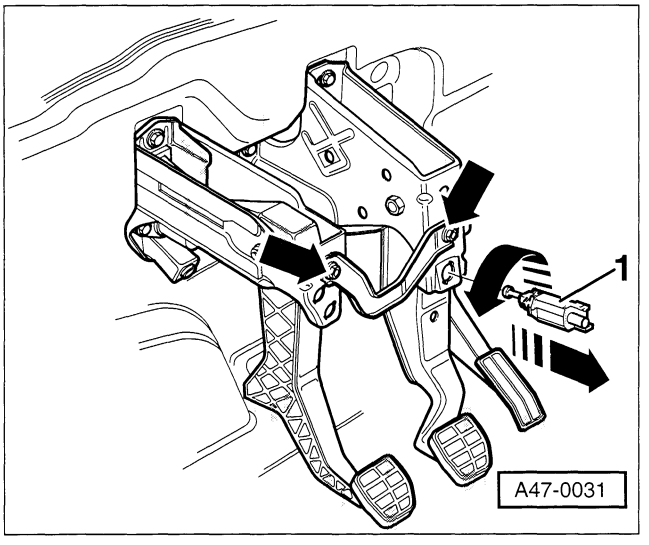
– Remove ABS control module and hydraulic unit, see **45 Anti-lock Brakes (ABS).**

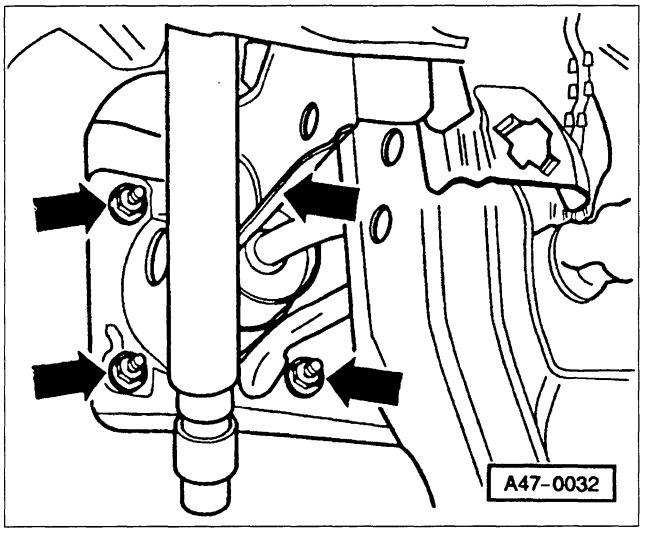
– Disconnect vacuum hose from brake booster.



➤ Remove trim panel below pedal cluster.

- Screws (**1**)
- Cover (**A**).





Vehicles with manual transmission

➢ Remove connecting plate between clutch and brake pedals (**arrows**).

Continued for all vehicles

– Remove brake light switch (**1**) by rotating (**dashed arrow**) and pulling out.

– Separate brake pedal from brake booster.

➢ Remove brake booster mounting nuts (**arrows**).

– Guide brake booster with brake master cylinder forward and out to remove.

– Install brake booster with brake master cylinder in reverse order of removal, noting the following:

- When installing brake master cylinder into brake booster, be sure that the push rod is correctly located in the master cylinder.
- After installing, bleed brakes as described earlier.
- Bleed clutch, see **30 Clutch**.
- Initiate basic settings and zero compensation of brake pressure sender 1 (G201) and brake pressure sender 2 (G214) as required.

– Install and adjust brake light switch, see **45 Anti-lock Brakes (ABS).**

> ***WARNING —***
> *"New style" brake light switch must be replaced after removal, see* **45 Anti-lock Brakes (ABS)**.

– Be sure to quality check your work.

QUALITY REVIEW

When you have finished working under the hood and around other areas of the vehicle, it is advisable to take a moment to quality check or review your work. This helps to insure that the operation or repair has been completed properly with all affected systems functioning within normal parameters. These may include the following:

- During the final road test make at least one controlled brake test where the brake pedal is felt to pulsate (ABS operation).
- Ensure that all brake lights operate correctly.
- Ensure that all cable ties and clamps that were removed as part of the repair are replaced.
- Ensure that all fasteners and hardware were replaced and torqued as specified.
- Check and adjust brake fluid level. using only the specified brake fluid.
- Make sure that all other components involved in the repair are positioned correctly, properly torqued and function properly.
- Make sure that all tools, shop cloths, fender covers and protective tapes are removed before closing the hood.
- Clean grease and fingerprints from painted surfaces, steering wheel and shifter.
- Ensure that any spilled brake fluid is cleaned from surfaces.
- Check the ABS control module for DTCs, correct and erase fault memory as appropriate.
- Initiate Basic Settings with a scan tool where appropriate.

48 Steering

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GENERAL

Power assisted rack and pinion steering is available on all vehicles covered by this manual. A vane type pump driven by the ribbed V-belt provides hydraulic pressure to the steering gear. Service of the steering gear, including repair of housing seal leaks is by replacement only. The power steering gear is available only as a complete assembly.

Special tools, equipment and procedures are required for most steering repair and component replacement. In addition, front wheel alignment is almost always disturbed when steering tie rods or steering gear are removed or replaced.

For removal of the airbag-equipped steering wheel, see **69 Seatbelts, Airbags**.

WARNING —

- *Do not re-use any fasteners that are worn or deformed in normal use. Most fasteners are designed to be used only once and become unreliable and may fail when used a second time. This includes, but is not limited to, nuts, bolts, washers, circlips, cotter pins, self-locking nuts and bolts. For replacements, always use new parts.*
- *Do not reinstall bolts and nuts coated with undercoating wax as correct tightening torque cannot be ensured. Always clean the threads of removed bolts and nuts that are to be re-used with a suitable solvent before installation. Ensure that new parts are clean.*
- *Do not use standard nuts and bolts in place of green colored parts. The green color denotes a special anti-corrosion process known as "dacromet" or "delta-tone". Torque specifications are given based on use of these parts only.*
- *Always replaced rusted or corroded bolts, nuts and washers even if not specifically indicated.*
- *DO NOT attempt to straighten or weld suspension struts, wheel bearing housings, control arms or any other wheel locating or load bearing components of the front suspension.*
- *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using a VAG 1551/1552 or equivalent scan tool.*

Special precautions for airbag equipped vehicles

Airbag systems can enhance passenger safety in the event of a collision. To accomplish this task, they rely on sensitive electronic circuits and fast-acting deployment devices. Special service precautions must be followed to prevent possible serious bodily injury to the repair technician and others involved in the handling and storage of airbag components and to insure proper operation in the event of a collision.

WARNING —

- *Before working on any airbag, steering wheel or steering column component, always **disconnect the battery first.***
- *No waiting time is required after disconnecting the battery.*
- *Airbags are inflated by an explosive device. Handled improperly or without adequate safeguards and training, the system can be very dangerous. Special precautions must be observed prior to any work at or near the steering wheel and steering column, including the pedal assembly.*
- *The airbag is a vehicle safety system. To guard against personal injury or airbag system failure, only trained Volkswagen service technicians should test, disassemble or service the airbag system.*
- *Airbag units that have been dropped onto a hard surface must not be installed. Always replace any airbag system component that has been mechanically or physically damaged (example: dented or cracked).*
- *Make sure that no one is in the passenger compartment when connecting the battery Ground (GND) strap to the battery negative (–) terminal.*
- *A technician must be electrostatically discharged before picking up or touching any airbag unit. This is accomplished by touching a suitable metal ground such as a water or heating pipe or metal frame. If in the vehicle, this is accomplished by touching a suitable chassis ground such as a door latch or striker.*
- *Install new airbag unit as soon as the unit is removed from the packaging. Reinstall in packaging if work will not be completed immediately.*
- *Do not leave any undeployed airbag unit unattended. If work is interrupted, store airbag unit in a secure location where it cannot be disturbed.*
- *Undeployed airbag units that have been replaced must only be stored and shipped in packaging designed specifically for the purpose such as that found with the replacement unit.*
- *Undeployed airbag units that have been replaced must be properly identified as such.*

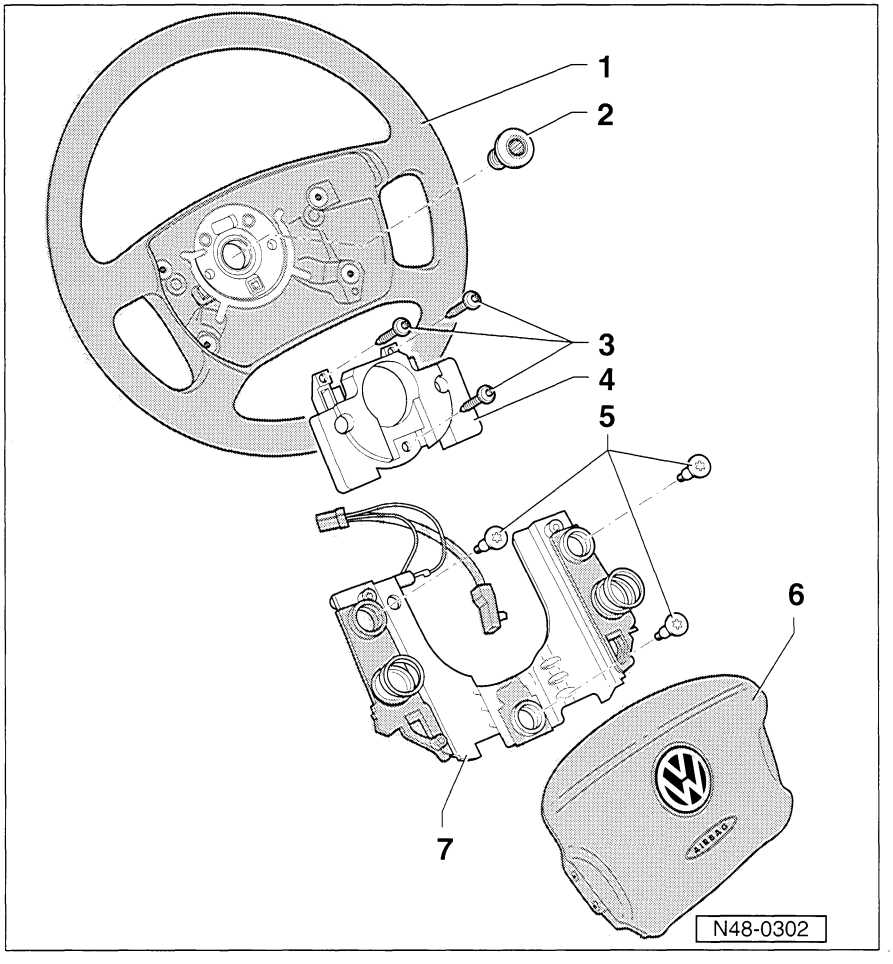
STEERING WHEEL

All vehicles covered by this manual are equipped with multiple airbags. The driver's airbag unit is installed in the center area of the steering wheel. For removal of the airbag-equipped steering wheel, see **69 Seatbelts, Airbags**.

Steering wheel, inner assembly

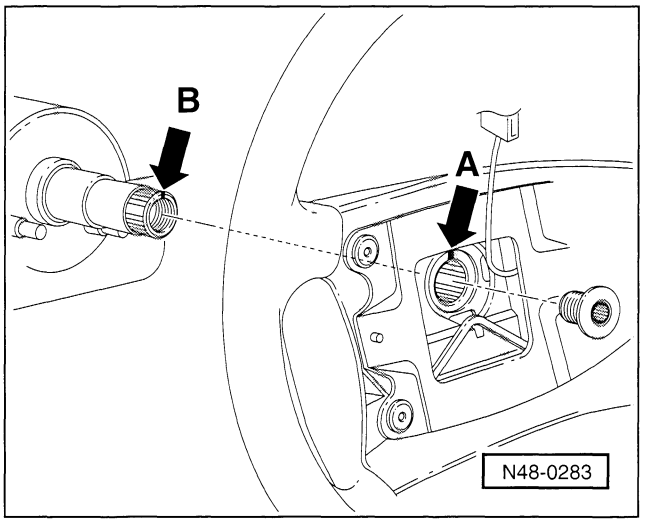
WARNING —

- *The storage and transportation of airbag units must be in accordance with all applicable federal, state and local rules and regulations.*
- *Airbag units that have been removed during the course of repairs must be stored with the padded side facing up and in a secure location where it cannot be disturbed.*
- *Observe all cautions, warnings and notes before starting repairs involving airbag systems.*



1. **Steering wheel**
   - Installed position, see **Steering wheel and steering column, installed position**
2. **Bolt, multi-point socket-head**
   - Tighten to 50 Nm (37 ft-lb) with locking compound
   - Can be reused up to 5 times
   - Mark with center punch after each installation
3. **Bolts, Torx®**
4. **Vibration damper**
   - Installed on vehicles equipped with ALH engine and automatic transmission
5. **Bolts, Torx®**
   - Tighten to 5 Nm (44 in-lb)
6. **Airbag unit**
7. **Securing plate**

Steering wheel and steering column, installed position



➤ Center punch mark on steering wheel (**A**) must align with center punch mark on steering column (**B**).

– Replacement steering columns do not have center punch marks.

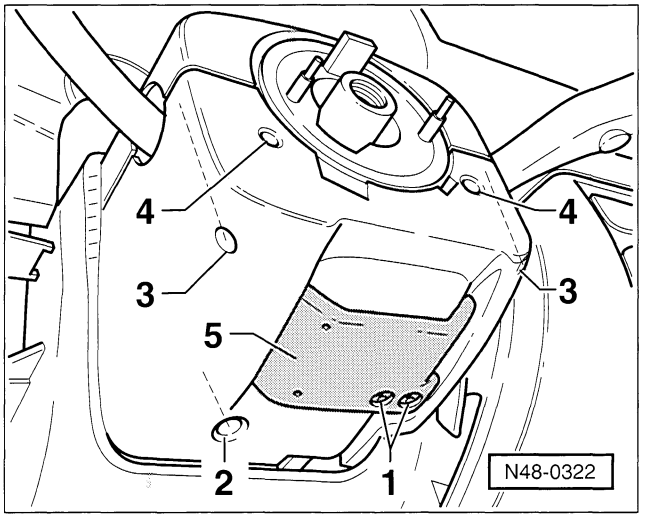
ESP steering angle sensor, removing and installing

Vehicles with ESP are additionally equipped with a steering angle sensor (G85). This sensor is installed in conjunction with coil connector and slip ring in a housing.

– Position front wheels in straight ahead position.

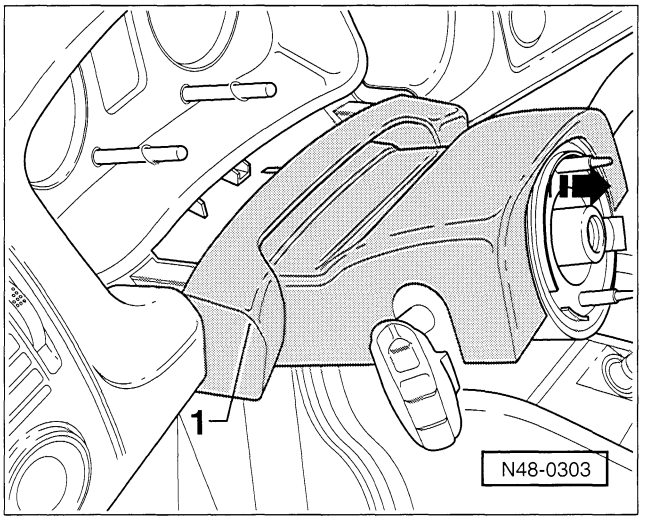
– Remove airbag and steering wheel, see **69 Seatbelts, Airbags**.

– Remove under dash closeout panels.

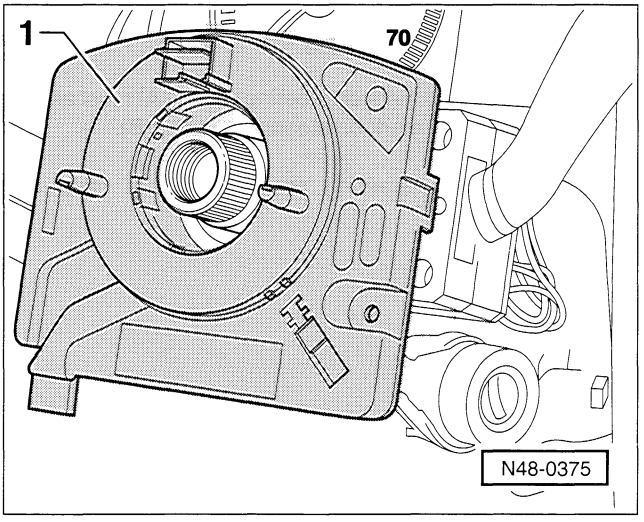


➤ Remove steering column adjustment handle bolts (**1**) and slide handle (**5**) off of lever.

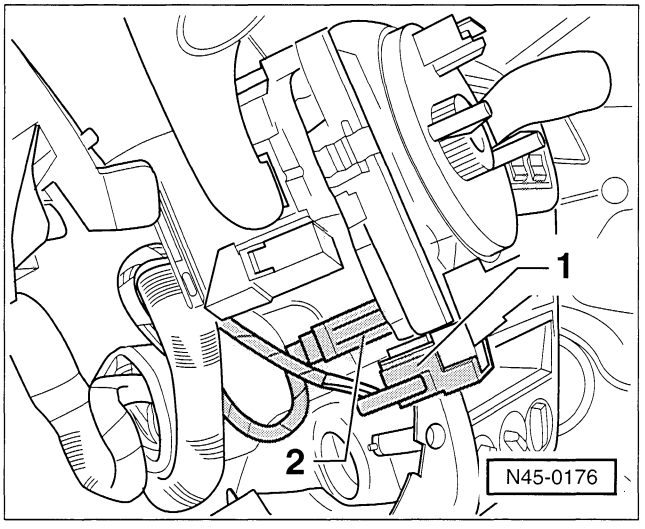
– Remove screws (**2**, **3** and **4**) and take off lower steering column switch trim.



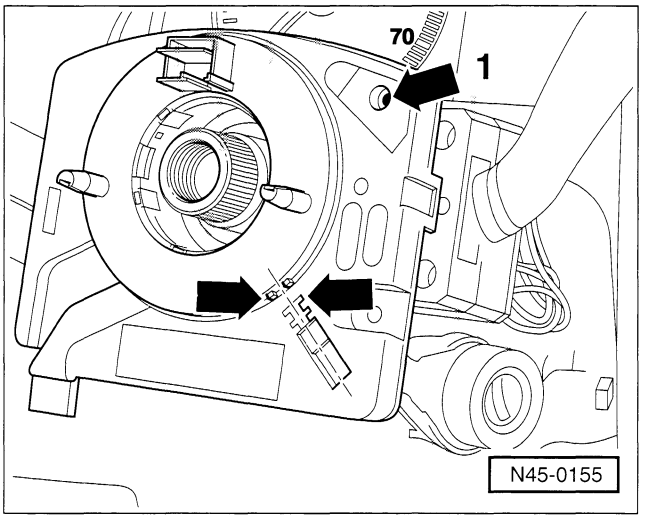
➤ Remove upper steering column switch trim (**1**).



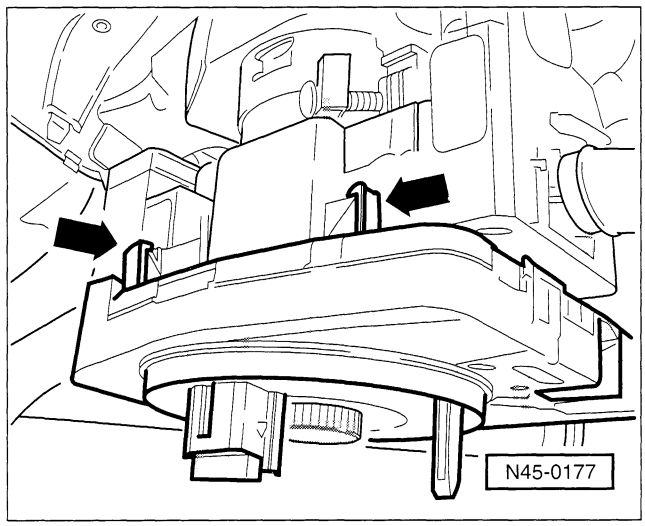
➢ The ESP steering angle sensor (G85) is installed in a housing (**1**) together with the spiral spring.



➢ Disconnect electrical connectors (**1**) and (**2**).



➢ Check to see that a yellow spot is visible through hole (**arrow 1**) and that the marking (**lower arrows**) align as shown.



➤ Lift hooks (**arrows**) carefully and pull off steering angle sensor.

– Install in reverse order of removal noting the following:
  - Ensure that front wheels are in the straight ahead position.
  - When installing steering wheel, steering angle sensor must be correctly seated and free of stress.
  - Check for yellow spot and alignment of markings as described above after installing steering angle sensor housing.
  - Remove securing cable tie if installing new steering angle sensor.

– Perform zero compensation using diagnostic scan tool VAG 1551/1552, VAS 5051/5052, scan tool program or equivalent.

STEERING COLUMN

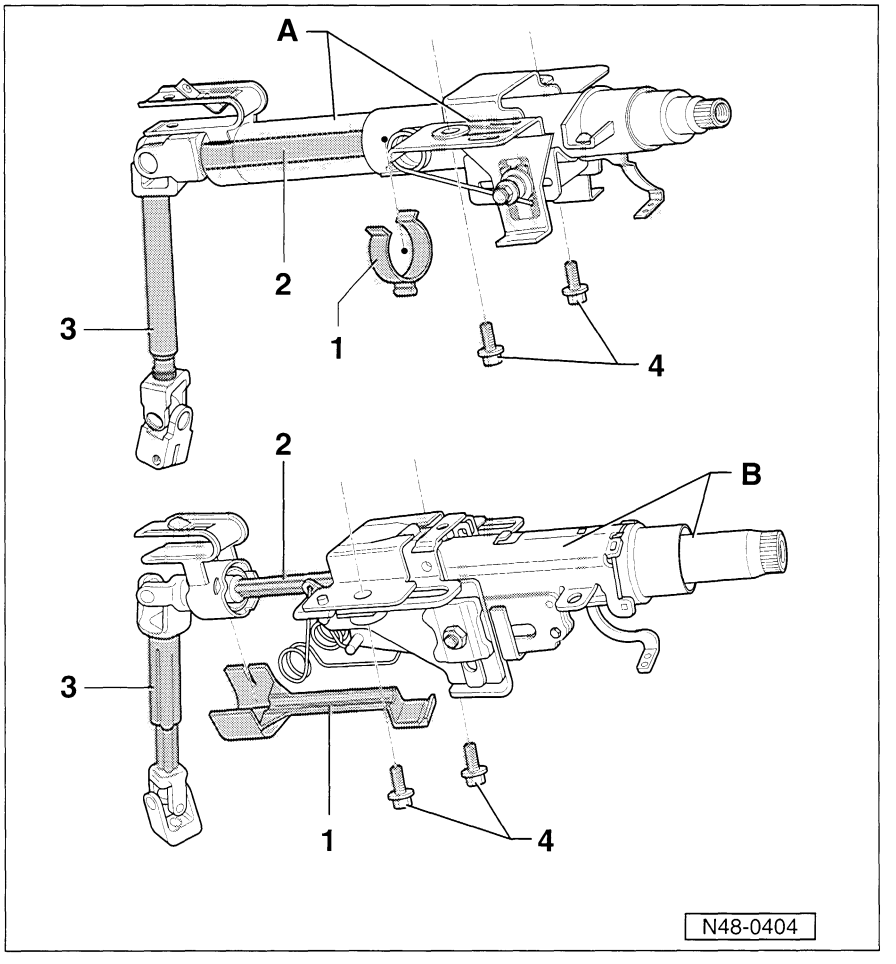
The vehicles covered by this manual are equipped with a steering column that is height adjustable and telescopic as standard equipment. Defective steering columns must be replaced as a complete assembly as no internal repair parts are available from Volkswagen. Steering columns from two different manufacturers have been used on the vehicles covered by this manual. The two versions are shown on the following page. When replacing a steering column, always use one from the same manufacturer as the original.

Steering column, versions

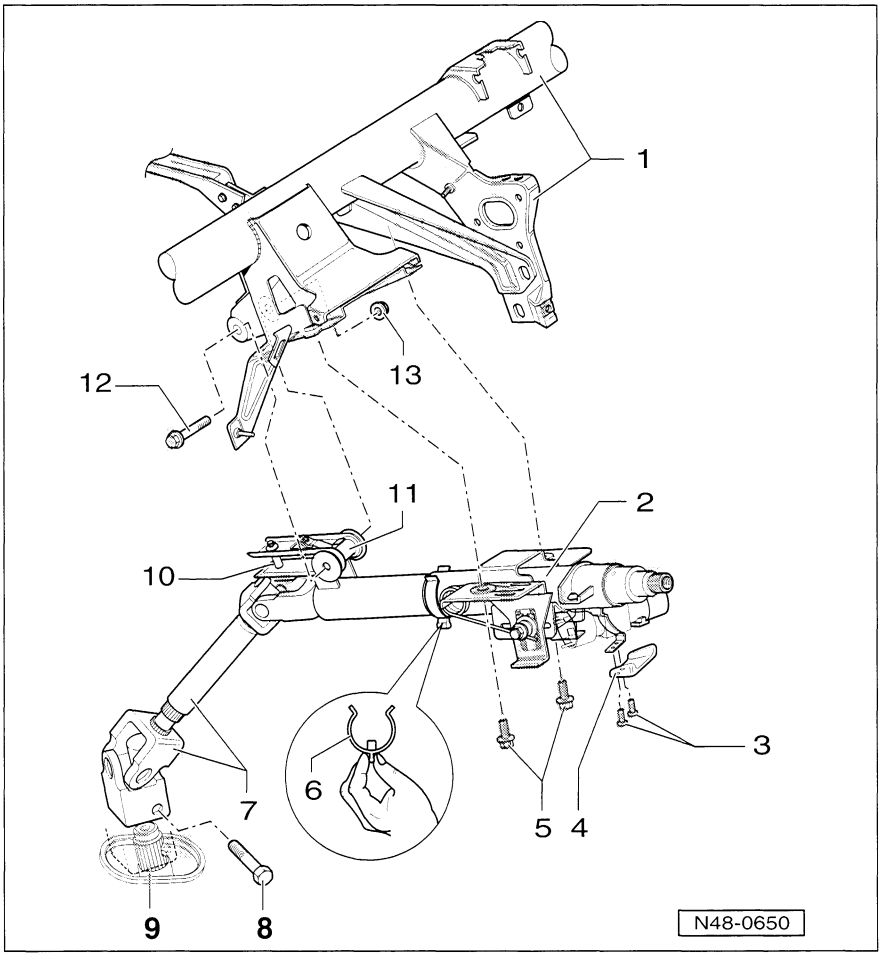
A. Steering column version by NACAM

B. Steering column version by Krupp Presta

1. **Transportation shipping device**
   - Remove first after steering column is installed
2. **Upper steering shaft**
   - Upper shaft is not visible on Nacam version
3. **Lower steering shaft with universal joint**
4. **Bolts, hex**
   - Tighten to 25 Nm (18 ft-lb)
   - Install with locking fluid



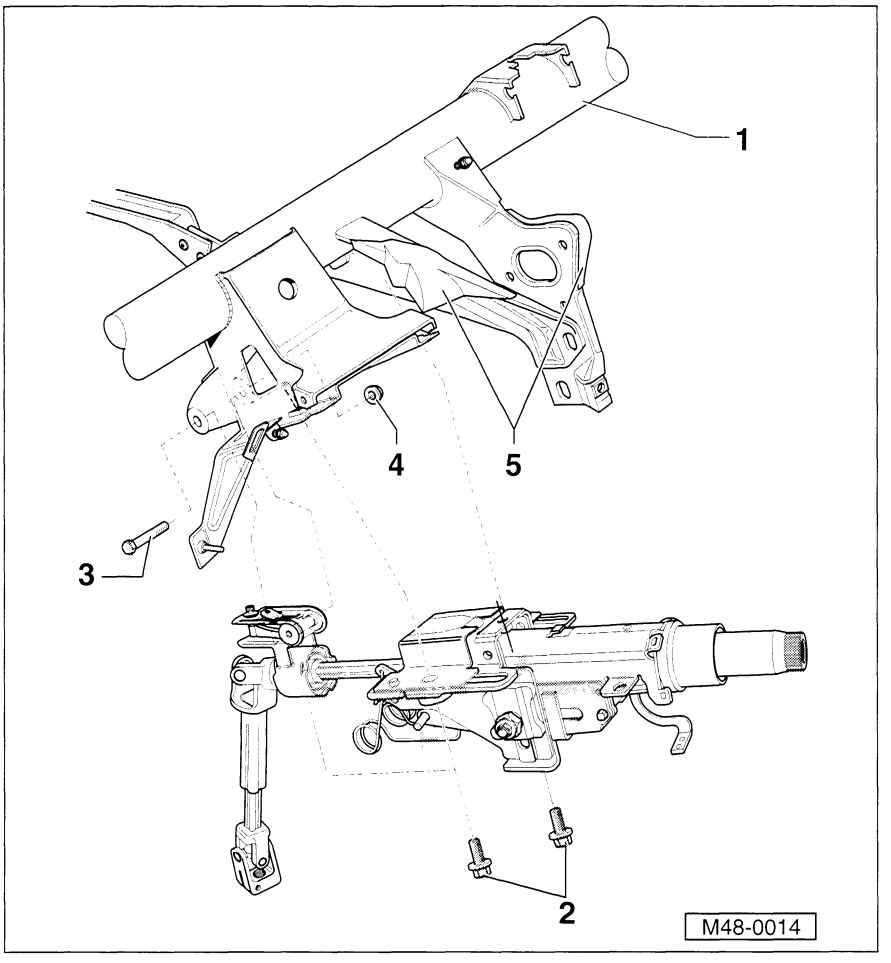
Steering column assembly (Nacam)



1. **Crossmember for steering column**
2. **Steering column**
   - Secure steering column before removal, see **Steering column, securing before removing**
   - Check for damage, see **Steering column, inspecting for damage**
3. **Bolts**
4. **Handle**
   - Lock/unlock column adjustment
5. **Bolts**
   - Tighten to 25 Nm (18 ft-lb)
6. **Transportation securing device**
   - Remove after column has been installed into vehicle
7. **Steering column universal joint shaft**
8. **Bolt**
   - Tighten to 30 Nm (22 ft-lb)
9. **Steering gear pinion shaft**
10. **Shear bolt**
    - Tighten until head shears off
11. **Pin**
12. **Bolt**
13. **Nut**
    - Tighten to 10 Nm (7 ft-lb)

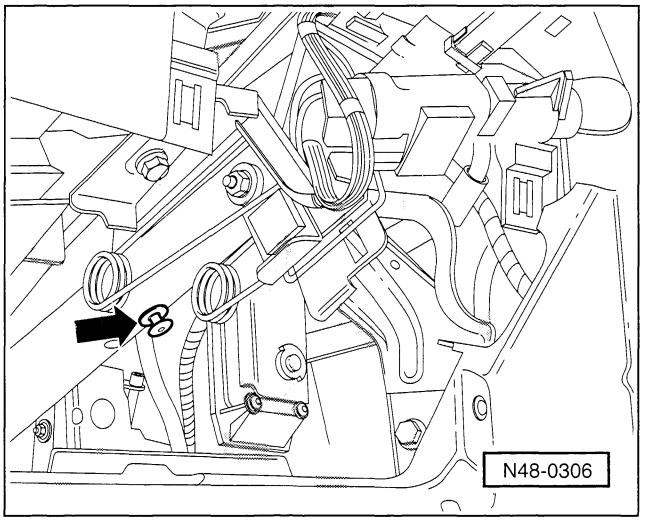
Steering column assembly (Krupp Presta)

1. **Crossmember for steering column**
   - Secure steering column before removal, see **Steering column, securing before removing**
   - Check for damage, see **Steering column, inspecting for damage**
2. **Bolts**
   - Tighten to 25 Nm (18 ft-lb)
3. **Hex bolt**
4. **Hex nut**
   - Tighten to 10 Nm (7 ft-lb)
5. **Plastic covers**
   - As applicable



Steering column, securing before removing

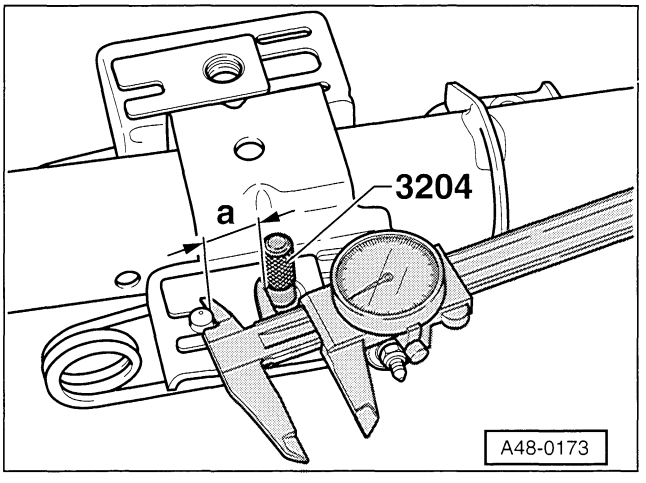
- Assembly aid is required to prevent upper and lower sections of steering column from pulling apart during removal.
- Splined sections can separate and cause rattling noises unless installed in original positions.



➤ Push or pull steering column slightly to align holes and insert suitable clip or pin into hole (**arrow**).

Steering column, inspecting for damage

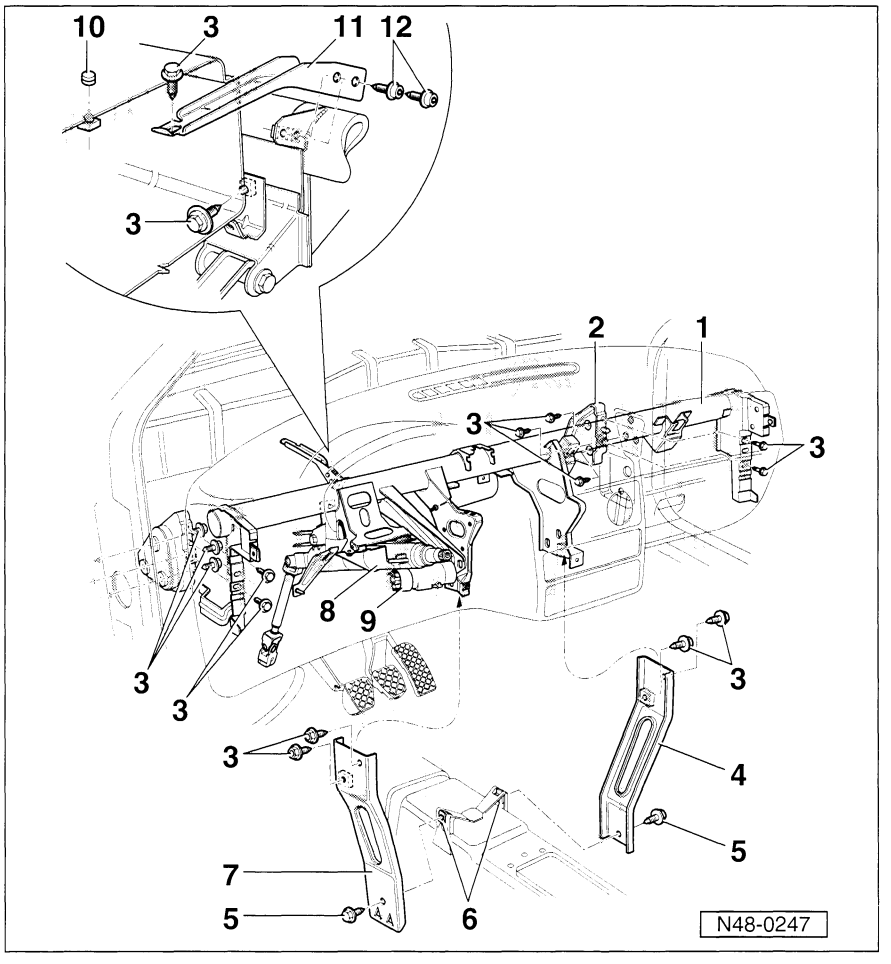
- Visually inspect for damage.
- Disconnect steering column universal joint shaft and check for smooth operation (without binding) of steering shaft.
- Check that steering column can be adjusted for full range of height and telescopic adjustment.



➤ Check gap (**a**) with alignment pin inserted in hole. Maximum distance from edge to edge is 23 mm (0.906 in).

Steering column crossmember, assembly

1. **Steering column crossmember**
2. **Adjustment brackets**
3. **Hex bolts**
   - Tighten to 25 Nm (18 ft-lb)
4. **Support, right**
5. **Bolts**
6. **Speed nuts**
7. **Support, left**
8. **Steering column assembly**
9. **Steering lock housing**
10. **Sealing plug**
11. **Support for bulkhead**
12. **Bolts**
    - Tighten to 10 Nm (89 in-lb)



Steering column switches and lock housing, removing and installing

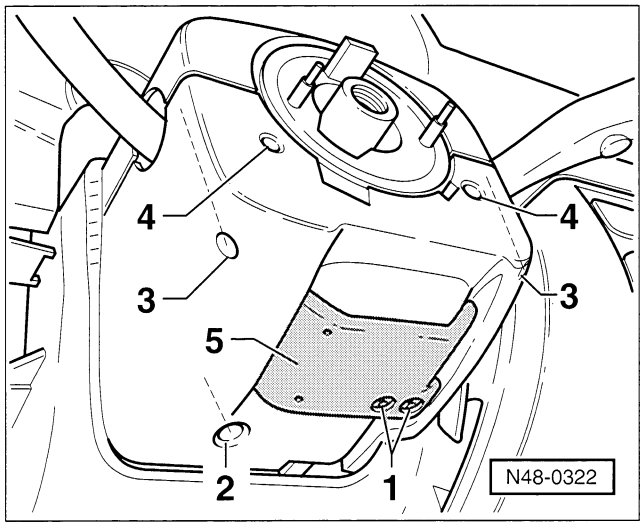
WARNING —
Observe all cautions, warnings and notes before starting repairs involving airbag systems.

– Turn the wheels to the straight ahead position.

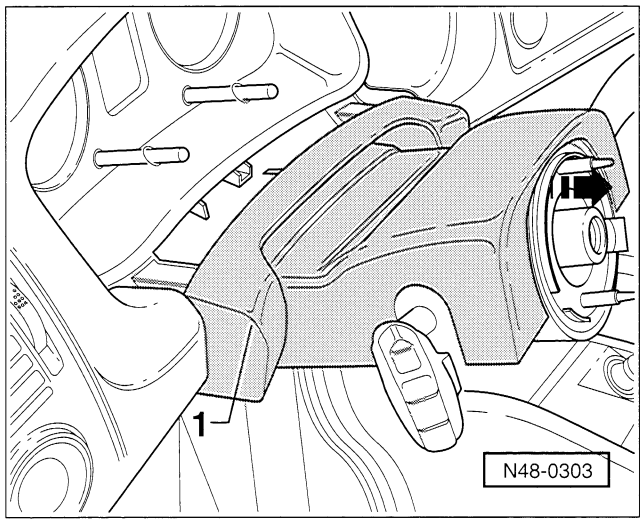
– Disconnect battery ground (GND) strap from battery negative (–) terminal. See the **Cautions** at the beginning of this repair group regarding battery disconnection.

NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.

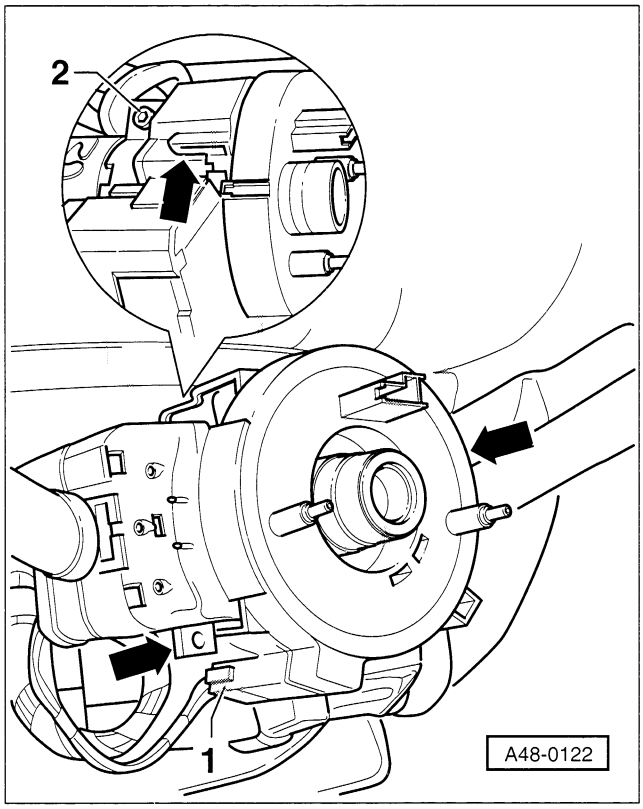
– Remove airbag and steering wheel, see **69 Seatbelt, Airbags**.



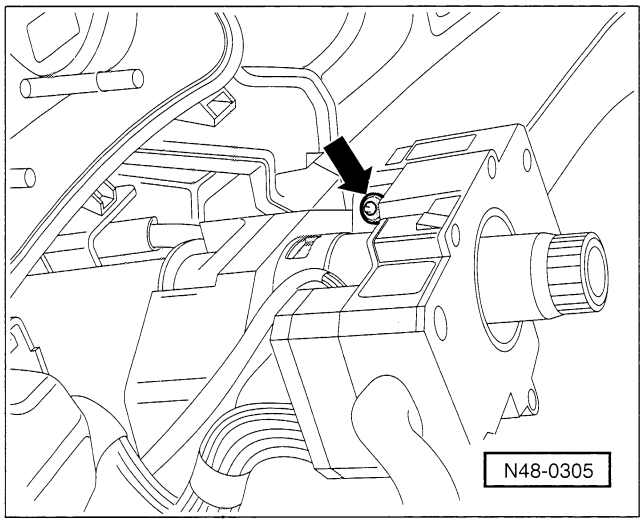
➤ Steering column as seen from below. Remove handle screws (**1**), handle (**5**), and securing screws (**2**, **3** and **4**).



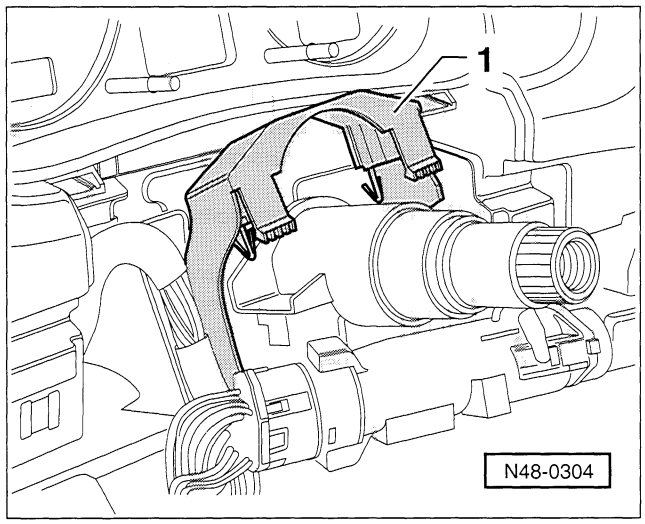
➤ Remove upper steering column switch trim (**1**).



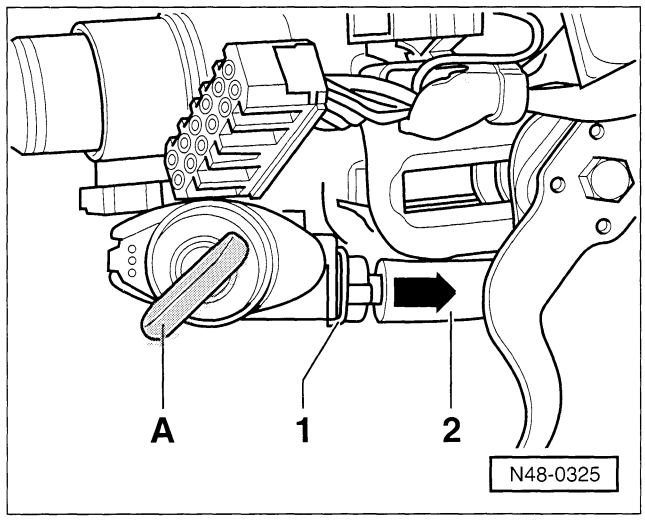
➢ Unplug harness connector (**1**) and release locking lugs (**arrow**) on spiral spring/slip ring and pull off.



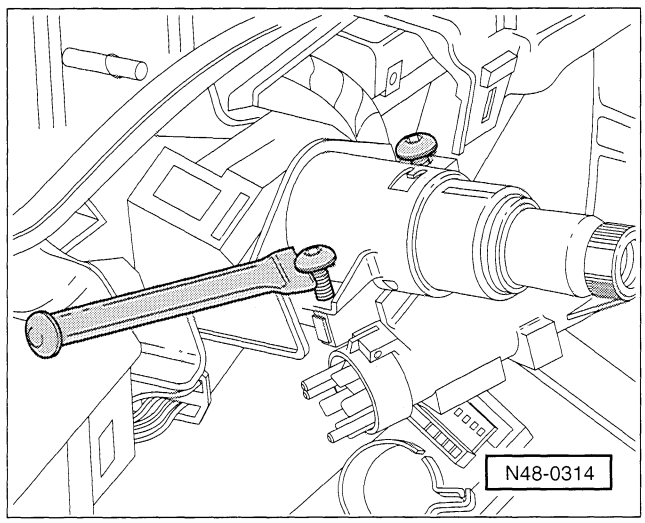
➢ Remove securing bolt (**arrow**) for steering column switch, unplug switch assembly and slide off steering column.



➤ Remove plastic cover (**1**) over shear bolts and pull up to remove.



➤ On vehicles with automatic transmission, unhook shift lock cable by placing shift lever in park, and turning ignition key (**A**) to the on position. Press wire retaining clip (**1**) upward or downward (depending on installed position) while pulling out (**arrow**) on locking cable (**2**).

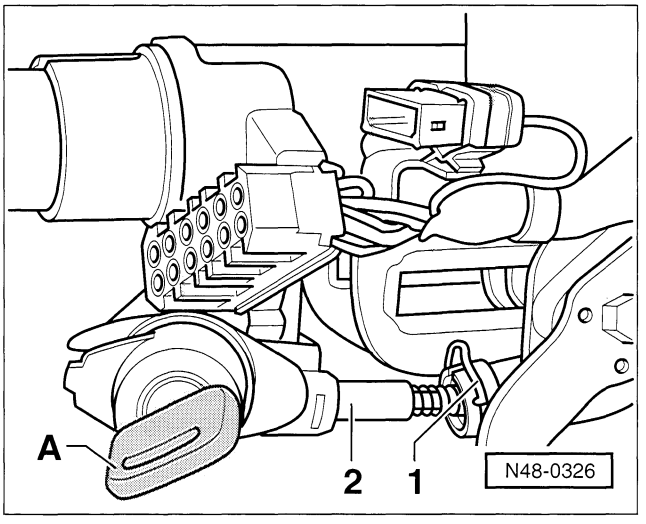


➤ Cut off shear head bolts using a suitable sharp chisel.

– Unplug harness connector on ignition switch and slide lock housing off of column.

– Begin installation by installing lock housing onto steering column with new shear bolts. Bolts are correctly torqued when hex head on bolt shears off.

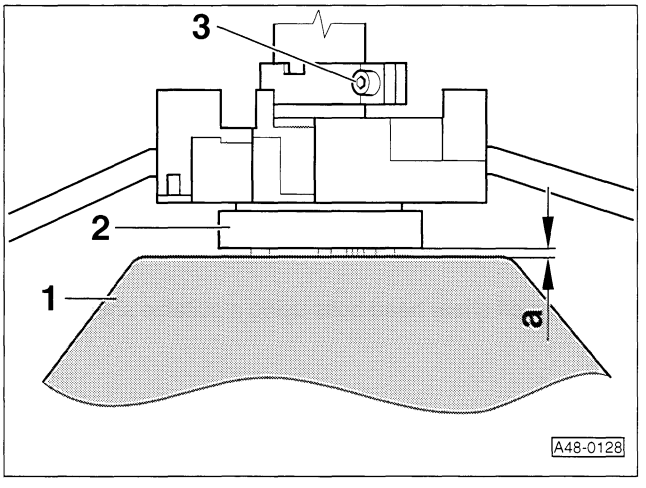
– Install plastic cover over shear bolts.



On vehicles with automatic transmission, connect shift lock cable (**2**) by placing shift lever in park, and turning ignition key (**A**) to the on position. Slide locking cable onto steering lock housing until wire clip (**1**) engages.

– Install steering column switch assembly.

– Install spiral spring/slip ring.



Temporarily install steering wheel (**1**) and adjust distance between spiral spring/slip ring (**2**) and steering wheel. Adjustment is made by sliding switch assembly on steering column and locking in place with securing screw (**3**).

Specification

- Clearance between steering wheel and spiral spring/slipring . . . . . approx. 2½ mm (0.1 in)

– Remove steering wheel and install steering column trim.

– Remainder of installation is the reverse of removal.

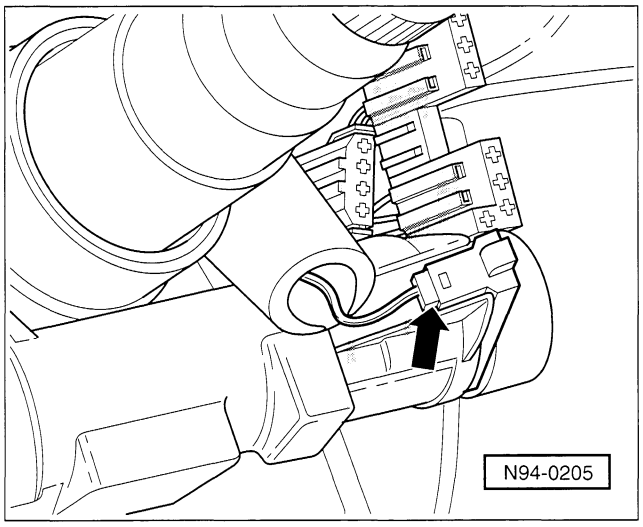
Tightening torque

- Steering wheel bolt. . . . . 50 Nm (37 ft-lb)

WARNING —
Observe all cautions, warnings and notes when completing repairs involving airbag systems.

Ignition lock cylinder and switch, removing and installing

WARNING —
Observe all cautions, warnings and notes before starting repairs involving airbag systems.



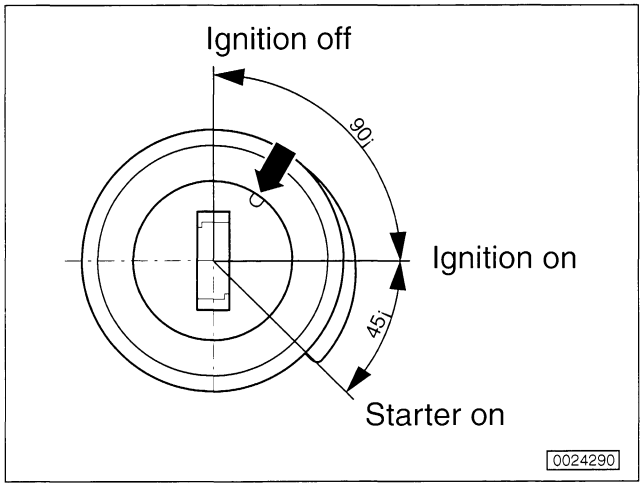
– Disconnect battery ground strap.

– Remove airbag and steering wheel, see **69 Seatbelt, Airbags**.

– Remove upper and lower steering column trim as described earlier.

➢ Where applicable, carefully disconnect harness connector for the inductive coil for anti-theft immobilizer from lock cylinder.

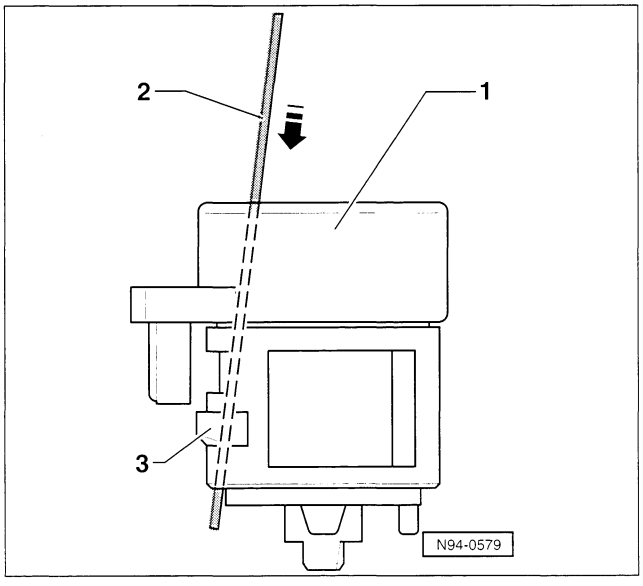
NOTE —
The induction coil for anti-theft immobilizer is integrated with lock cylinder and cannot be serviced separately.



➢ Insert ignition key into lock cylinder and turn to ignition **ON** position.

– Insert a wire tool approximately 1.2 mm (0.047 in) in diameter into the opening (**arrow**) in the face of the lock cylinder.

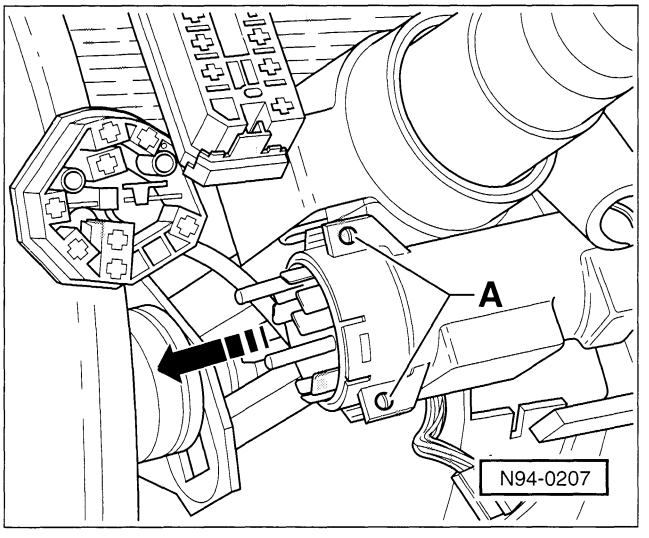
NOTE —
A large paper clip or a 3/64 inch drill bit are suitable for inserting into lock cylinder opening.



➢ Remove ignition lock cylinder by pushing in (**arrow**) on wire tool (**2**) while pulling gently on key. Wire tool (**2**) will release locking tab (**3**) and allow lock cylinder to slide out.

– Disconnect harness connector from ignition switch.

– Remove sealant (paint) from ignition switch securing screws.



➤ Remove screws (**A**) and remove switch in direction of **arrow**.

– Loosen ignition switch securing screws and pull ignition switch out from steering lock housing.

NOTE —

- *When installing ignition/starter lock switch ensure that it is in the same position as the lock cylinder, e.g. "ignition on".*
- *Be sure to use locking compound on ignition switch securing screws when installing.*

– Install ignition lock cylinder by inserting key into lock cylinder and turning key into the same position used on removal.

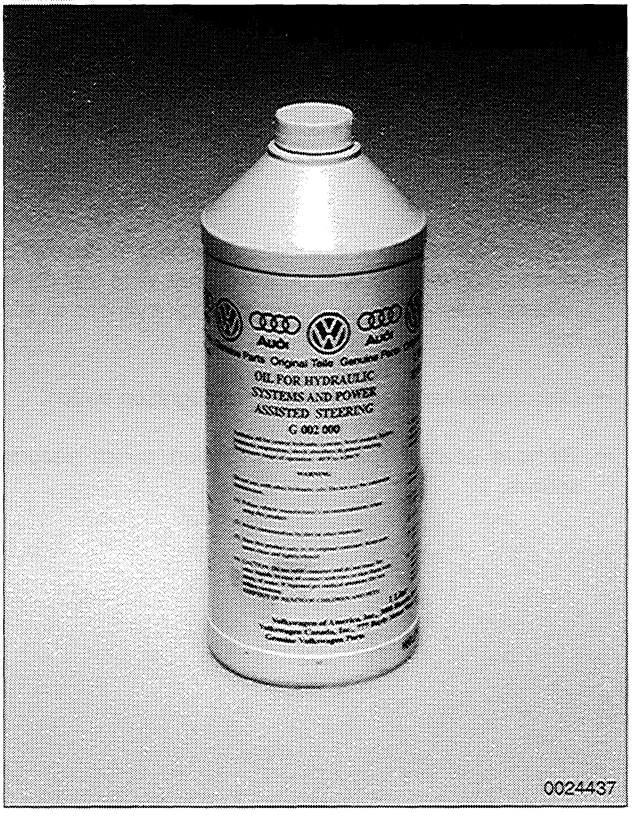
– Insert wire tool into opening and slide assembly fully into ignition lock housing until seated.

– Remove wire tool and check for smooth operation of ignition lock and cylinder.

– Installation is reverse of removal for remaining components.

> ***WARNING —***
> *Observe all cautions, warnings and notes when completing repairs involving airbag systems.*

POWER STEERING GEAR



POWER STEERING GEAR

The power rack and pinion steering gear is not serviceable, malfunctioning units must be replaced.

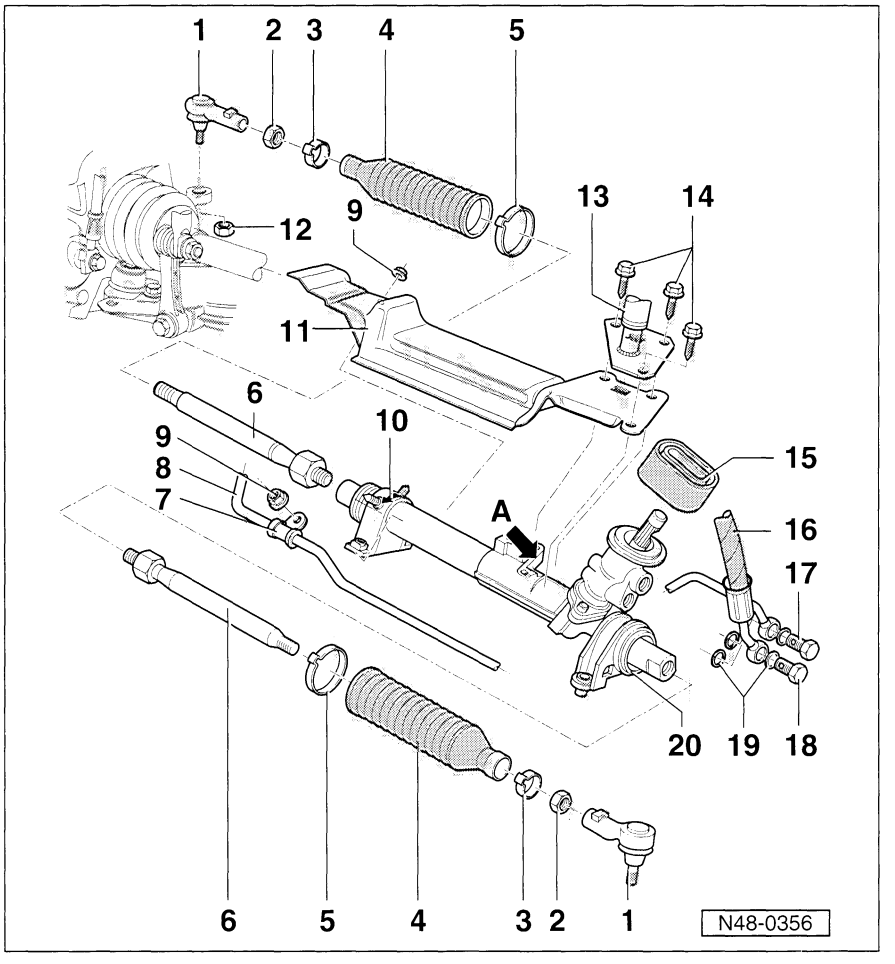
Specifications

- Special steering rack grease . . . . . .AOF 063 000 04
- Power steering hydraulic oil . . . . . G 002 000
- Power steering hydraulic oil quantity . . . . . 0.7 - 0.9 L (23.6 - 30.4 oz.)

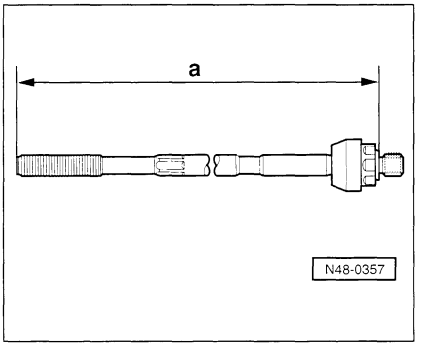
Tightening torque

- Power steering gear to subframe (M8) always replace . . . . .20 Nm (15 ft-lb) + ¼ turn (90°)
- Subframe to body (M14) always replace . . . .100 Nm (74 ft-lb) + ¼ turn (90°)
- Universal joint to steering gear pinion always replace (M8) . . . . . 30 Nm (22 ft-lb)
- Return line banjo bolt (M16) . . . . . 45 Nm (33 ft-lb)
- Pressure hose banjo bolt (M14) . . . . 38 Nm (28 ft-lb)
- Pendulum support to transmission (M8) always replace . . . . .40 Nm (30 ft-lb) + ¼ turn (90°)
- Tie rod end to wheel bearing housing (M12) always replace . . . . . 45 Nm (33 ft-lb)

Power steering gear, assembly



1. **Tie rod end**
   - Removing, see **Tie rod, removing**
2. **Nut**
   - Tighten to 50 Nm (37 ft lb)
3. **Clamp**
   - Always replace
   - Use special clamp pliers (VAG 1275 or equivalent) to install
4. **Boot**
   - Must not be twisted while adjusting toe
   - Remove steering gear to replace
5. **Clamp**
   - Always replace
   - Use special clamp pliers (VAG 1275 or equivalent) to install
6. **Tie rod**
   - Tighten to 75 Nm (55 ft-lb)
   - Replacement parts are supplied preset
   - Check vehicle alignment if replaced
7. **Clamp with rubber sleeve**
8. **Hydraulic return line**
   - Installing, see **Power steering return line, installing**
9. **Nut**
   - Tighten to 22 Nm (16 ft-lb)
10. **Mounting bracket with rubber bushing**
    - Arrow on bracket points forward
    - Replace if threads in welded nut are damaged
11. **Heat shield**
12. **Nut, self-locking**
    - Tighten to 45 Nm (33 ft-lb)
13. **Selector mechanism bearing bracket**
    - Center on support (**arrow A**) with heat shield (**11**)
14. **Bolts**
    - Tighten to 24 Nm (18 ft-lb)
15. **Gasket**
16. **Hydraulic pressure hose**
17. **Banjo bolt**
    - Tighten to 45 Nm (33 ft-lb)
18. **Banjo bolt**
    - Tighten to 38 Nm (28 ft-lb)
19. **Seals**
    - Always replace
20. **Power steering gear**
    - Center before installing, see **Power steering rack, determining center position**
    - Adjusting, see **Power steering gear, adjusting**

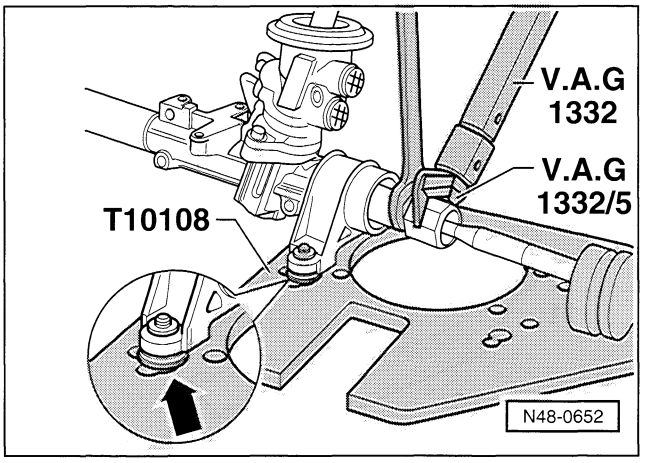


Tie rods, modified

- Early tie rod, dimension a: 343.1 mm
- Late tie rod, dimension a: 318.9 mm

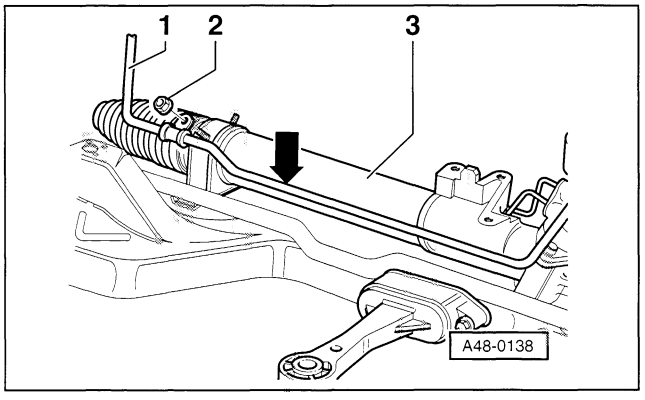
NOTE —

Do not mix early and late tie rods on the same vehicle.



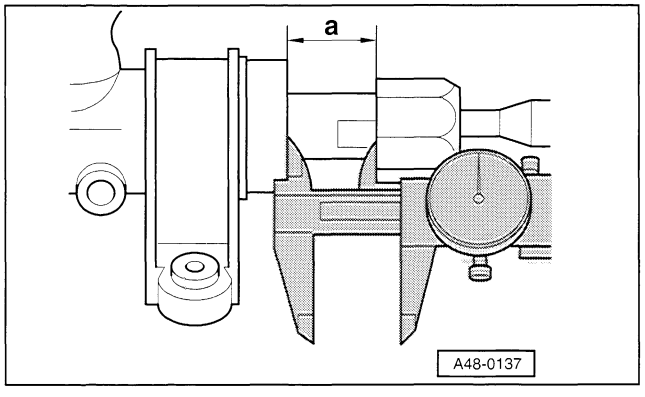
Tie rod, removing

- Steering gear must be removed before removing tie rods. Use Volkswagen special tools VAG 1332and 1332/5 or equivalent to remove tie rod. Use transmission support T10108, or similar to hold steering gear.
- Seal power steering line connections on steering gear.
- Clean area around steering gear boot.
- Open boot clamps and push boot back.
- Clamp steering gear in vice and remove tie rod using appropriate tools as shown earlier.



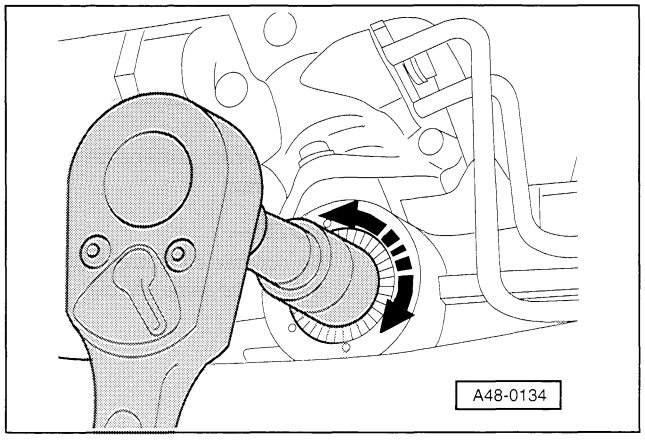
Power steering return line, installing

- When installing power steering return line, a gap (**arrow**) of approx. 10 mm (0.39 in) must exist between return line (**1**) and steering gear (**3**).
- Tighten nut (**2**) to 22 Nm (16 ft-lb).



Power steering rack, determining center position

- Center position must be identified before installation.
- Slide rack until dimension (**a**) is obtained.
- Dimension (**a**) = 30.5 mm (1.20 in).



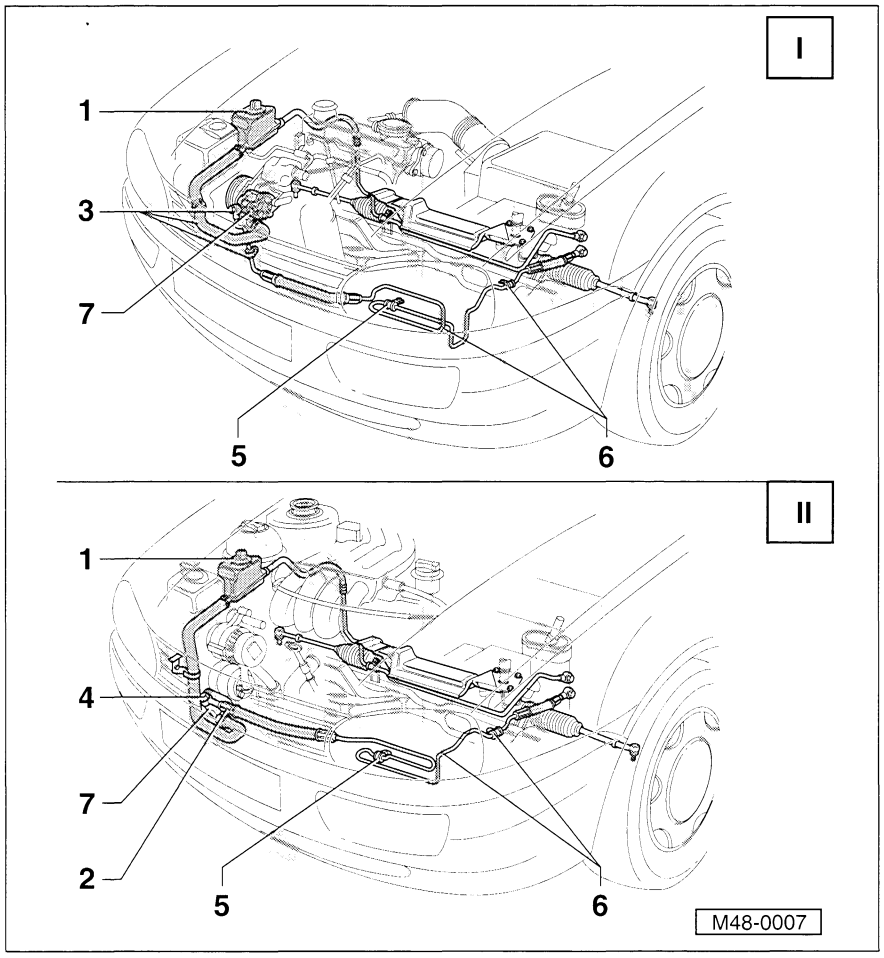
Power steering gear, adjusting

- Use of a helper is necessary to adjust steering gear.
- Raise vehicle and position front wheels straight ahead.
- Turning steering wheel back and forth (approx. 30° from center) will produce a knocking noise if play is excessive.
- Carefully turn adjustment screw in until knocking noise can no longer be heard from inside vehicle.
- Road test vehicle to ensure steering returns to center without sticking.
- Secure lock nut for adjustment screw with a punch mark.

POWER STEERING HYDRAULIC HOSES

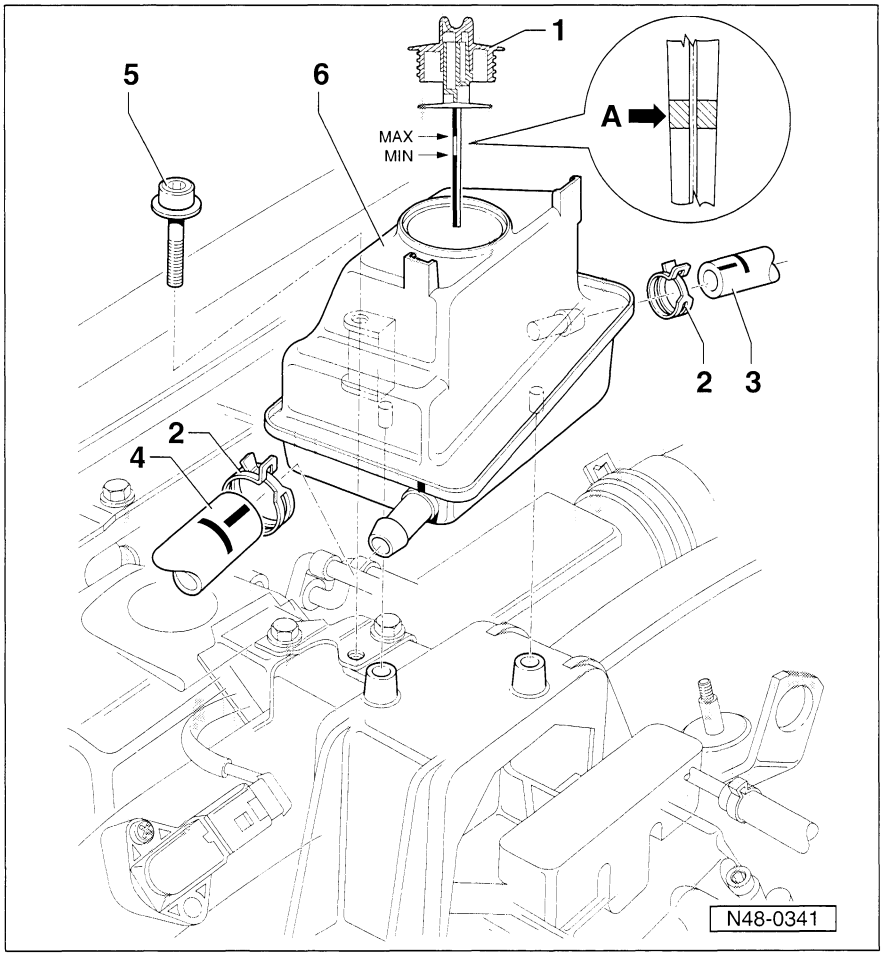
Power steering lines, overview

1. **Fluid reservoir**
2. **Pressure hose/line**
   - Vehicles with TDI engine and A/C
3. **Pressure hose/line**
   - Vehicles with TDI engine and no A/C
4. **Pressure hose/line**
   - Vehicles with TDI engine and A/C
5. **Pressure hose/line**
   - On 5-speed manual transmission 02J
6. **Pressure hose/line**
   - On automatic transmission
7. **Pressure hose/line**
   - Fill before installing



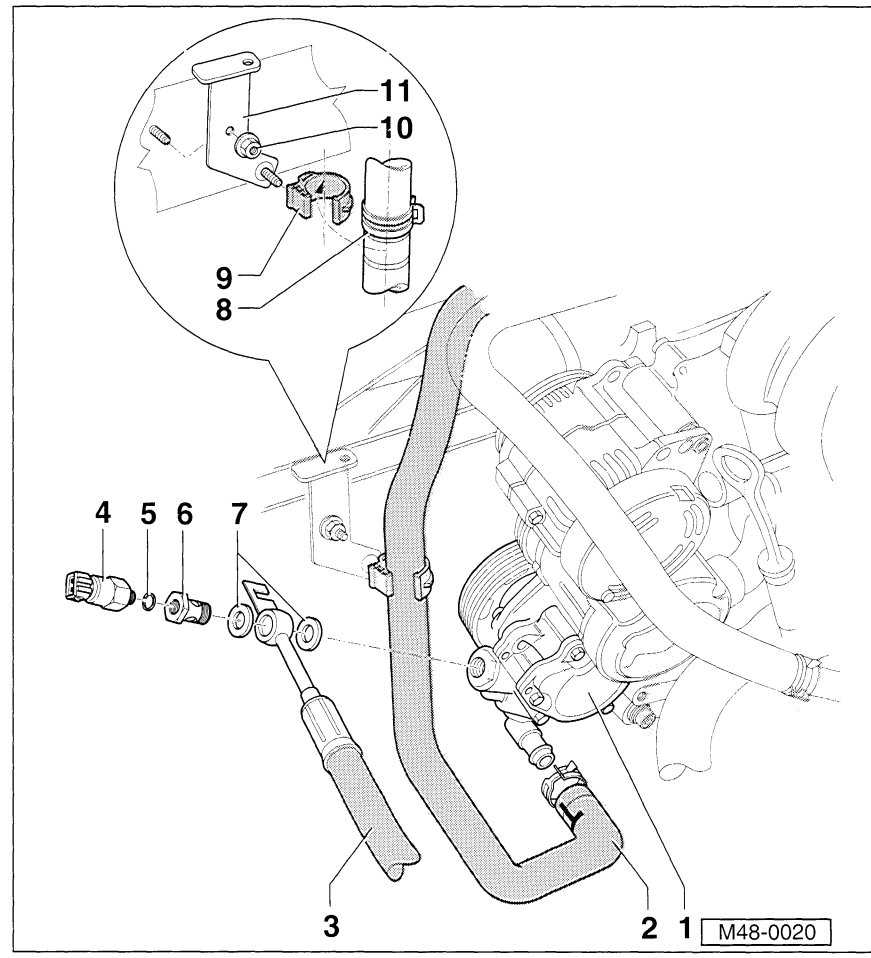
Power steering fluid reservoir, assembly

1. **Cap with dip stick**
   - Twist to open using suitable tool as required
   - Screw cap on fully to check oil level
   - Oil level with engine warm, approx. 50°C (122°F): between **MIN** and **MAX** marks (**arrow A**)
   - Oil level with engine cold: not over **MIN** marking
2. **Spring clamp**
3. **Suction hose**
4. **Return hose**
5. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
6. **Reservoir**



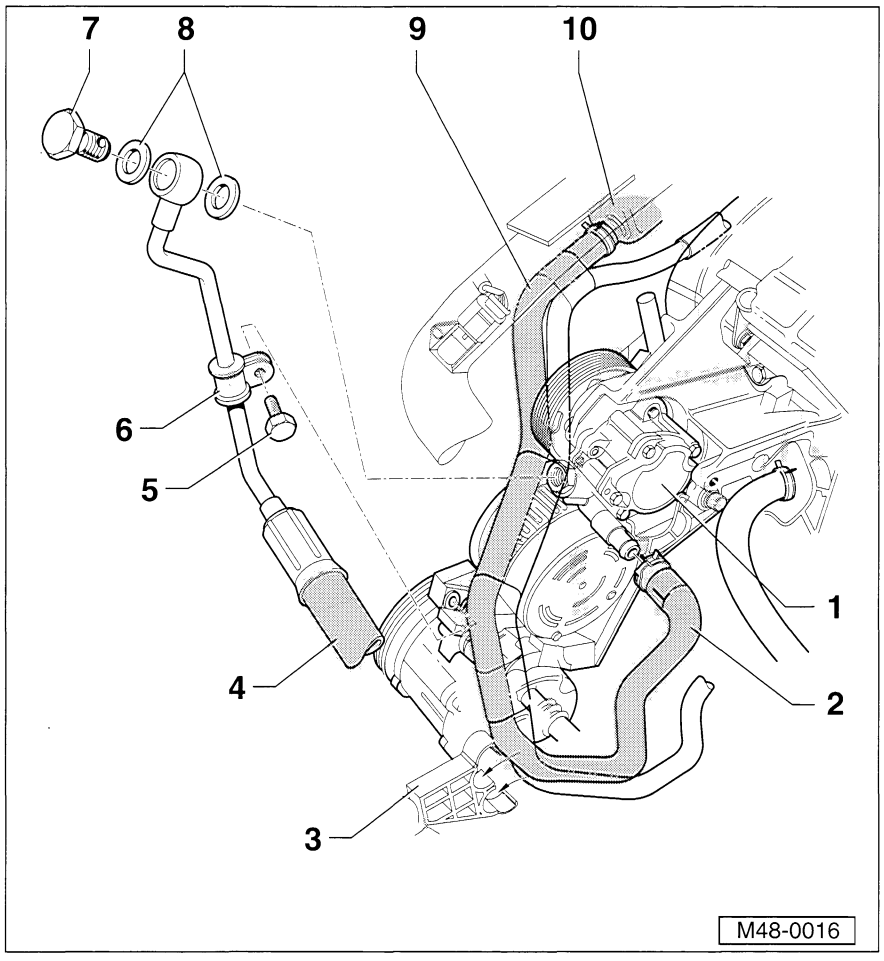
Power steering hoses (gasoline engines with A/C)

1. **Power steering pump**
   - Fill with oil before installing
2. **Suction hose**
3. **Pressure hose**
4. **Pressure switch**
   - Only on 1.8L engine
   - Switches at 40 bar (580 psi)
   - Tighten to 15 Nm (11 ft-lb)
5. **Seal**
   - Only on 1.8L engine
   - Always replace
6. **Banjo bolt**
   - Without pressure switch (item **4**) on 2.0L and 2.8L
   - Tighten to 30 Nm (22 ft-lb)
7. **Seals**
   - Always replace
8. **Suction hose**
   - White or yellow ring must seat within retainer (item **9**)
9. **Retainer**
10. **Bolt**
11. **Mounting bracket**



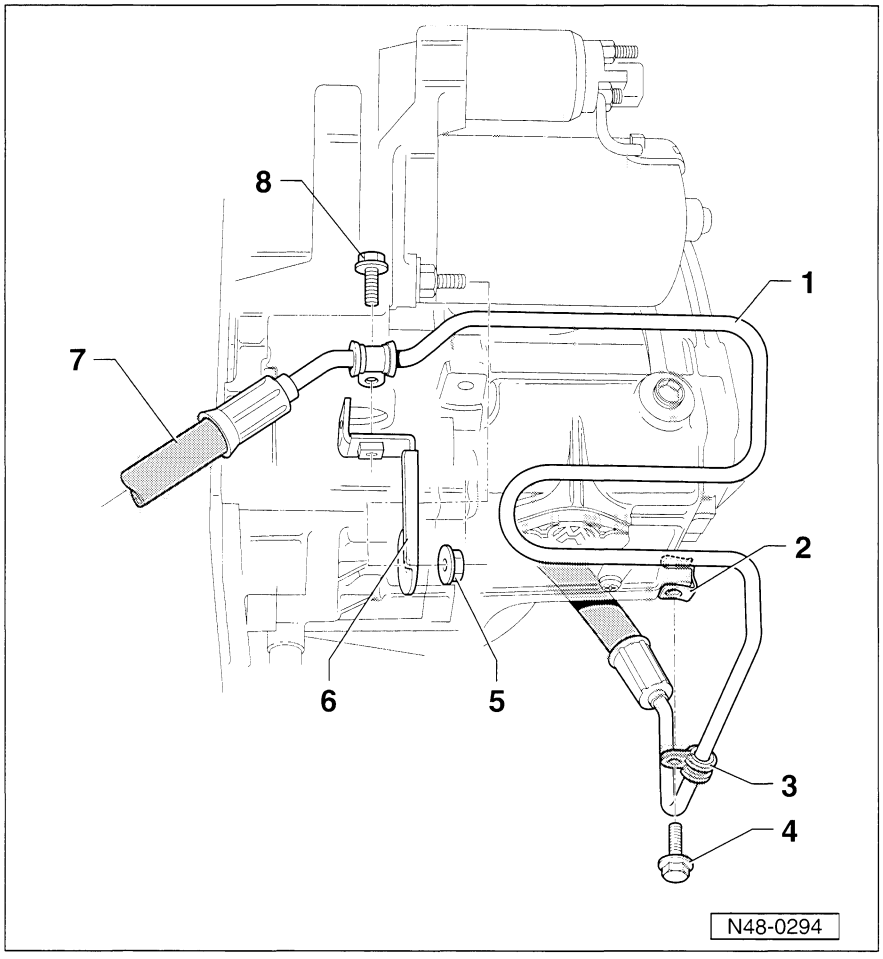
Power steering hoses (diesel engine with A/C)

1. **Power steering pump**
   - Fill with oil before installing
2. **Suction hose**
3. **Mounting bracket**
4. **Pressure hose**
5. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
6. **Clamp**
7. **Banjo bolt**
   - Tighten to 30 Nm (22 ft-lb)
8. **Seals**
   - Always replace
9. **Suction hose**
10. **Fluid reservoir**



Pressure hose, mounting to manual transmission

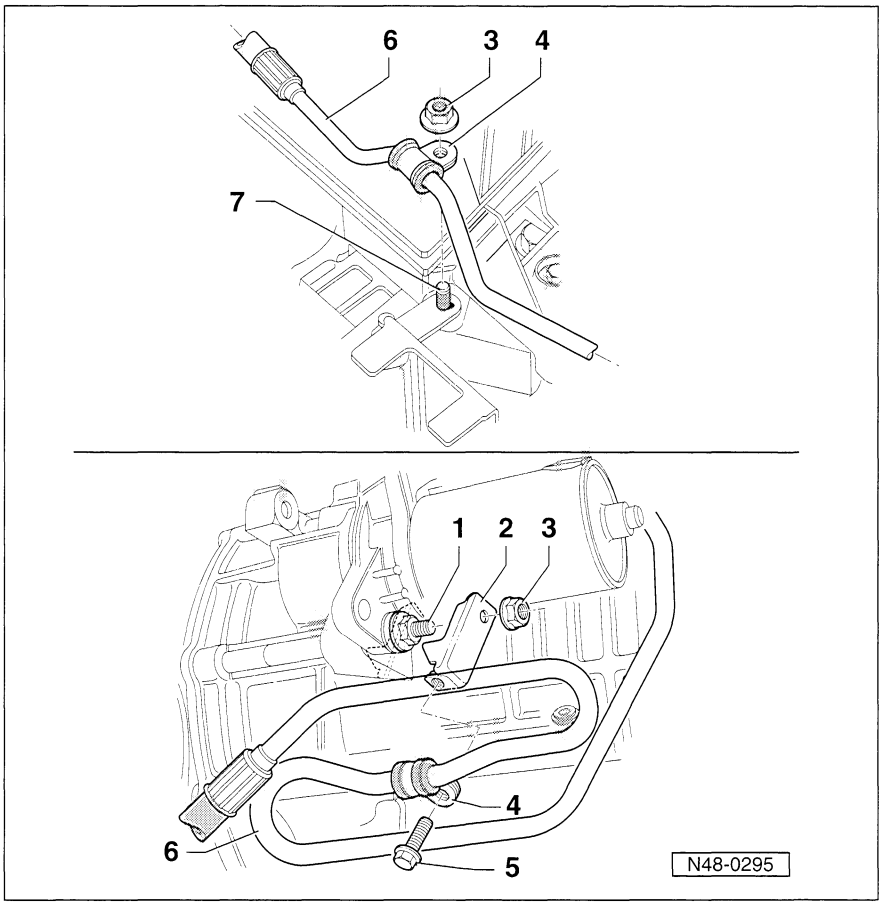
1. **Pressure line**
2. **Speed nut**
3. **Mounting clamp**
4. **Bolt**
   - Tighten to 22 Nm (16 ft-lb)
5. **Nut**
   - Tighten to 25 Nm (18 ft-lb)
6. **Mounting bracket**
7. **Pressure hose**
8. **Bolt**
   - Tighten to 22 Nm (16 ft-lb)



Pressure hose, mounting to automatic transmission

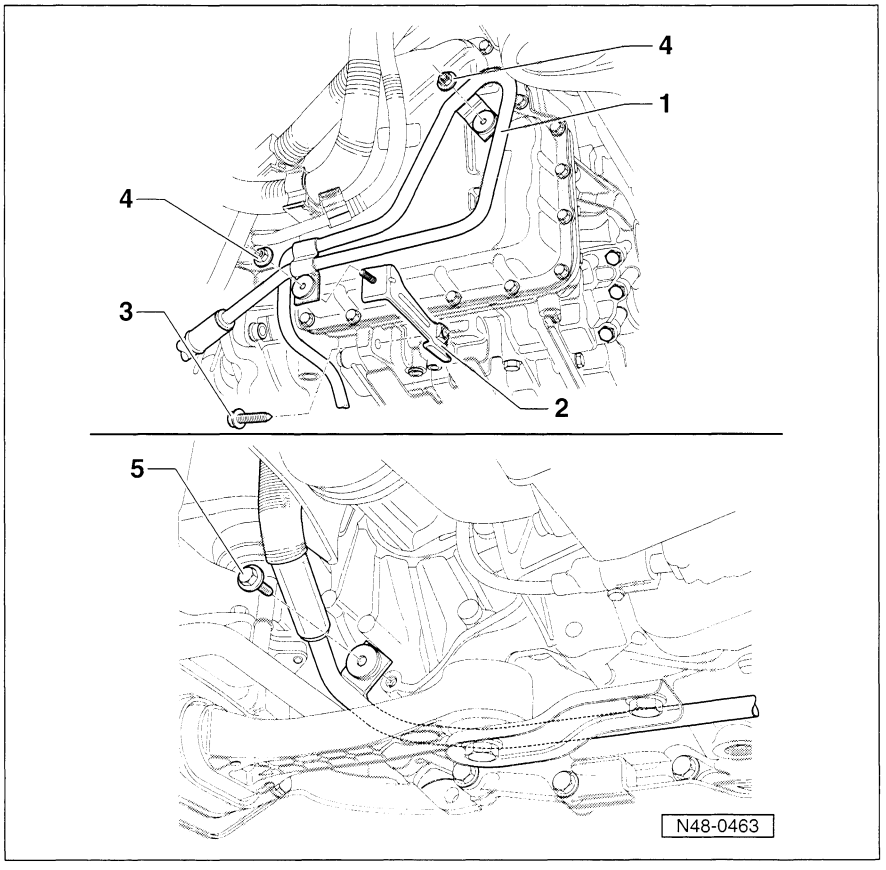
01M 4-speed transmission

1. **Starter mounting bolt**
2. **Mounting bracket**
3. **Nut**
   - Tighten to 22 Nm (16 ft-lb)
4. **Clamp**
5. **Nut**
   - Tighten to 22 Nm (16 ft-lb)
6. **Pressure hose**
7. **Securing bolt on transmission**



09A 5-speed transmission

1. **Pressure hose**
2. **Mounting bracket**
3. **Bolt**
   - Tighten to 22 Nm (16 ft-lb)
4. **Nut**
   - Tighten to 9 Nm (6 ft-lb)
5. **Bolt**
   - Tighten to 22 Nm (16 ft-lb)



POWER STEERING PUMP

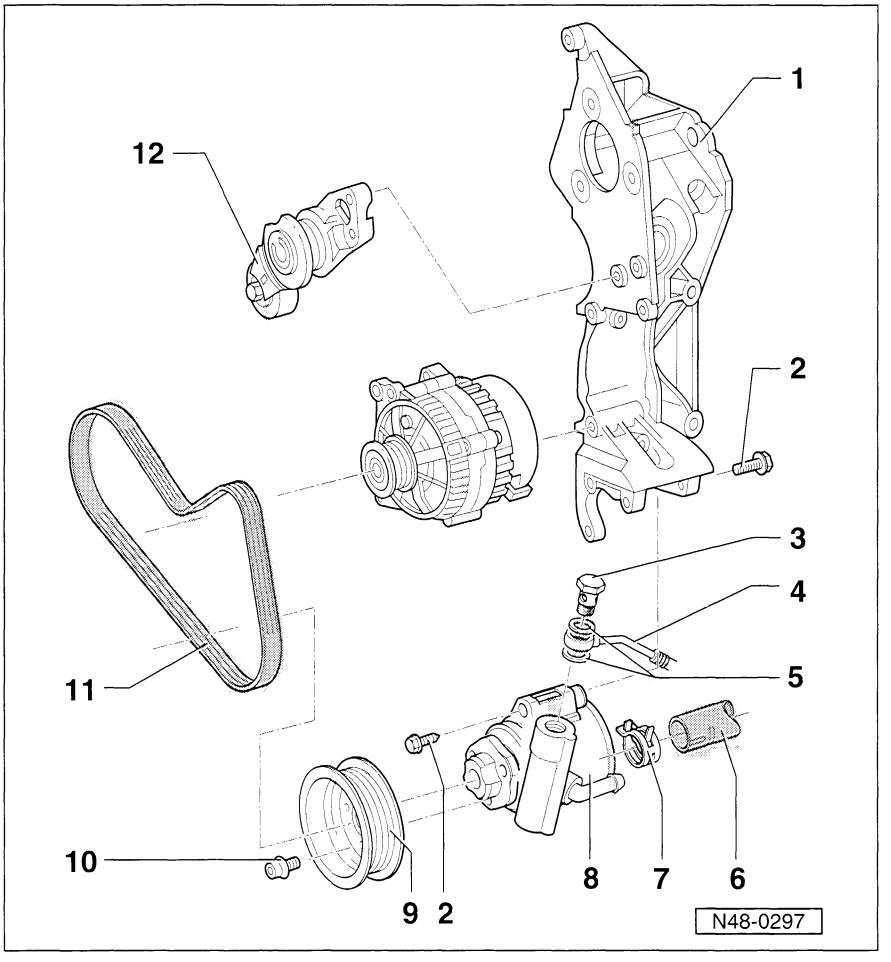
Different power steering pump positions and belt routings are used on the vehicles covered by this manual depending on engine type and equipment level.

Specification

Power steering pump pressures at idle

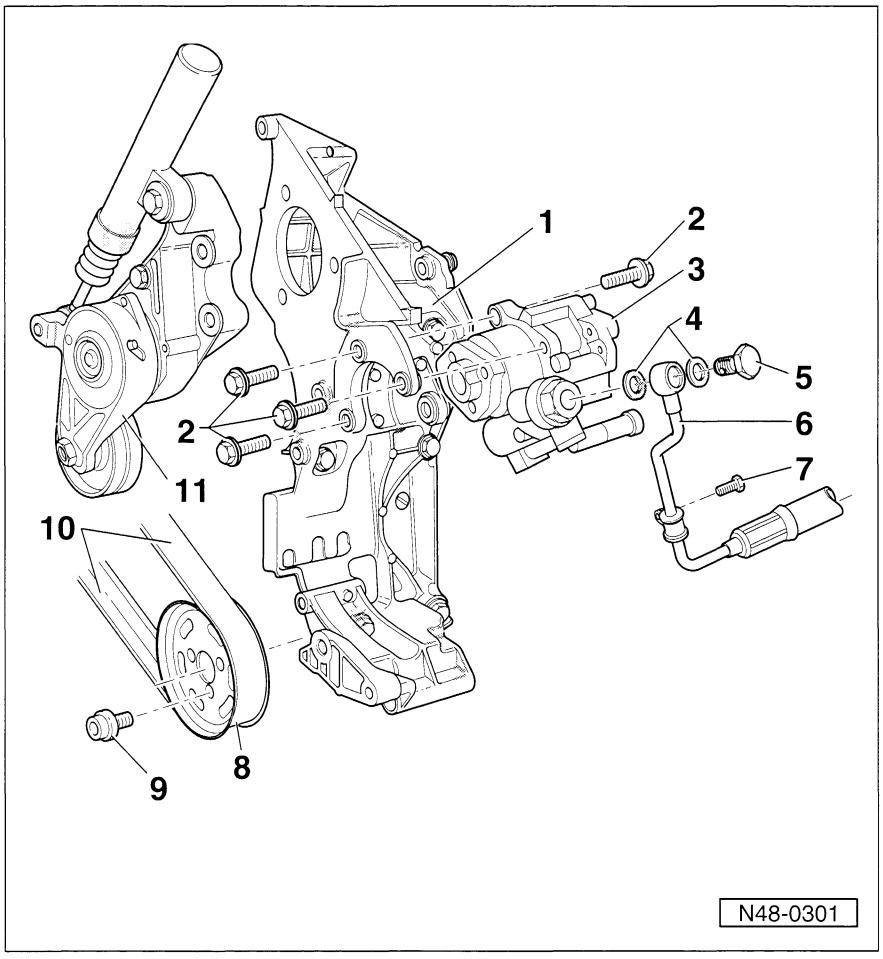
- Gasoline engines: 5-95 bar (1233-1378 psi)
- Diesel engines: 96-105 bar (1392-1523 psi)

Power steering pump assembly, (pump in lower mounting bracket)



1. **Bracket (diesel shown, gasoline similar)**
2. **Bolts**
   - Tighten to 25 Nm (18 ft-lb)
3. **Banjo bolt**
   - Tighten to 38 Nm (28 ft-lb)
4. **Pressure hose assembly**
5. **Seals**
   - Always replace
6. **Suction hose**
7. **Spring clamp**
8. **Power steering pump**
   - Fill with oil before installing
9. **Belt pulley**
10. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
11. **Ribbed V-belt**
    - Using a crayon or marker, mark the direction of travel before removing the ribbed belt
    - Reinstalling a used belt in the opposite direction could damage the belt
    - Make sure belt is correctly seated in the pulleys when installing
12. **Ribbed V-belt tensioner**

Power steering pump assembly, (pump in upper mounting bracket)



1. **Bracket**
2. **Bolts**
   - Tighten to 25 Nm (18 ft-lb)
3. **Power steering pump**
   - Fill with oil before installing
4. **Seals**
   - Always replace
5. **Banjo Bolt**
   - Tighten to 30 Nm (22 ft-lb)
6. **Pressure hose assembly**
7. **Bolt**
   - Tighten to 22 Nm (16 ft-lb)
8. **Belt pulley**
9. **Socket-head bolt**
   - Tighten to 25 Nm (18 ft-lb)
10. **Ribbed V-belt**
    - Using a crayon or marker, mark the direction of travel before removing the ribbed belt
    - Reinstalling a used belt in the opposite direction could damage the belt
    - Make sure belt is correctly seated in the pulleys when installing
11. **Ribbed V-belt tensioner**

50 Body–Front

GENERAL 50-1

FRONT BODY COMPONENTS 50-1
- Front fender assembly 50-2
- Fender dimensions, Golf/GTI 50-3
- Fender dimensions, Jetta 50-3
- Lock carrier, removing and installing 50-4
- Lock carrier, service position 50-5

FRONT NOISE INSULATION 50-5
- Noise insulation (gasoline engines) 50-5
- Noise insulation (diesel engines) 50-5
- Lower front bumper noise insulation 50-6

GENERAL

This repair group covers the front body section, front fender and radiator support removal and installation. The radiator support can be removed from the car as one unit to facilitate repairs, such as engine removal.

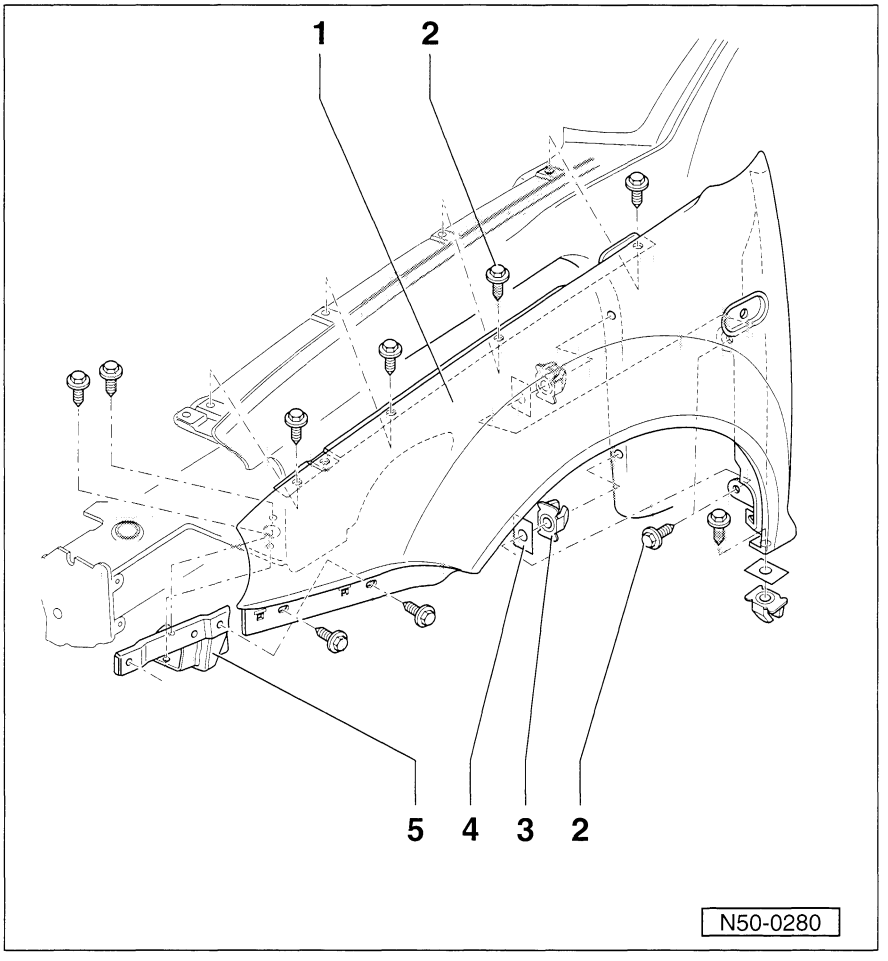
> ***WARNING —***
> *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using a VAG 1551/1552 or equivalent scan tool.*

NOTE —
Volkswagen refers to the radiator support as a lock carrier.

FRONT BODY COMPONENTS

The front fenders are both part of the front clip which must be removed as a complete assembly. See the assembly views on the following pages.

Front fender assembly



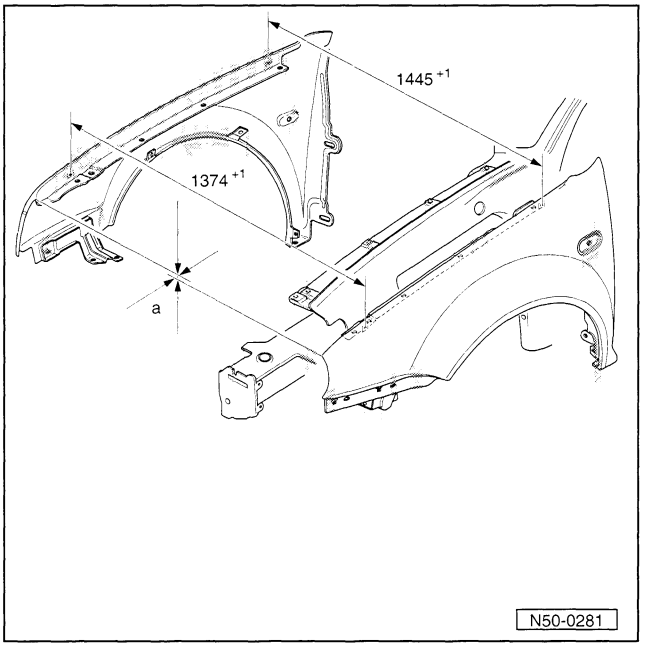
1. **Fender**
   - Dimensions, see **Fender dimensions, Golf/GTI** or **Fender dimensions, Jetta**
   - Removing:
     Remove bumper cover, see **63 Bumpers**
     Remove wheel housing liner, see **66 Body–Exterior Equipment**
     Heat fender in area of A-pillar with hot air blower to help with removal
   - Before installing screws on fender, fit a zinc intermediate piece (VW part no. AKL 381 035 50) to each bolt position contact area

   NOTE —

   Volkswagen part numbers are given for reference only. Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.

2. **Bolt**
   - Qty. 9
   - Tighten to 6 Nm (53 in-lb)
3. **Spring nut**
4. **Seal**
5. **Bracket**
   - Bolted to front of longitudinal member

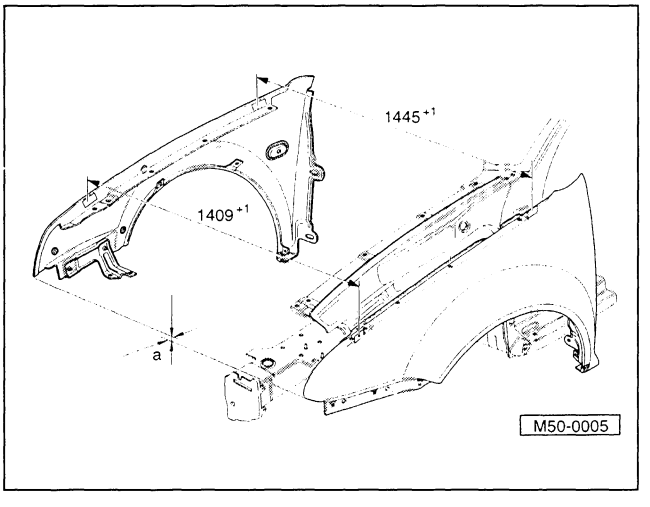
Fender dimensions, Golf/GTI



➢ Dimensions above shown in mm.

– Offset between fender horizontal and vertical points a = 0 - 2 mm (0.0787 in.).

Fender dimensions, Jetta

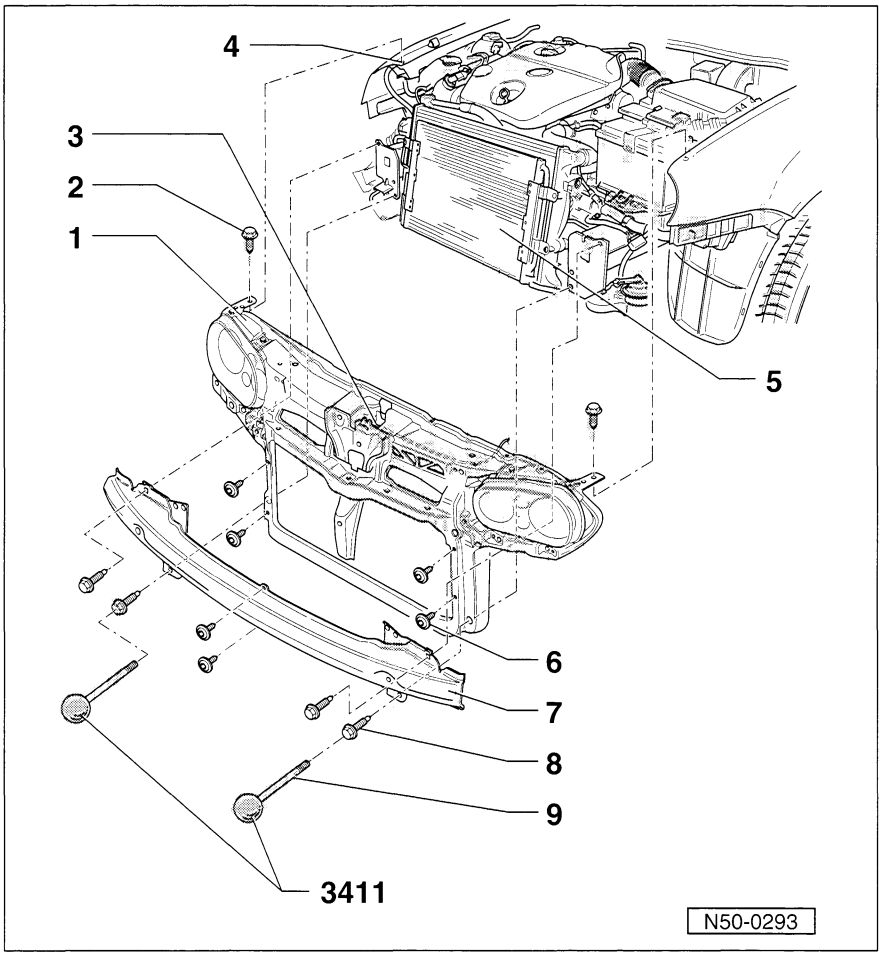


➢ Dimensions above shown in mm.

– Offset between fender horizontal and vertical points a = 0 - 2 mm (0.0787 in.).

Lock carrier, removing and installing

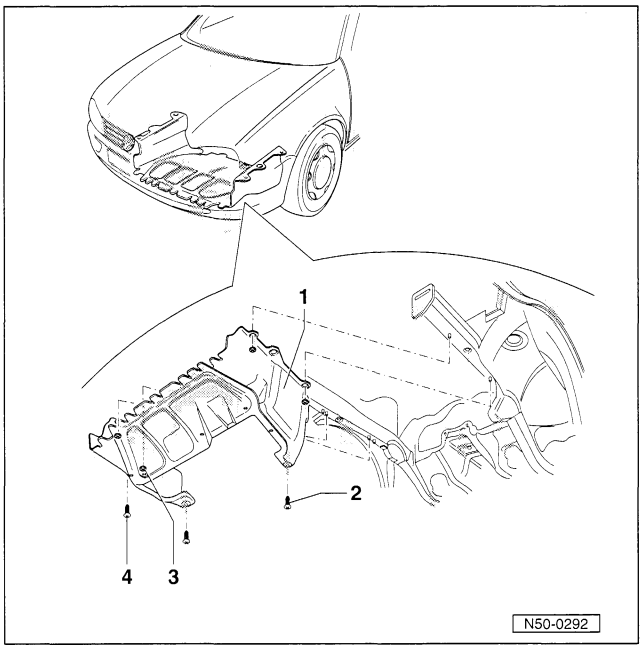
1. **Lock carrier with attachments**
   - Removing:
     Disconnect Bowden cable (**3**) and harness connectors on lock
     Disconnect harness connector from headlights
     Remove front bumper and bumper carrier, see **63 Bumpers**
     Disconnect headlight washer system at T-connection
     Unbolt radiator and condenser from lock carrier and secure in engine compartment
   - Align lock carrier to floor pan members when installing
2. **Bolt**
   - Qty. 2
   - Tighten to 8 Nm (71 in-lb)
3. **Bowden cable**
4. **Hole in side panel**
5. **Radiator and condenser**
   - Do not hang condenser by lines/hoses
   - Do not kink condenser lines/hoses
6. **Bolt**
   - Qty. 4
   - Tighten to 8 Nm (71 ft-lb)
7. **Bumper beam**
8. **Bolt**
   - Qty. 4
   - Tighten to 20 Nm (15 ft-lb)
9. **Guide rods 3411**
   - VW special tool for holding lock carrier in service position



Lock carrier, service position

The lock carrier can be moved forward to allow easier access for various service procedures.

- Remove front bumper cover, see **63 Bumpers**.
- Disconnect bowden cable on hood lock.
- Remove one lock carrier mounting bolt from each floor pan member and install VW special tool 3411 (guide rods), or equivalent.
- Remove remaining lock carrier mounting bolts and pull lock carrier forward.

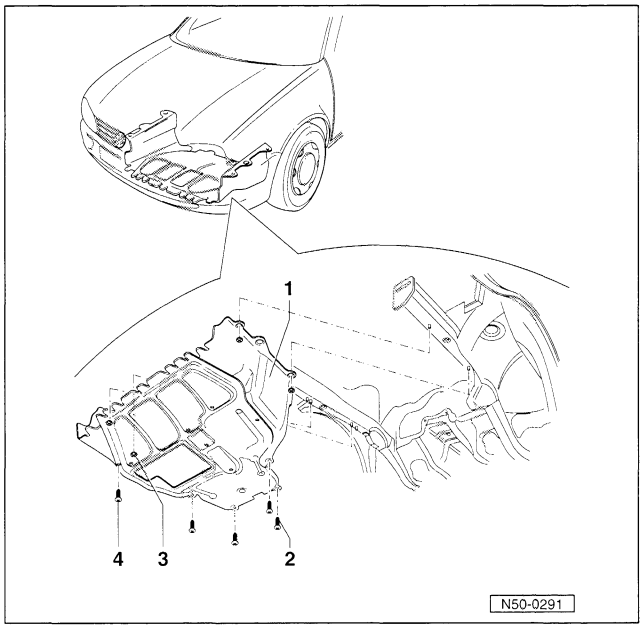


FRONT NOISE INSULATION

Gasoline and diesel equipped vehicles have different lower sound absorption panels (belly pans).

Noise insulation (gasoline engines)

Noise insulation assembly (**1**) bolted to lock carrier in gasoline equipped vehicles. Mounting hardware also shown (**2**, **3** and **4**).

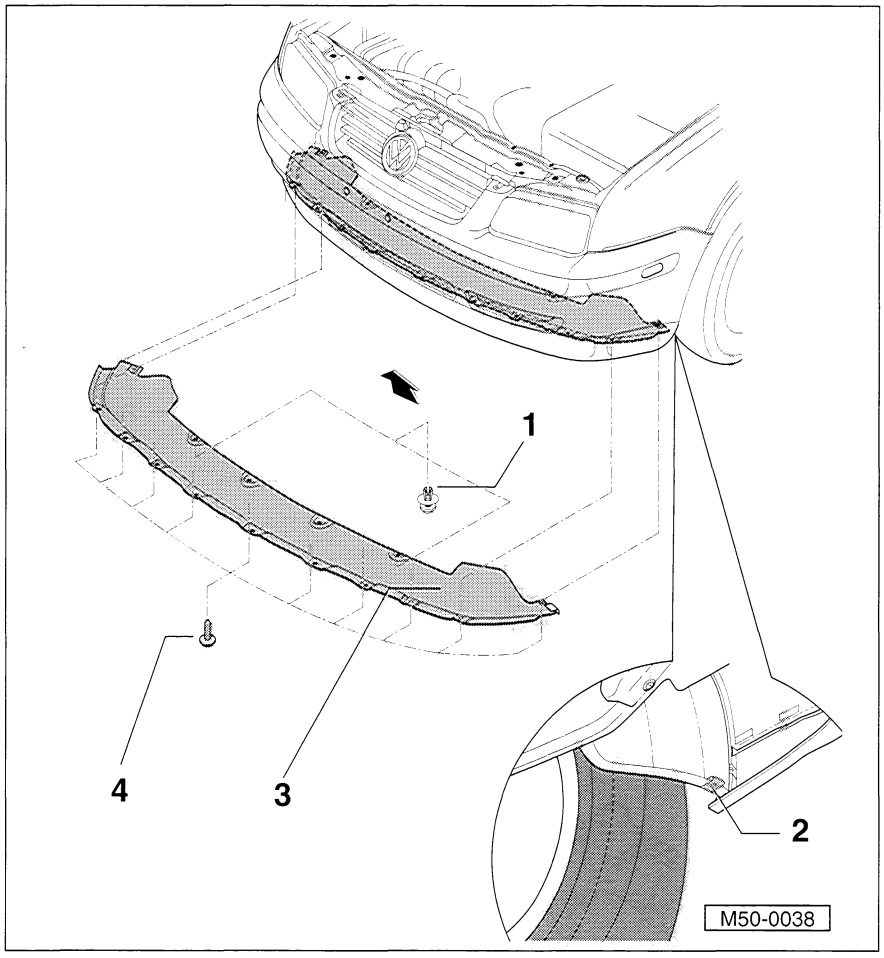


Noise insulation (diesel engines)

Noise insulation assembly (**1**) bolted to lock carrier in diesel equipped vehicles. Mounting hardware also shown (**2**, **3** and **4**).

Lower front bumper noise insulation

1. **Spreader clip**
   - Quantity: 2
2. **Clip**
   - Quantity: 2
3. **Lower bumper protection panel**
   - Bolted and inserted into lock carrier i forward area
4. **Screws**
   - Quantity: 13

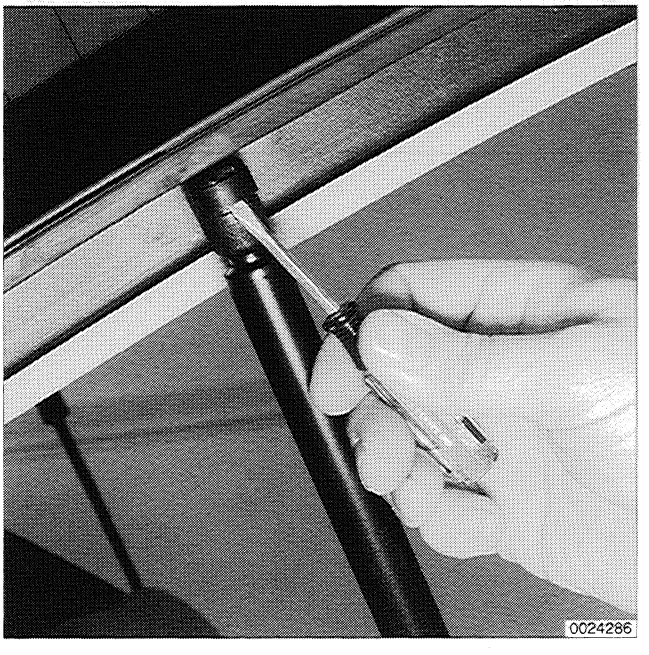


55 Hood and Lids

GENERAL 55-1

FRONT HOOD 55-2
- Hood assembly 55-2
- Hood release cable assembly 55-3
- Release lever, removing and installing 55-4
- Hood lock assembly 55-5
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GENERAL

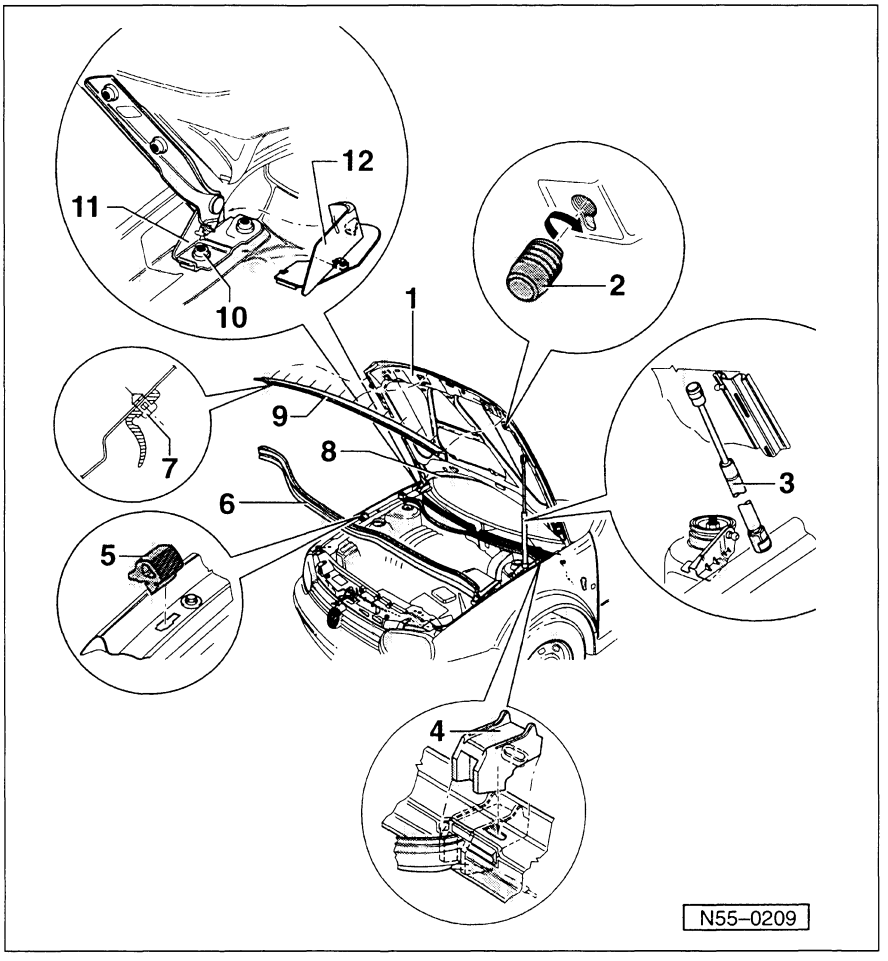
The front hood and rear hatch are easily removed with the aid of a helper. Where applicable, the support strut(s) should first be disconnected. Be sure to mark the lid location in reference to the hinges for proper alignment during installation.

– After prying up strut retaining clip with screwdriver, remove strut from ball stud. Do not remove clip completely.

NOTE —
If strut is to be re-used do not remove retaining clip completely.

FRONT HOOD

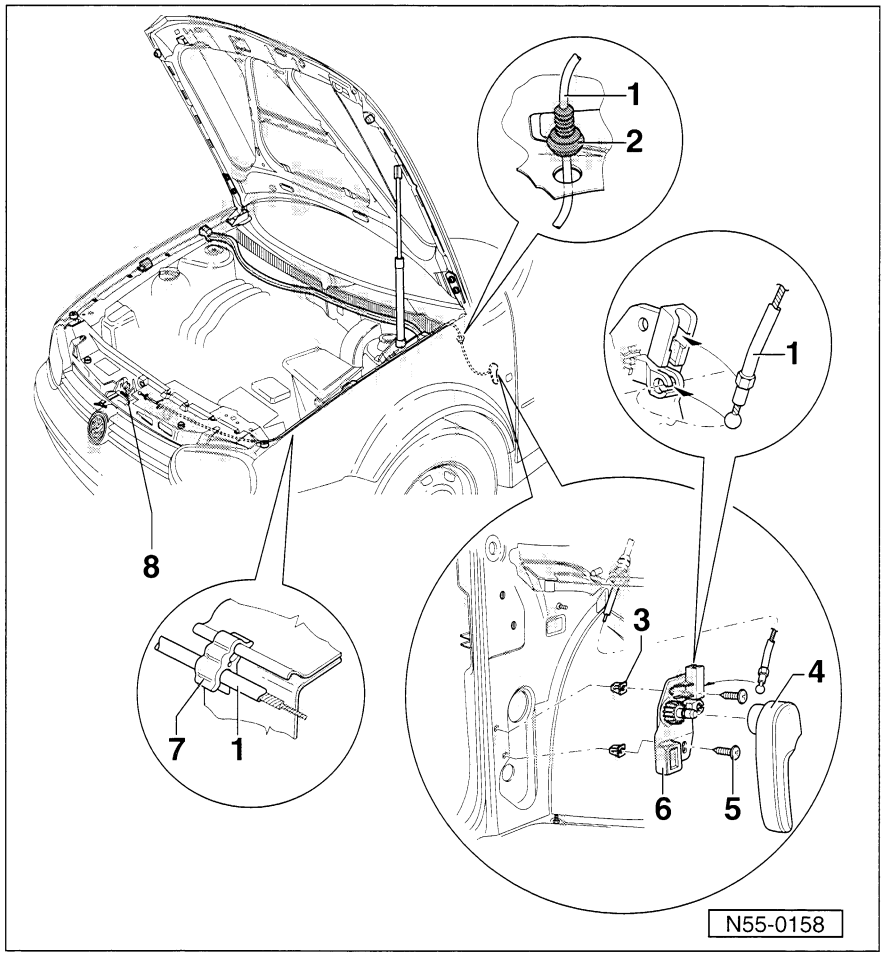
Hood assembly

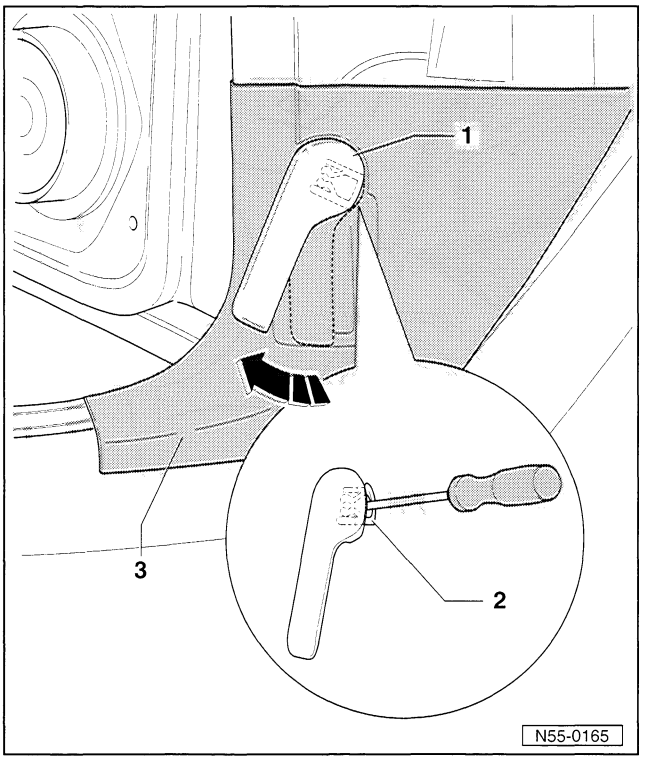


1. **Hood**
   - Removing:
     Remove windshield washer hoses and jets
     Take out bolts (**9**) and remove hood
2. **Rubber stop**
   - Adjust hood height to fenders using rubber stops
3. **Gas-filled strut**
4. **Cushion**
5. **Rubber stop**
6. **Plenum seal**
   - Pushed onto flange
7. **Clip**
8. **Spray jet/hose**
   - Removing, see **92 Wipers and Washers**
9. **Guide piece**
10. **Bolt**
    - Tighten to 23 Nm (17 ft-lb)
11. **Hinge**
    - Hood can be aligned between fenders by moving hinges within the slotted holes
    - After installation or adjusting, treat hinges and bolts with corrosion protection
12. **Hinge cover**
    - Clipped on, pull off at right angles

Hood release cable assembly

1. **Hood release (bowden) cable**
   - Removing:
     Remove release lever (**4**)
     Remove cable from clip at lock (**8**) and engine compartment (**7**)
     Remove lower A-pillar trim, see **70 Trim–Interior**
     Tie string (approx. 39 in.) to cable at hood release and pull cable out at release lever end
   - Use the same string to pull new cable into place
2. **Grommet**
3. **Spreader nut**
4. **Release lever**
   - Removing and installing, see **Release lever, removing and installing**
5. **Self-tapping screw**
6. **Lever bracket**
   - Cable attached
7. **Cable clip**
8. **Hood lock**





Release lever, removing and installing

➤ Pull back release lever (**1**) approx. 2 cm (0.8 in.).

– Insert small screwdriver into gap between release lever and clip (**2**).

– Let go of release lever and pry clip off (clip falls behind trim).

– Unclip trim (**3**) from bracket at center and from sill panel.

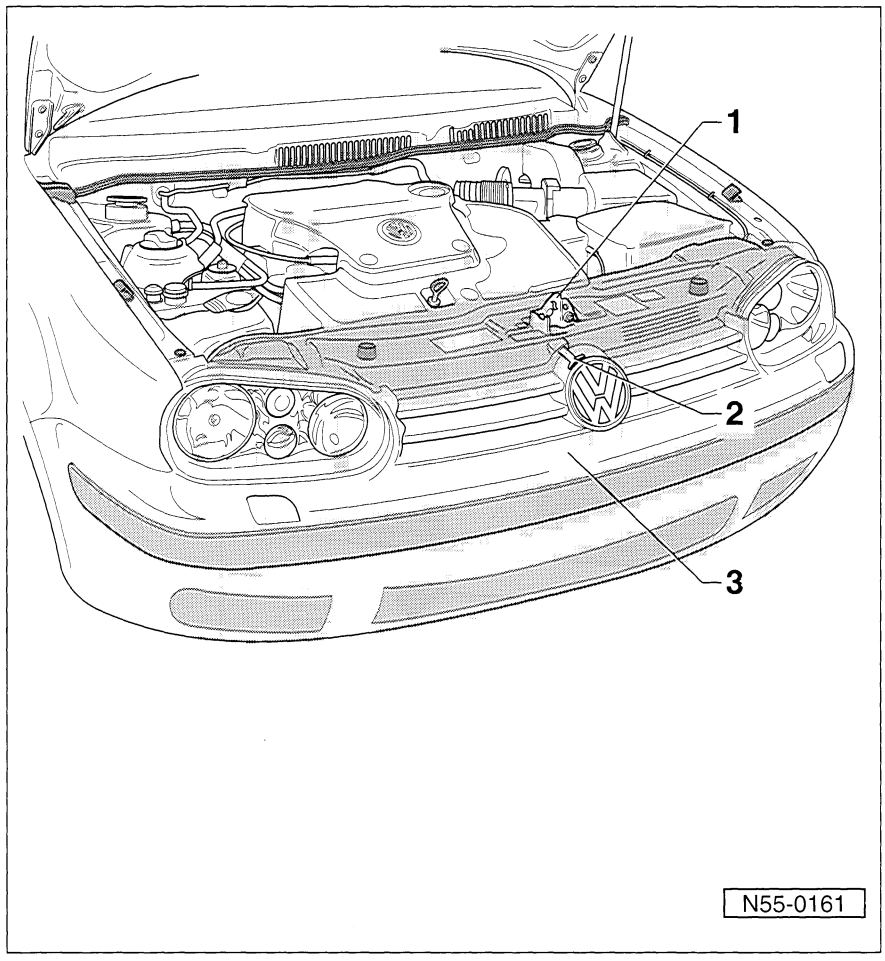
– To install, clip trim (**3**) into sill first.

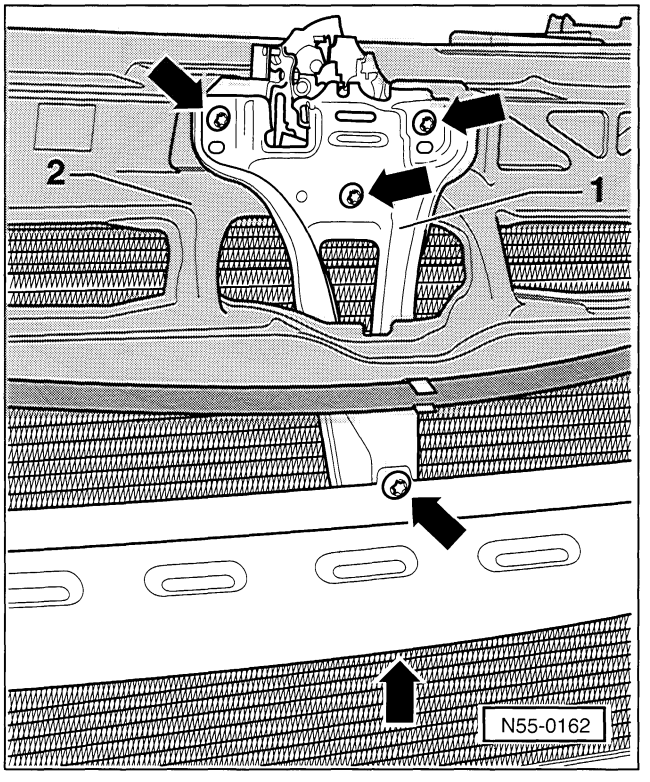
– Push clip (**2**) completely into release lever and press release lever onto bracket.

– Check operation of release lever.

Hood lock assembly

1. **Hood lock**
   - Adjust with slotted mounting holes
   - Removing:
     Remove radiator grille and bumper
     Remove lock support, see **Hood lock support, removing**
     Remove hood lock, see **Hood lock, removing**
2. **Release lever**
3. **Bumper**

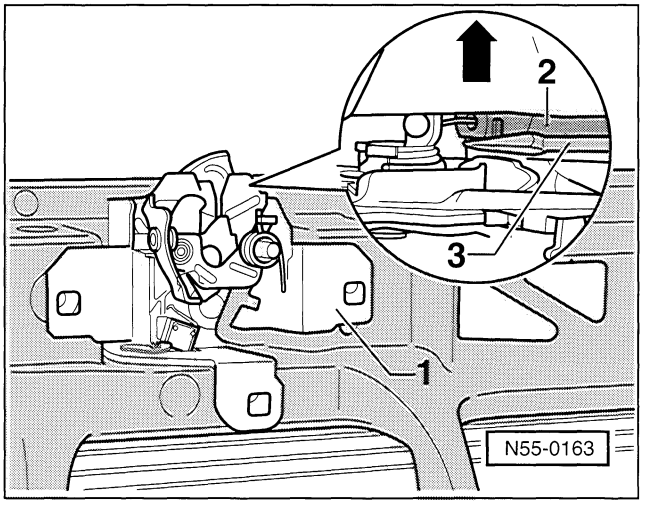




Hood lock support, removing

➢ Remove five bolts (**arrows**).

– Remove lock support (**1**) from lock carrier (**2**).

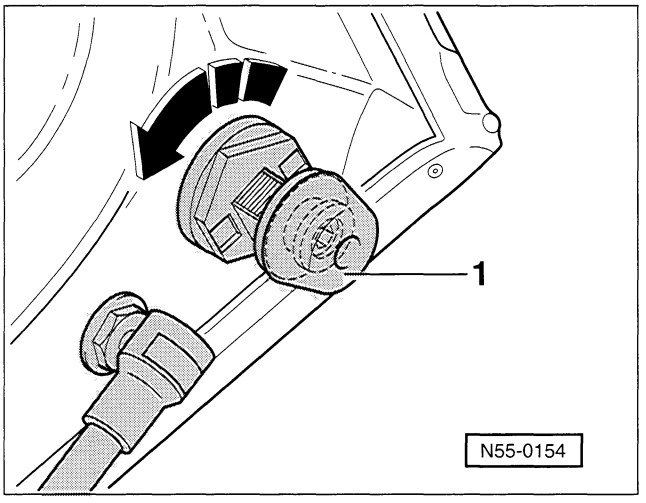


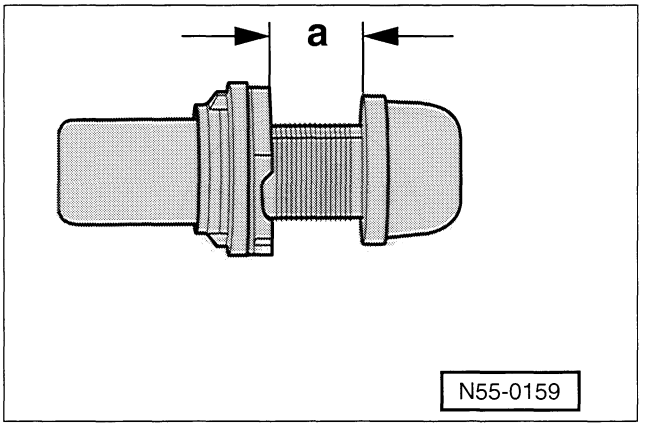
Hood lock, removing

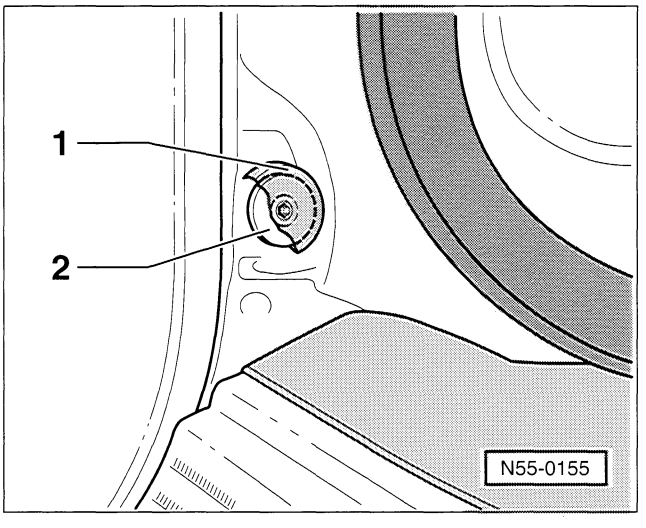
➢ Pull hood lock (**1**) forward slightly.

– Unclip Bowden cable (**2**) from lock in direction of **arrow** using a screwdriver (**3**).

– Disconnect microswitch from connector.







REAR LIDS

Rear hatch/lid, adjusting

The rear hatch or rear lid (trunk) is properly adjusted when the shut lines are even all around and the hatch/lid does not project to far in or out. All contours must align when the rear hatch/lid is closed.

NOTE —

- *The vehicle must be standing on its wheels when adjusting the rear lid.*
- *The following illustrations are for Golf/GTI vehicles, Jettas are very similar.*

➢ Turn adjustment buffer through 90° (**arrow**) with an open end wrench (24 mm) and remove from hole in lid.

– Remove rubber stop (**1**) from buffer adjustment screw and unscrew locking screw using 3 mm hex key until notched slide can be pulled out.

➢ Pull notched slide out of housing and set buffer stop height (dimension **a**) to 12.5 mm (0.49 in).

– Install rubber stop and buffer assembly into rear lid and turn adjustment buffer trough 90° in the opposite direction necessary for removal.

➢ For Golf/GTI only, unscrew cap (**1**) from blind rivet (**2**) on left and right sides of hatch opening.

– Close rear lid using light pressure at center and holding handle (as applicable for Golf/GTI).

– For Golf/GTI check for a gap of 5 mm between rear lid and side panel using Volkswagen special tool 3371 adjustment gauge or equivalent.

– Open rear lid and replace caps on blind rivet (as applicable for Golf/GTI).

– Tighten locking screw on adjustment buffers.

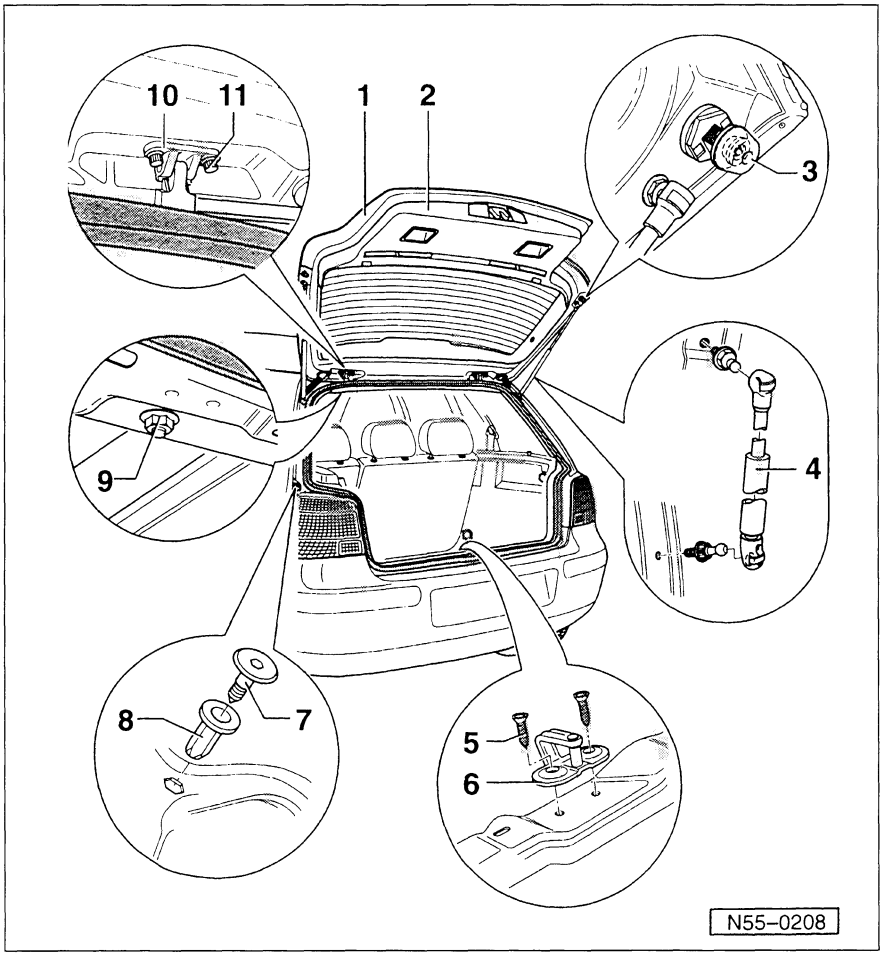
Tightening torque

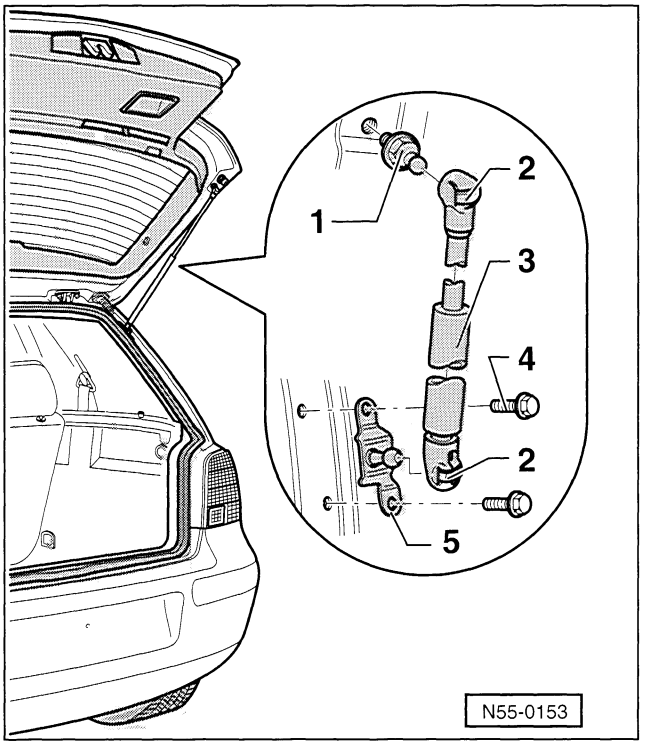
- Rear lid adjustment buffer locking screw . . . . . 1.5 Nm (13 in-lb)

– Check that rear hatch closes without too much force and doesn't have any up or down movement when in locked position. When unlocking, the lid will pop up slightly due to pre-tension on hinge.

Rear hatch assembly (Golf)

1. **Rear hatch**
2. **Trim**
   - Removing and installing, see **70 trim–Interior**
3. **Rubber stop**
4. **Gas-filled strut**
   - Removing and installing, see **Gas-filled strut, removing**
5. **Screw**
   - Tighten to 22 Nm (16 ft-lb)
6. **Lock plate**
   - Adjusting - within oversized holes
7. **Cap**
8. **Blind nut**
9. **Hex nut**
10. **Hinge**
11. **Bolt**
    - Tighten to 22 Nm (16 ft-lb)



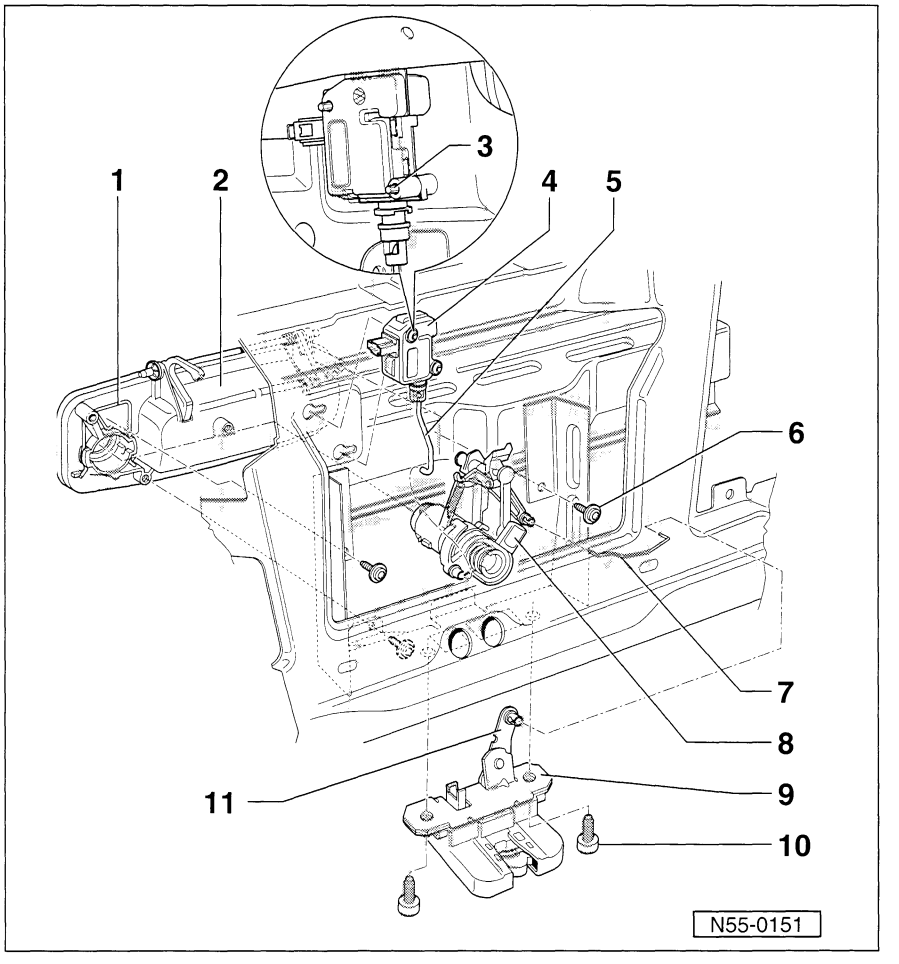


Gas-filled strut, removing

➢ Lift retaining clip (**2**) with a screwdriver and pull gas strut off ball head stud (**1**).

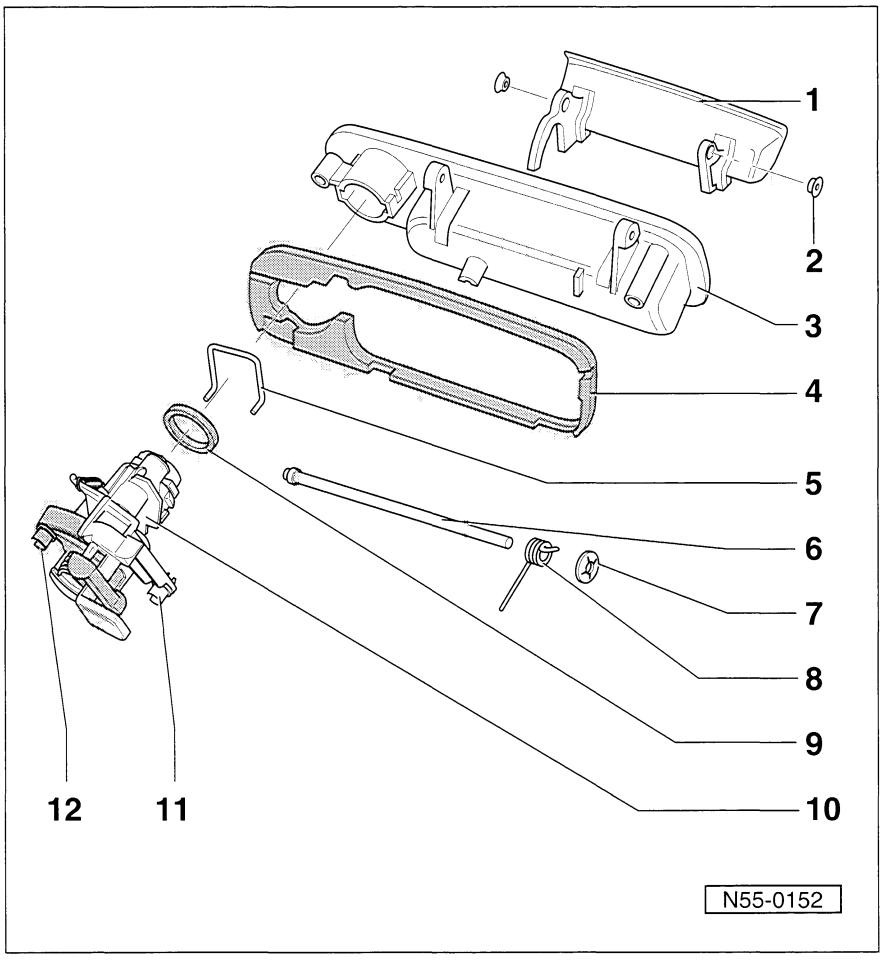
– Do not remove retaining clip completely if gas strut is to be re-used.

Rear hatch lock assembly (Golf)



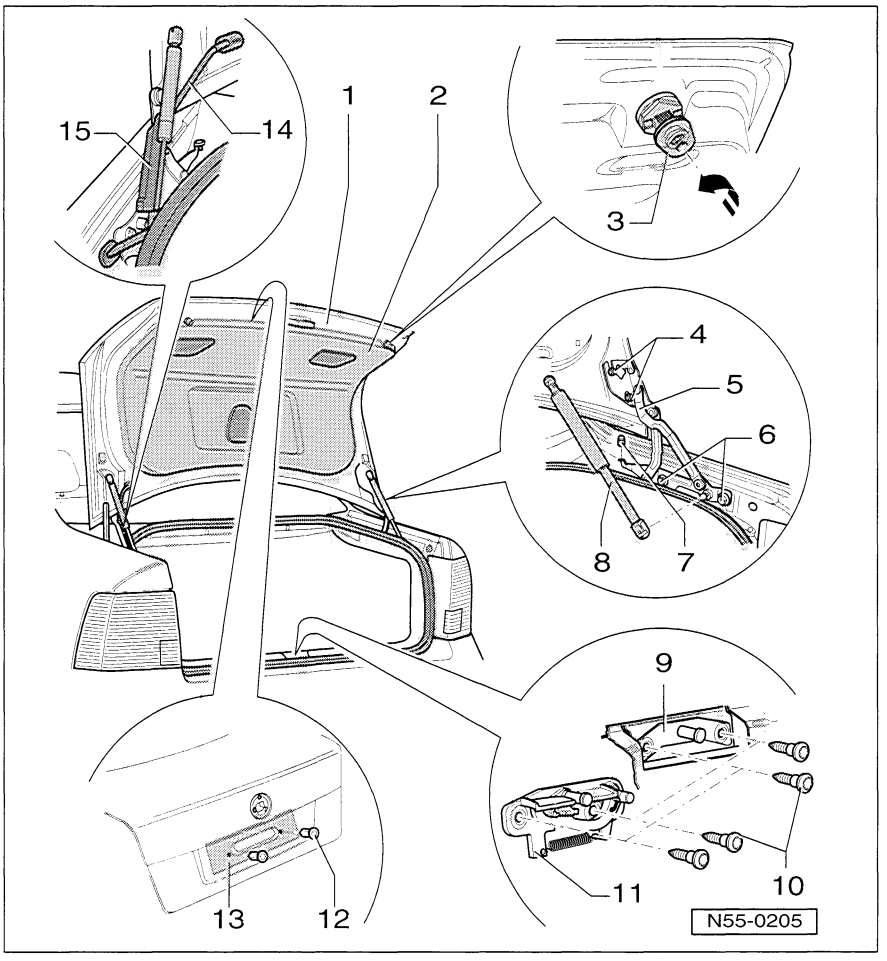
1. **Securing clip**
2. **Handle**
   - Removing:
     Unclip rear hatch trim (handle is secured with one cross-head screw)
     Unclip pull rod (**5**)
     Pry out securing clip (**1**) and take lock cylinder out of handle
     Disconnect harness connector for rear interior light and, if applicable, unclip central locking operating rod
     Remove torx bolts (**6**) and remove handle from rear hatch
3. **Actuator securing bolt**
   - Release and tighten with VW special tool T 10010 socket
4. **Central locking actuator**
   - Unscrew actuator with VW special tool T10010 socket
5. **Pull rod**
6. **Torx screw**
7. **Operating rod**
   - Press relay lever (**11**) against stop and insert operating rod without tension
8. **Lock cylinder housing**
   - See following page for removal and installation
9. **Lock**
   - Removing:
     Remove rear hatch trim, see **70 Trim–Interior**
     Disconnect harness connector
     Unclip operating rod (**7**), unscrew bolt (**10**) and remove lock from rear hatch
   - When installing, locate striker catch in detent
10. **Countersunk bolt**
    - Tighten to 20 Nm (15 ft-lb)
11. **Relay lever**

Lock cylinder housing assembly (Golf)



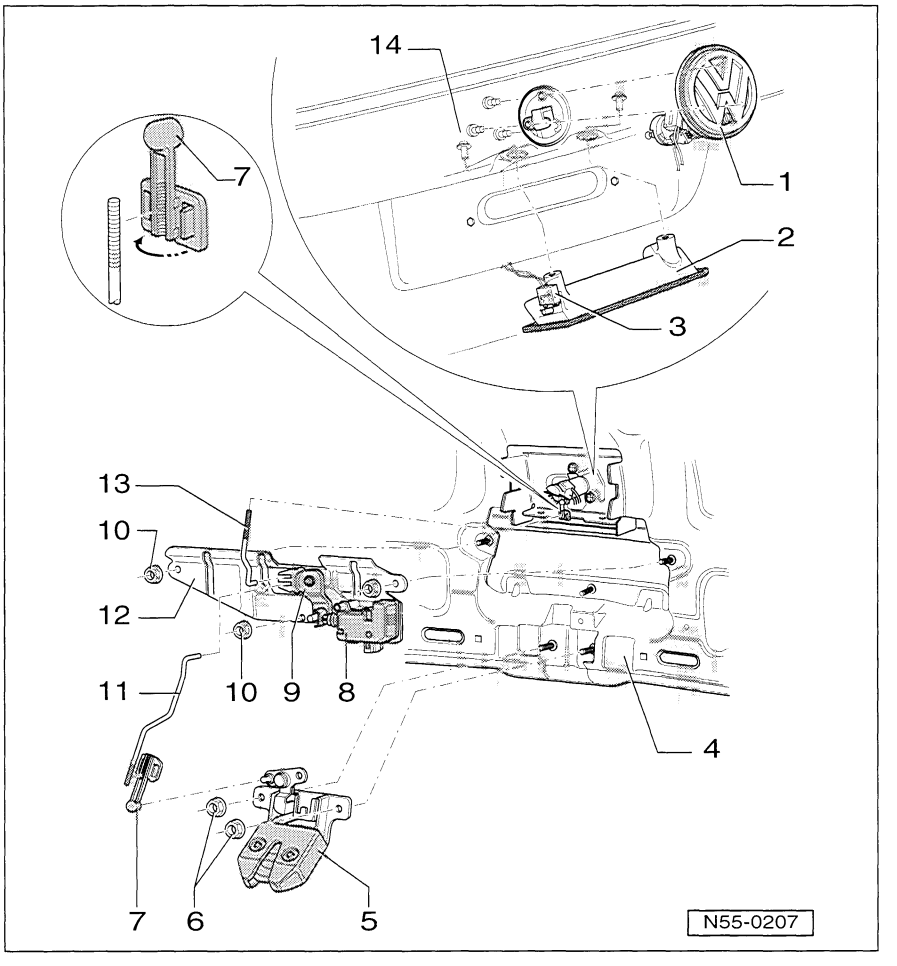
1. **Handle**
2. **Guide sleeves**
3. **Handle recess**
4. **Seal**
5. **Retaining clip**
6. **Pin**
7. **Circlip**
8. **Spring**
9. **Seal**
10. **Lock cylinder housing**
    - Removing:
      Unclip rear hatch trim (handle is secured with one cross-head screw)
      Unclip pull rod (item **5** on previous page)
      Pry out securing clip (**5**) and take lock cylinder out of handle recess (**3**)
    - Installing:
      Engage securing clip
      Install lock cylinder housing to handle trim and engage (a clicking must be heard)
11. **Rod clip**
    - For rear lid lock
12. **Rod clip**
    - For actuator

Rear lid assembly (Jetta)



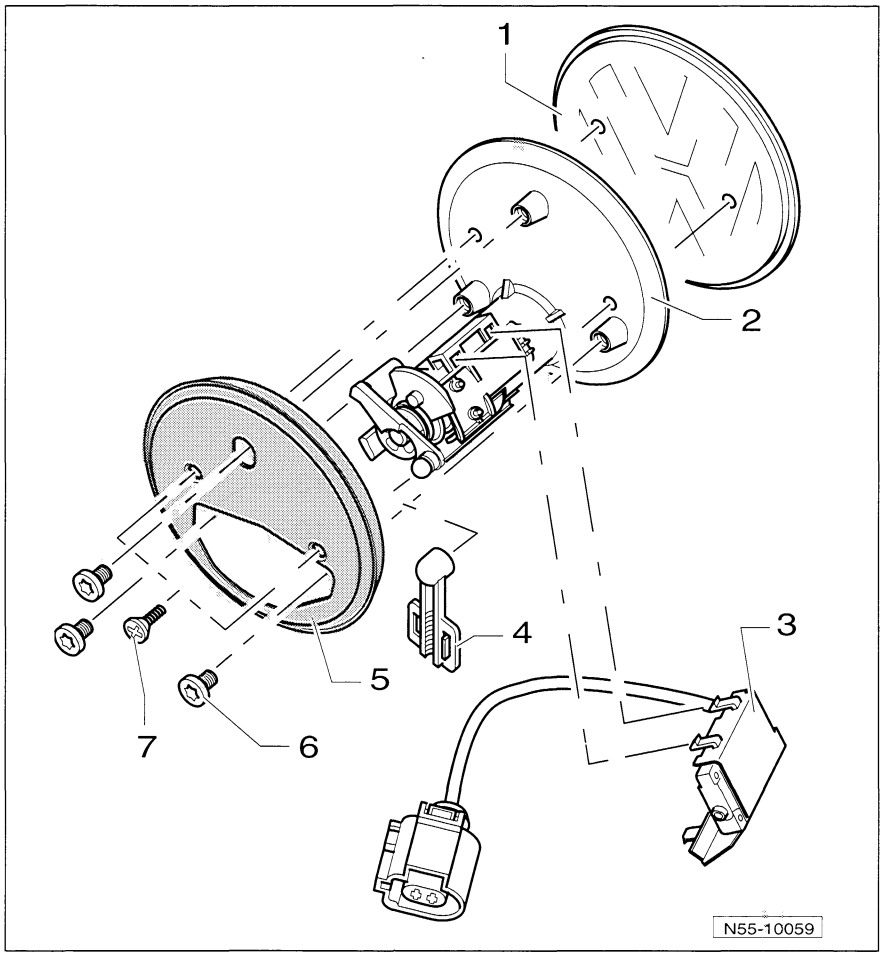
1. **Rear lid**
2. **Trim**
   - Removing and installing, see **70 Trim–Interior**
3. **Adjustment stop**
4. **Hex nut**
   - Tighten to 22 Nm (16 ft-lb)
5. **Hinge**
6. **Bolt**
   - Tighten to 22 Nm (16 ft-lb)
7. **Rubber stop**
8. **Gas-filled strut**
   - Removing and installing, same as Golf as described earlier
9. **Lock plate**
   - Move within oversized holes to adjust
10. **Bolt**
    - Tighten to 22 Nm (16 ft-lb)
11. **Lock plate**
    - only for US models
12. **Rivet nut**
    - Install with rivet nut installation tool VAG 1765 B or equivalent
13. **Base for license plate**
    - Only apply pressure on hatched area
    - Replacement part has two foils. The first foil cover the adhesive, the second must be pulled off after assembly
14. **Wiring**
15. **Hinge cover**

Rear lid lock assembly (Jetta)



1. **Lock cylinder housing**
   - Removing, see **Rear lid lock cylinder housing assembly (Jetta, Jetta wagon)**
2. **Handle**
   - Removing:
     Remove lock trim, see **70 Trim–Interior**
     Remove bolt (**14**)
     Disconnect wiring for switch (**3**)
     Remove handle from lock
3. **Rear lid release switch**
4. **Rear lid**
5. **Lock**
   - Removing:
     Remove lock trim, see **70 Trim–Interior**
     Disconnect wiring from lock
     Unclip actuator rod (**11**)
     Remove hex nuts (**6**) and remove lock
6. **Hex nut**
   - Tighten to 7 Nm (62 in-lb)
7. **Linkage lever**
8. **Rear lid release motor**
   - Removing:
     Remove lock trim, see **70 Trim–Interior**
     Disconnect wiring from motor
     Unclip actuator rod (**11**) from lock
     Unclip actuator rod (**13**) from lock cylinder
     Remove hex nuts (**10**) and bracket (**12**)
     Remove rear lid release motor from bracket
9. **Linkage lever**
10. **Hex nut**
    - Tighten to 7 Nm (62 in-lb)
11. **Actuator rod**
    - Press linkage lever (**7**) against stop on motor (**8**) and hook in actuator rod without tension
12. **Support bracket**
13. **Actuator rod**
    - Press linkage lever (**7**) against stop on motor (**8**) and hook in actuator rod without tension
14. **Bolt**
    - Tighten to 7 Nm (62 in-lb)

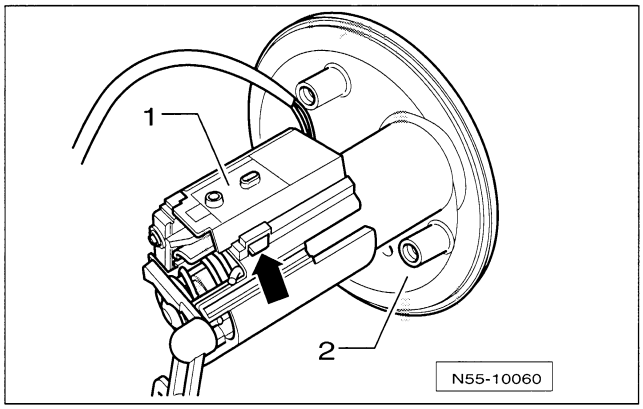
Rear lid lock cylinder housing assembly (Jetta, Jetta wagon)



1. **VW emblem**
   - Attached to lock cylinder housing (**2**) with two-sided adhesive tape and mounting screws (**7**)
2. **Lock cylinder housing**

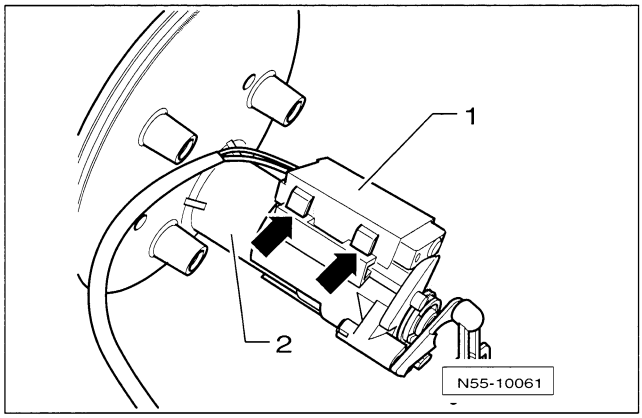
   Removing:

   - Remove rear lid trim, see **70 Trim–Interior**
   - Disconnect wiring for micro-switch (**3**)
   - Remove operating rod at actuator lever
   - Remove mounting bolts (**6**)
   - Remove lock cylinder housing with VW emblem from rear lid
3. **Micro-switch**
   - See **Rear lid lock cylinder micro-switch, removing and installing**
4. **Linkage clip**
   - To remove operating rod, disconnect linkage clip and pull open
5. **Seal**
6. **Bolt**
   - Tighten to 4 Nm (35 in-lb)
   - Qty: 3
7. **Screw**
   - Qty: 2



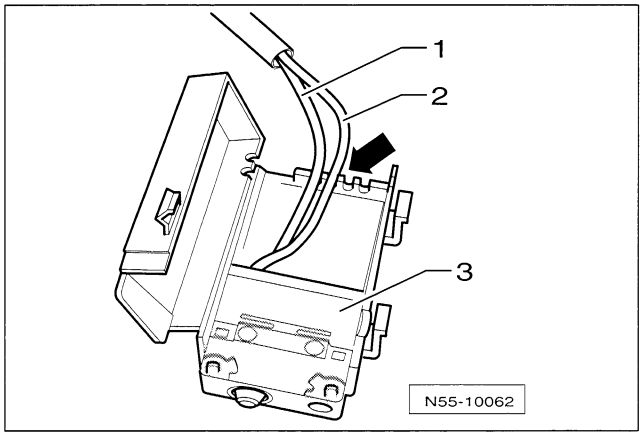
Rear lid lock cylinder micro-switch, removing and installing (Jetta, Jetta wagon)

➢ Release retaining tab (**arrow**) of micro-switch (**1**) by pressing tab downward.



➢ Disengage retaining tabs (**arrows**) of micro-switch (**1**) from lock cylinder housing (**2**).

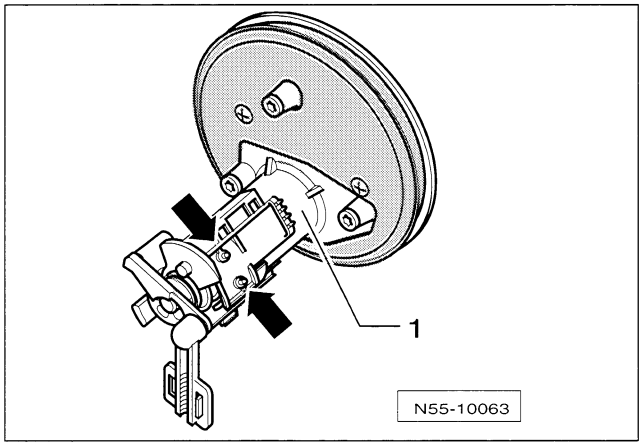
– Remove micro-switch from lock cylinder housing.



➢ To install, position wires (**1** and **2**) in cutouts (**arrow**) of switch housing.

NOTE —
Micro-switch wires may be damaged if not properly positioned before closing housing lid.

– Fold housing lid over wires and latch retaining tabs.



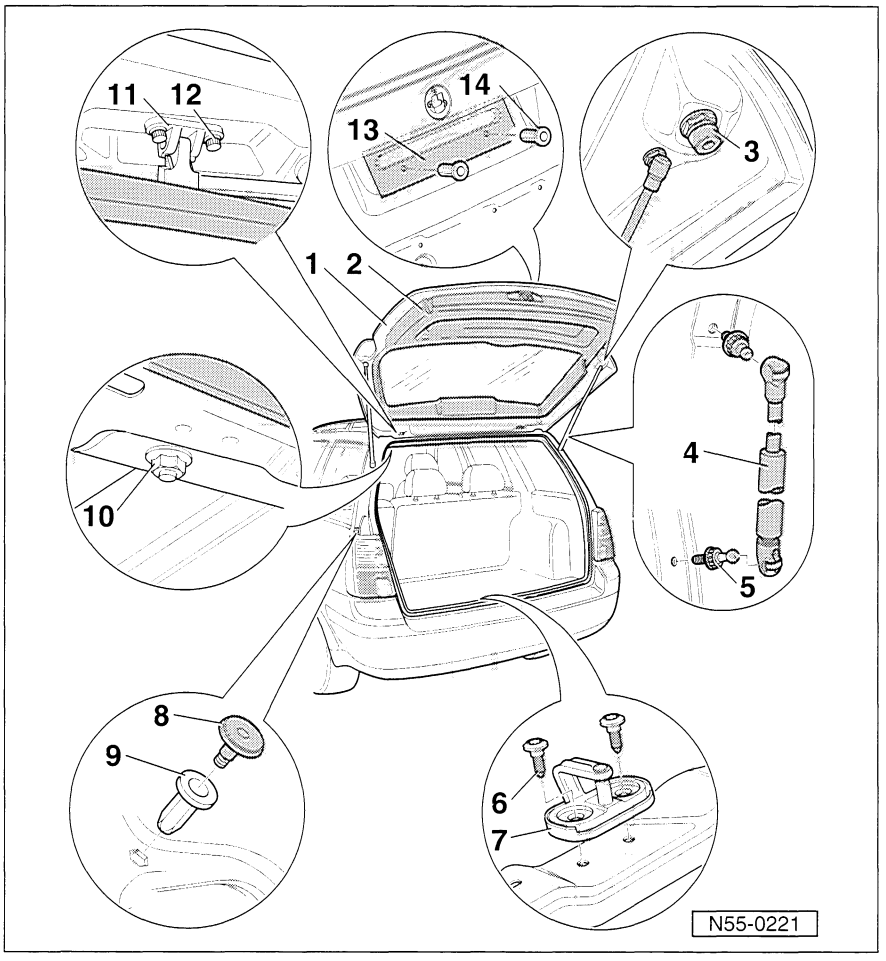
➢ Make sure that micro-switch is properly positioned at securing tabs (**arrows**) on lock cylinder housing (**1**).

– Lock micro-switch to lock cylinder housing with retaining tab, as shown above in illustration N55-10060.

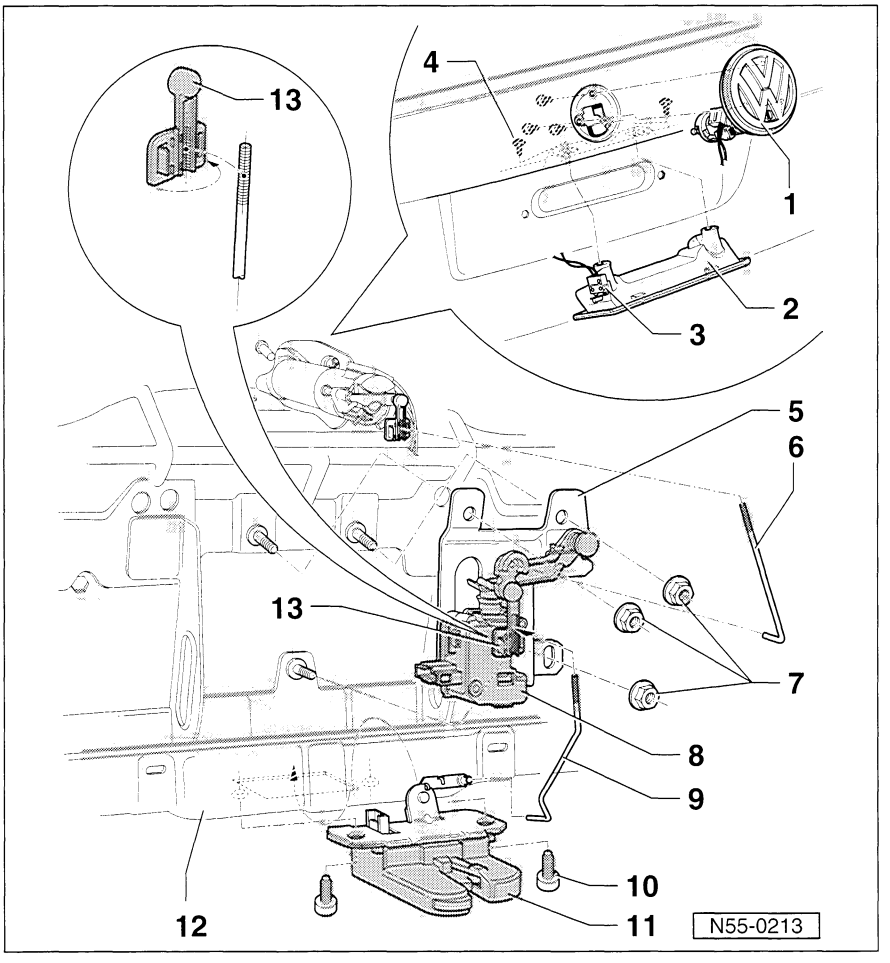
– Install lock cylinder housing in reverse order of removal.

Rear hatch/tailgate assembly (Jetta wagon)

1. **Rear hatch/tailgate**
   - See **Rear hatch/lid, adjusting** given earlier
2. **Trim**
3. **Adjustment buffer**
4. **Gas-filled strut**
5. **Ball head stud**
   - Tighten to 10 Nm (7 ft-lb)
6. **Bolt**
   - Tighten to 22 Nm (15 ft-lb)
7. **Lock plate**
   - Move within oversized holes to adjust
8. **Cap**
9. **Pop rivet nut**
10. **Hex nuts**
    - Tighten to 22 Nm (15 ft-lb)
11. **Hinge**
12. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
13. **Base for license plate**
    - Only apply pressure on hatched area
    - Replacement part has two foils. The first foil cover the adhesive, the second must be pulled off after assembly
14. **Pop rivet nut**
    - Pull in with pop rivet nut tool VAG 1765 A

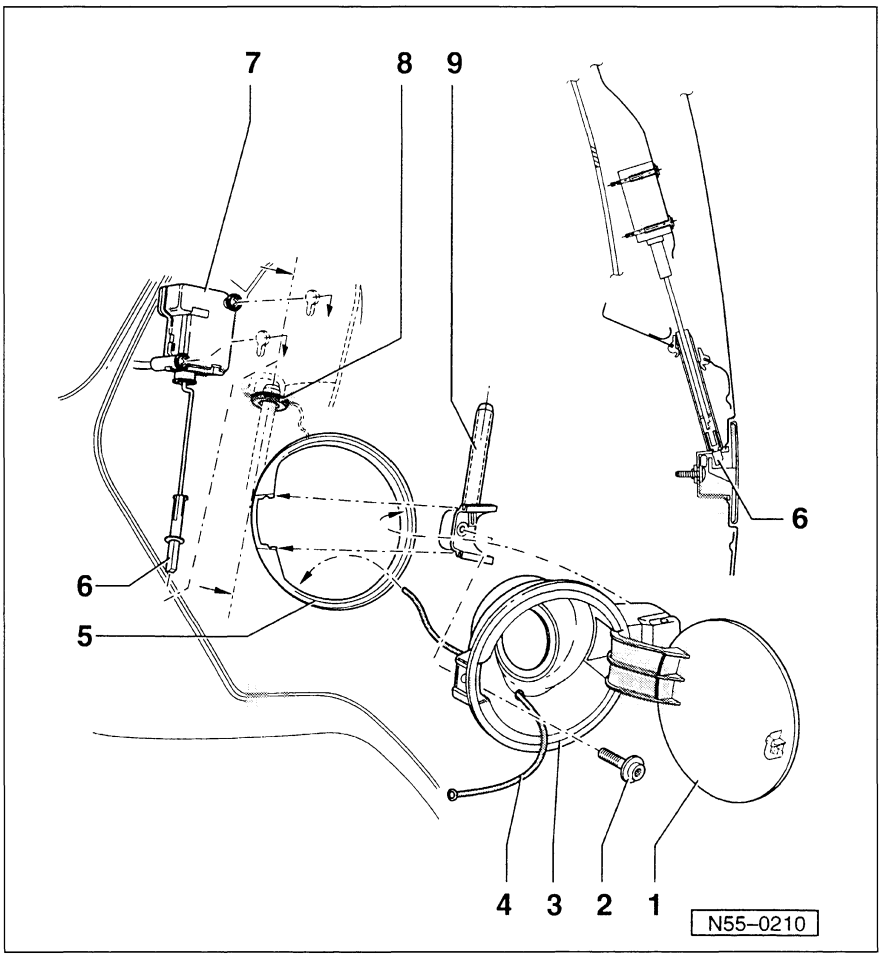


Tailgate/trunk lock assembly (Jetta wagon)

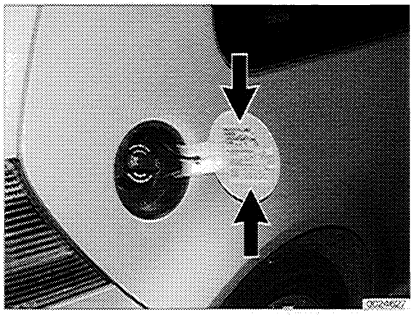


1. **Lock cylinder housing**
2. **Handle**
   - To remove:
     Remove bolt (**4**)
     Separate connection for switch (**3**) and take off handle
3. **Tailgate/trunk lid release switch (E165)**
4. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
5. **Carrier plate**
6. **Operating rod**
   - Press relay lever against stop and insert operating rod stress-free
7. **Hex nut**
   - Tighten to 7 Nm (62 in-lb)
8. **Tailgate/trunk release motor (V139)**
   - To remove:
     Separate connector from motor
     Unclip operating rods (**6**) on lock cylinder housing
     Unclip operating rod (**9**) on tailgate lid release motor
     Remove hex nuts (**7**) and take off carrier plate (**5**)
     Unbolt tailgate release motor (**8**) from carrier plate
9. **Operating rod**
   - Press relay lever against stop and insert operating rod stress-free
10. **Bolt**
    - Tighten to 22 Nm (16 ft-lb)
11. **Lock**
    - To remove:
      Remove tailgate/trunk lid trim
      Disconnect harness connector
      Unclip operating rod (**9**)
      Remove 2 hex nuts (**10**) and remove lock
12. **Tailgate/trunk lid**
13. **Relay lever**

Tank flap unit assembly (Golf)



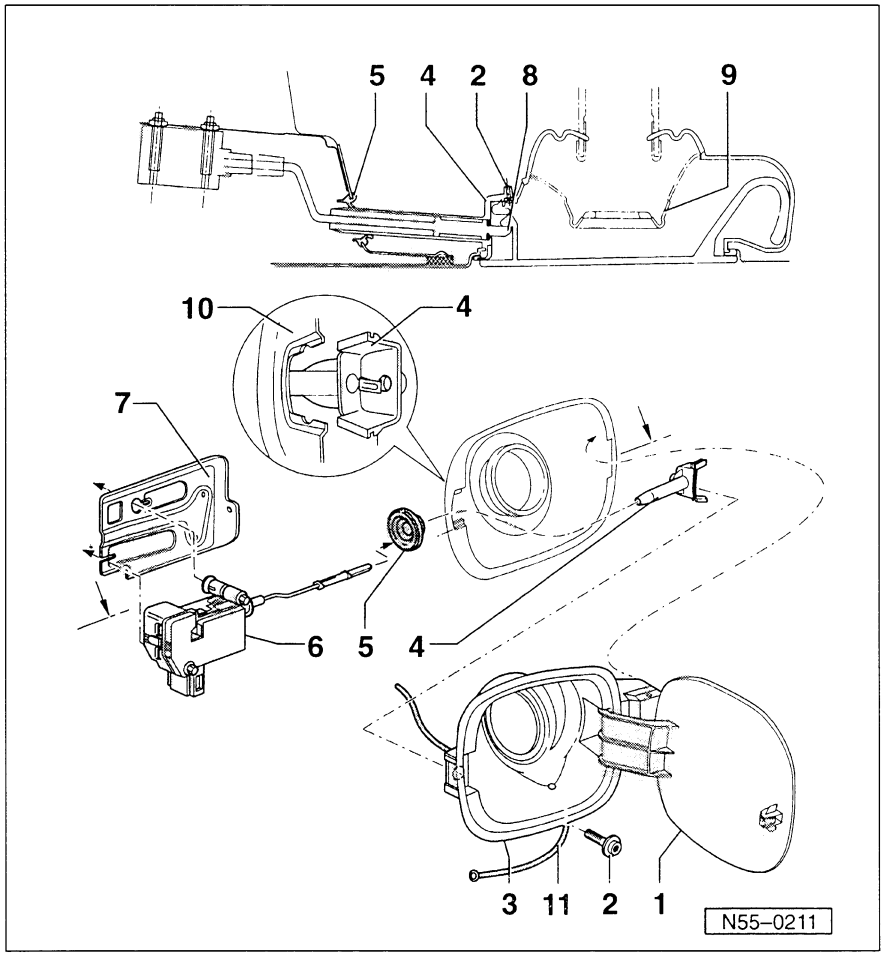
1. **Tank flap unit**
   - Removing:
     Unscrew tank filler cap
     Press back lock rod by operating remote release
     Remove bolt (**2**)
     Pull rubber part off fuel tank filler and swing flap unit out of quarter panel
   - Installing:
     Assembly piece (**9**) and actuator unit (**7**) should already be installed
     Install tank flap unit (rubber part rolled up) with hinge side first
     Secure tank flap unit and assembly piece
   - Vehicle operating information is sometimes printed on a sticker attached to inside of tank flap. See **Fuel filler flap data stickers**
2. **Bolt**
3. **Tank flap cup**
   - Can only be removed as part of tank flap unit
   - Press out securing pin in tank flap unit to remove
4. **Drain tube**
5. **Side piece**
6. **Release rod**
7. **Actuator unit for tank flap**
8. **Seal**
9. **Assembly piece**
   - Assists in removal and installation



Fuel filler flap data sticker

- Upper arrow: sticker with gasoline octane (AKI and RON) or diesel cetane requirements. Varies with vehicle engine type.
- Lower arrow: tire size, load, and inflation specifications.

Tank flap unit assembly (Jetta and wagon)



1. **Tank flap unit**
   - Removing:
     Unscrew tank filler cap
     Press back lock rod by operating remote release
     Remove cross-head screw (**1**)
     Pull rubber part off fuel tank filler and swing flap unit out of quarter panel
   - Installing:
     Assembly piece (**4**) and actuator unit (**6**) should already be installed
     Install tank flap unit (rubber part rolled up) with hinge side first
     Secure tank flap unit and assembly piece
   - Vehicle operating information is sometimes printed on a sticker attached to inside of tank flap. Information will be the same as for the Golf. See **Fuel filler flap data stickers** for Golf on previous page
2. **Bolt**
3. **Tank flap cup**
   - Can only be removed as part of tank flap unit
   - Press out securing pin in tank flap unit to remove
4. **Assembly piece**
   - Pushed into quarter panel
5. **Seal**
6. **Actuator unit for tank flap**
7. **Quarter panel**
8. **Release rod**
9. **Rubber part**
   - Rolled up on assembly
10. **Side piece**
11. **Drain tube**

57 Front Doors

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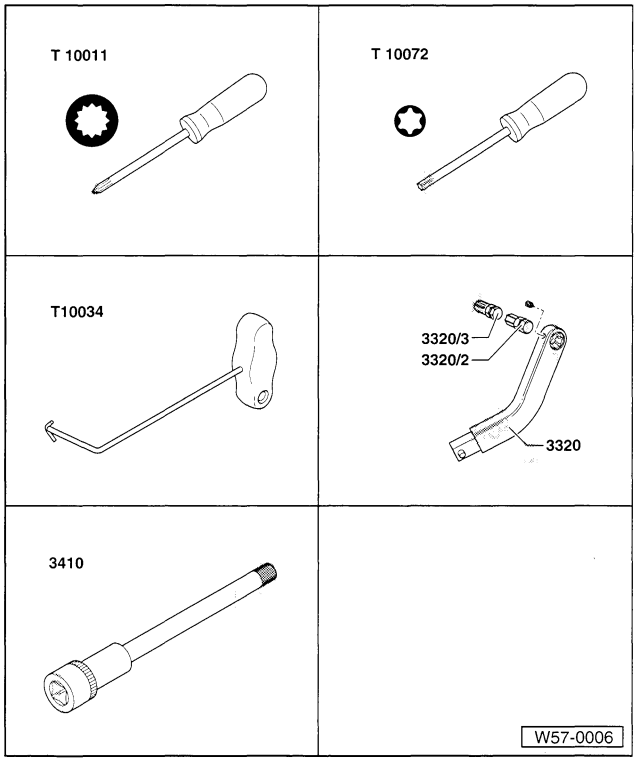
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GENERAL

This repair group covers removal and installation of the front door assemblies, the front door glass and window regulators, and service to the door lock assemblies including the central locking system. Special tools and equipment are required for some operations. For removal of door panels see **70 Trim–Interior**.

> ***WARNING —***
> *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using a VAG 1551/1552 or equivalent scan tool.*



Special tools

Various special tools are specified for door service

- Socket wrench T10011 (outside door handle removal)
- Socket wrench T10072 (outside door handle removal)
- Assembly tool T10034 (outside door handle installation)
- Box spanner 3320/2 and 3320/3 for 3320 (door removal, installation, adjustment)
- Socket 3410 (door adjustment)

Power windows

Models equipped with power windows feature the ability to raise and lower both front windows by using the key in the front door lock. By holding the key in the locked position for more than 1 second, either window that was in the down position will be raised to the closed position in addition to locking the vehicle. This feature is known as convenience close.

As a ventilation aid in hot weather, both front windows can also be lowered. By holding the key in the unlock position for more than 2 seconds, both front windows will be lowered at the same time, in addition to unlocking the vehicle.

Power windows also feature pinch protection and one-touch up and one-touch down operation. The one-touch up feature is deactivated as soon as the ignition is switched off. The power windows will also remain functional (without one-touch up) for approximately 10 minutes after the ignition is shut off provided that a door is not opened.

Central locking

All models are available with central locking that is activated by insertion of the key into an outside door, by activation of a locking switch from within, or by the keyless remote.

When opening a locked vehicle from the outside with the key, there are two options. If the key is turned once, only that particular door will unlock. If the key is quickly turned twice, both doors will be unlocked. This safety feature is known as selective unlocking.

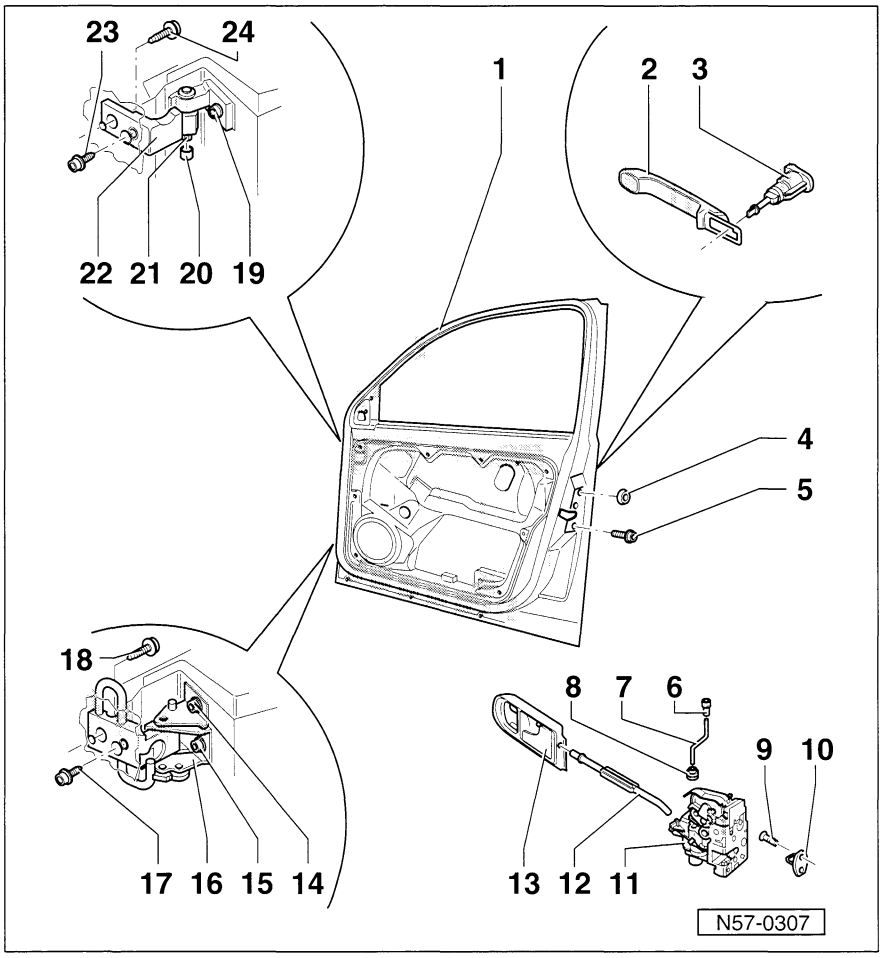
DOORS

The doors are designed with a split hinge that can be slid apart. After disconnecting the appropriate electrical connectors and the door check, the complete door can easily be removed from the vehicle as required. Most of the internal components of the doors including the window regulators and window glass are assembled into a modular assembly known as an assembly carrier.

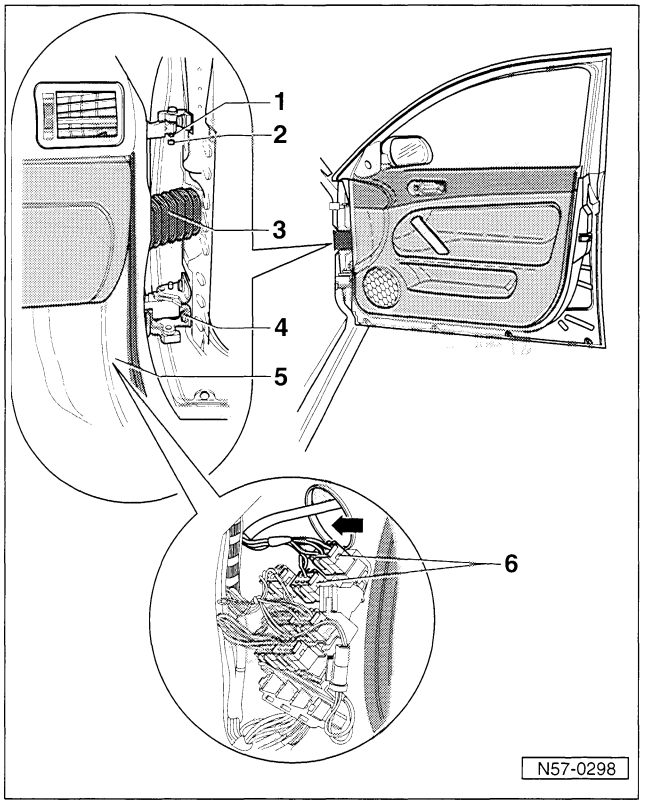
Door assembly

NOTE —

- *The instrument panel must be removed to remove and adjust the upper door hinges.*
- *Always replace the hinge bolts if loosened.*



1. **Door**
2. **Door handle with base**
3. **Lock cylinder housing**
4. **Cover cap**
5. **Bolt**
   - Tighten to 18 Nm (13 ft-lb)
   - Install with locking compound
6. **Locking button**
7. **Locking rod**
8. **Rubber boot**
9. **Bolt**
   - Tighten to 20 Nm (15 ft-lb)
10. **Striker plate**
11. **Door lock assembly**
12. **Bowden cable**
13. **Interior release handle**
14. **Multi-point socket head bolt**
    - M8 x 28
    - Tighten to 20 Nm (15 ft-lb) + ¼ turn (90°)
    - Always replace bolt after loosening
15. **Multi-point socket head bolt**
    - M8 x 28
    - Tighten to 20 Nm (15 ft-lb) + ¼ turn (90°)
    - Always replace bolt after loosening
16. **Door hinge with arrester**
    - Hinge is divided
17. **Multi-point socket head bolt**
    - M8 x 28
    - Install from inside vehicle
    - Remove A-pillar lower trim, see **70 Trim–Interior**
    - Tighten to 20 Nm (15 ft-lb) + ¼ turn (90°)
    - Always replace bolt after loosening
18. **Multi-point socket head bolt**
    - M8 x 28
    - Tighten to 20 Nm (15 ft-lb) + ¼ turn (90°)
    - Always replace bolt after loosening
19. **Multi-point socket head bolt**
    - M8 x 28
    - Tighten to 20 Nm (15 ft-lb) + ¼ turn (90°)
    - Always replace bolt after loosening
20. **Cover cap**
21. **Bolt**
    - Tighten to 13 Nm (10 ft-lb)
22. **Door hinge**
    - Hinge is divided
23. **Multi-point socket head bolt**
    - M8 x 22
    - Install from inside vehicle
    - To loosen or tighten bolt, remove and install instrument panel, see **70 Trim–Interior**
    - Tighten to 20 Nm (15 ft-lb) + ¼ turn (90°)
    - Always replace bolt after loosening
24. **Multi-point socket head bolt**
    - M8 x 28
    - Tighten to 20 Nm (15 ft-lb) + ¼ turn (90°)
    - Always replace bolt after loosening



Door, removing and installing

Remove lower A-pillar lower trim (**5**), see **70 Trim–Interior**. Disconnect harness connectors (**6**).

– Remove wiring harness boot (**3**) at A-pillar and carefully work wiring harness connectors through opening (**arrow**).

> ***CAUTION —***
> *Do not close door with harness connectors between door and A-pillar. They will be crushed.*

– Pry off cover cap (**2**) and remove bolt (**1**) from upper hinge pin.

– Remove lower bolt (**4**) from hinge using VW special tool 3320 door adjusting wrench and 3320/2 box spanner. Always replace this bolt upon installation.

– Carefully lift door upward and out of hinge brackets.

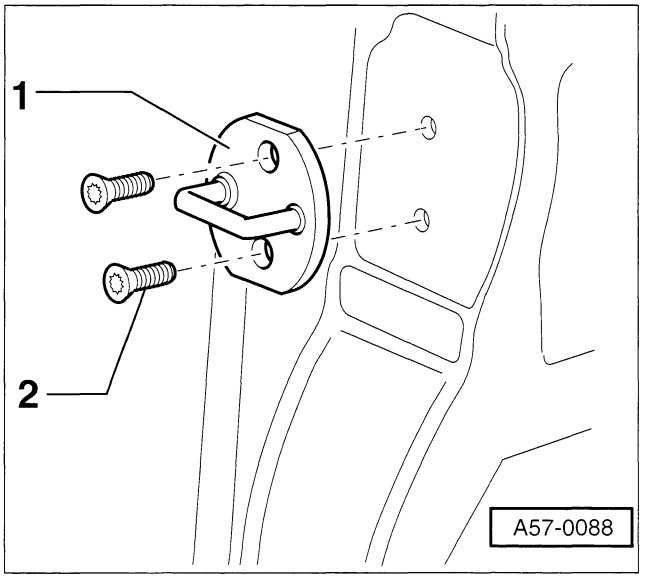
– Installation is the reverse of removal.

Tightening torques

- Upper hinge bolt . . . . . 13 Nm (10 ft-lb)
- Lower hinge bolt (always replace) . . . . . 20 Nm (15 ft-lb) + ¼ turn (90°)

Door, adjusting

For proper door adjustment, door hinge must be loosened at pillar. Other measures, such as aligning door upward, are not effective. Excess pressure thereafter will again cause door to sag. For this, door adjusting wrench 3320 with Box spanner 3320/2 must be used. If it should be necessary that door hinge must be loosened at upper A-pillar from inside. VW special tool, socket insert 3410 can be used to do this. To do so, instrument panel must be removed first, see **70 Trim–Interior**.



Door, adjusting striker plate

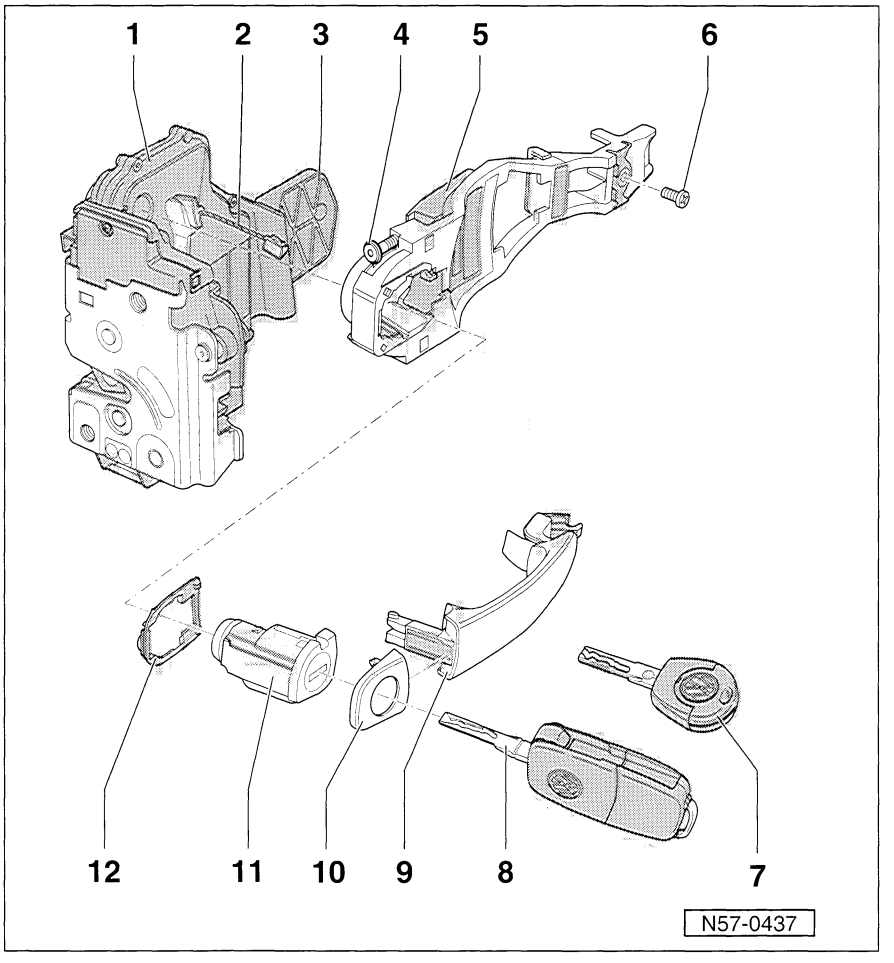
Loosen bolts (**2**) and move striker plate (**1**) until door shell is flush with contour of body. Tighten bolts.

Tightening torque

- Striker plate to door pillar . . . . . 20 Nm (15 ft-lb)

> ***NOTE —***
> *Striker plate adjustment is only used to align the door inward or outward, not vertically. Door should not move up or down when closed or opened. If this occurs, vertical alignment of striker is incorrect*

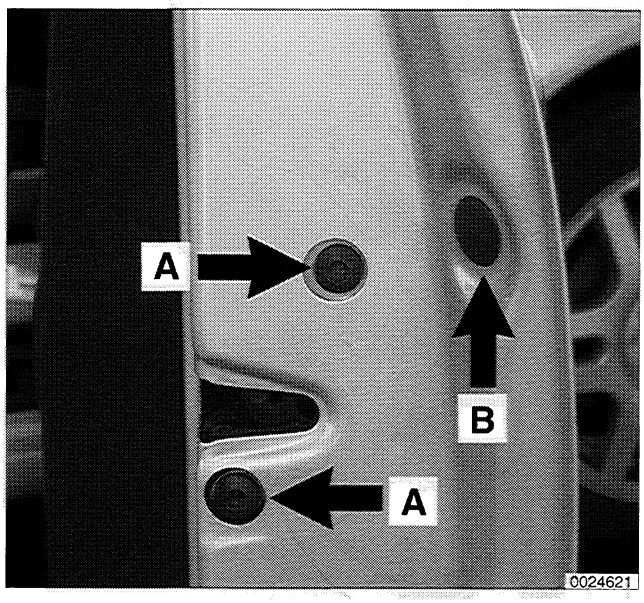
Door handle and lock assembly

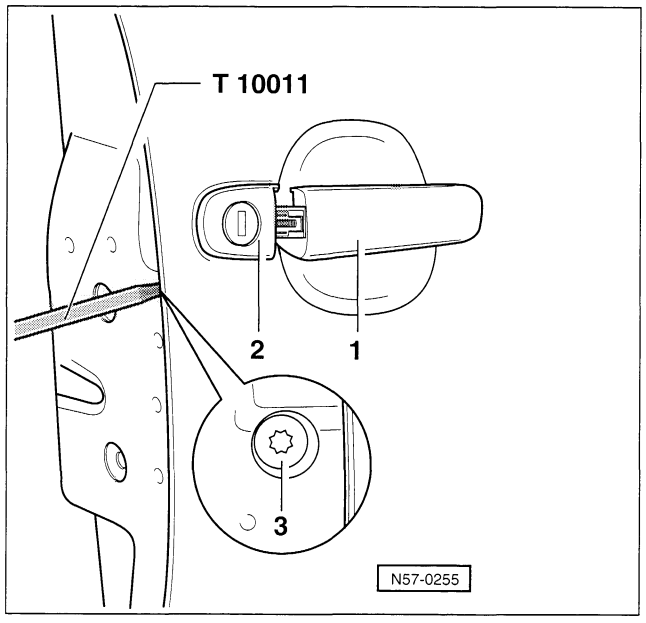


1. **Door lock**
   - The door lock can only be removed with the carrier assembly
2. **Cable**
   - Outside door handle release
3. **Retaining bracket**
   - Bolted and riveted to carrier assembly and door lock
4. **Bolt**
   - Requires either special socket tool T10011, or T10072 (Torx T20), see **Special tools** given earlier
   - Loosening this bolt releases the lock cylinder housing, allowing it to be pulled out of handle bracket
   - Bolt must not be threaded in without lock cylinder housing installed or locking ring may fall into door

   NOTE —

   Loosen multi-point socket head bolt only. If bolt is removed, door lock must be removed to realign.
5. **Handle bracket**
   - Removing:
     Door handle, lock cylinder housing and assembly carrier are removed first
     Remove screw (**6**) and slide bracket slightly to rear and remove from door
6. **Screw**
7. **Key**
   - Non-foldable
   - With-out radio-frequency remote control
   - Master or valet profile
8. **Key**
   - Foldable
   - With radio-frequency remote control
   - Master key profile
9. **Door handle with base**
10. **Lock cylinder cover (trim)**
11. **Lock cylinder housing**
    - Only supplied with lock cylinder and keys
12. **Gasket**





Lock cylinder housing, removing and installing

➢ Carefully pry out cover cap (**B**) to access multi-point or Torx head bolt holding the lock cylinder or blank in place. Do not loosen bolts (**A**) for door latch unit.

– Pull door handle open and hold.

➢ Pull door handle (**1**) in direction of **arrow** to open position and hold. Unscrew door handle mounting screw (**3**) until lock cylinder (**2**) is released. Use VW special socket tool T10011 or T10072 (Torx T20), as applicable to remove mounting screw (**3**).

NOTE —

- *Loosen multi-point socket head bolt only. If bolt is removed, door lock must be removed to realign.*
- *The door handle will remain open on its own if the multi-point socket head bolt is loosened properly.*
- *For more information on the various special tools, see* **Special Tools** *given earlier in this section.*

– Pull lock cylinder housing straight out.

NOTE —

Inserting the key into lock cylinder aids in removing the lock cylinder housing.

Installing

– Ensure that door handle has remained opened from the removal procedure.

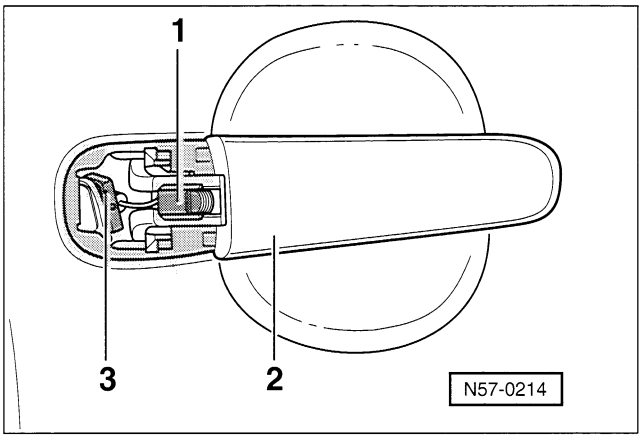
– Carefully install lock cylinder housing into opening in door.

– Tighten multi-point socket bolt. As screw is tightened, an audible noise should be heard indicating correct seating of lock cylinder housing and tensioning of door handle spring.

– Operate key and door handle to ensure correct operation.

– Reinstall sealing plug.

Door handle, removing and installing



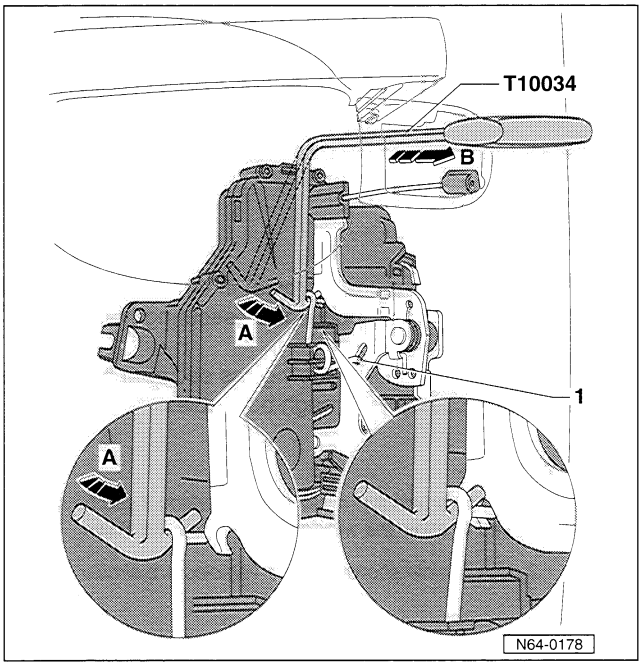
– Remove lock cylinder housing as described earlier.

➢ Remove cable clip (**1**) from door handle lock release with a pick or a small screwdriver.

– Swing rear of door handle out of door, pivoting from front of handle.

NOTE —
By pivoting door handle out, door handle spring is tensioned and locked. After door handle is installed, spring tension is released.

Installing

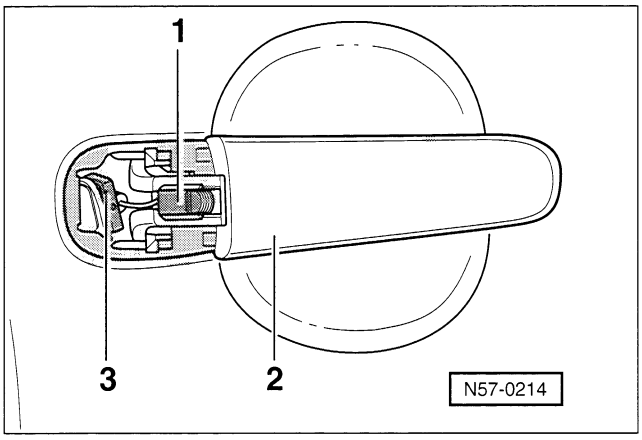


NOTE —
Replacement door handles are supplied finished in primer only and must be painted prior to installation.

➢ Hook VW special tool T 10034 under (**arrow A**) lock spring (**1**) and into door lock mechanism by pulling tool (**arrow B**).

– Position lock spring up into door lock mechanism by pulling special tool outward.

– Slip front of door handle into door opening and swing rear of door handle into position against door.



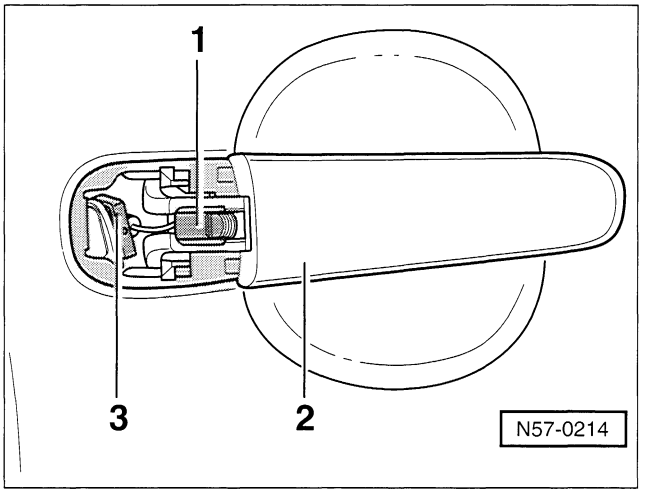
➢ Snap cable clip (**1**) into slot and engage in door handle (**2**), taking care not to pull cable tight.

NOTE —
*When installing cable clip, do not pull lock operating lever (**3**) while pushing on door handle (**2**).*

– Install lock cylinder housing and check door handle function. Door will not open if bowden cable is not correctly installed and adjusted.

Door lock, removing

The window regulator, door glass, door speaker and door lock are secured to the door assembly carrier. The door lock can only be removed after the assembly carrier is removed.

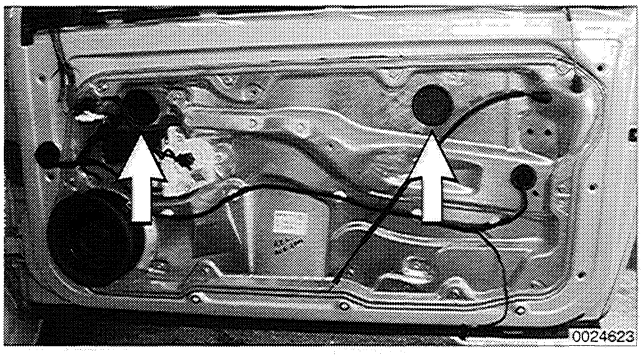


NOTE —
The assembly carrier can only be removed when the door window clamping brackets of the window regulator are unscrewed. This is accomplished by lowering the door window to the height of the holes in assembly carrier and loosening the clamping brackets.

– Remove door trim panel. See **70 Trim–Interior**.

– Remove lock cylinder housing as given earlier.

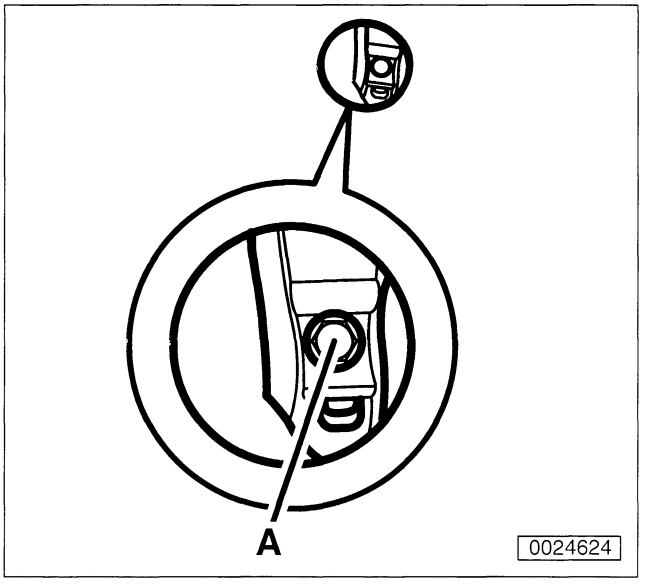
➢ Remove cable clip (**1**) from door handle with pick or screwdriver.



➢ Pry out sealing plugs (**arrows**) in door assembly carrier to gain access to window glass securing bolts.

– Lower window until window glass securing bolts are visible and accessible through both holes.

NOTE —
- *If the power window motor is not working it can be removed to allow the window glass to be slid down.*
- *2-door vehicle shown; 4-door vehicles are similar.*



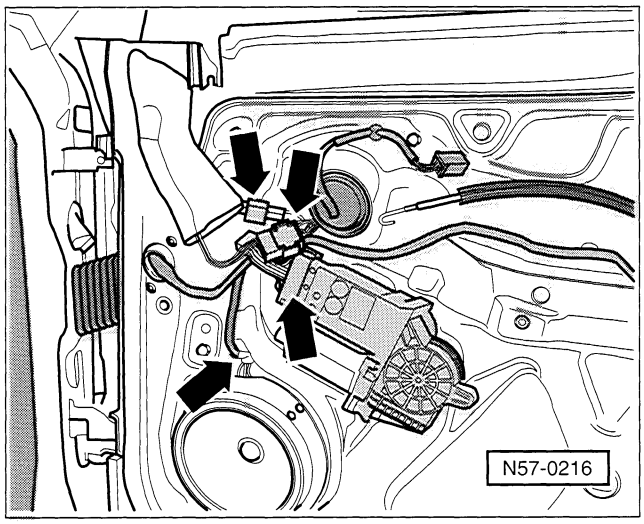
➢ Loosen window glass securing bolts (**A**) and carefully press glass securing clamps apart.

NOTE —
Bolts should be either a 10 mm hex or a Torx 30.

– Push window glass upward in the track. Secure the window glass in up position with VAG 1344 or equivalent commercially available suction cup tools. Alternatively, attach strips of suitable adhesive tape to the inside glass, and loop over the door frame. Attach the other end to the outside of the glass.

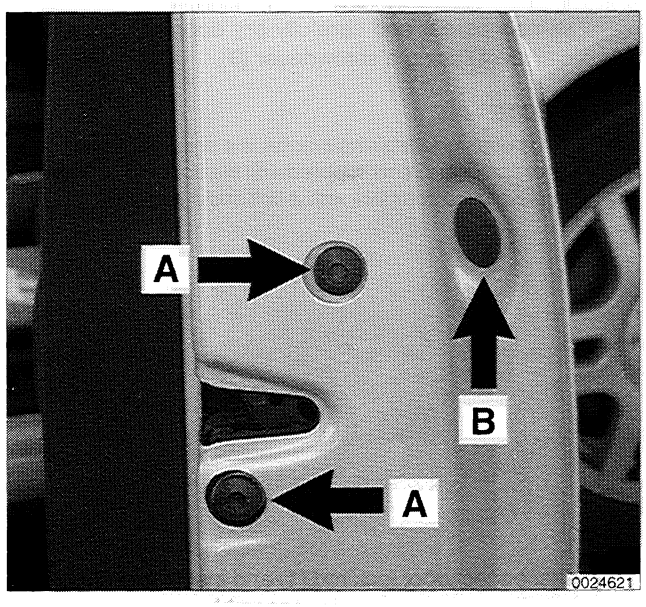
– Remove hood release lever on left side, as required. See **55 Hoods and Lids**.

– Remove lower A-pillar trim. See **70 Body–Interior Trim**.

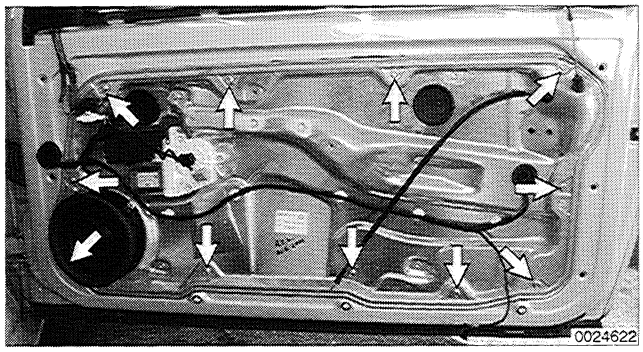


➢ Disconnect multi-pin harness connectors (**arrows**) and position wires out of way for removal of assembly carrier.

NOTE —
Carefully note the installed position of these harness connectors before disassembly. This will facilitate their installation upon reassembly.



➢ Remove door lock mounting bolts (**A**).

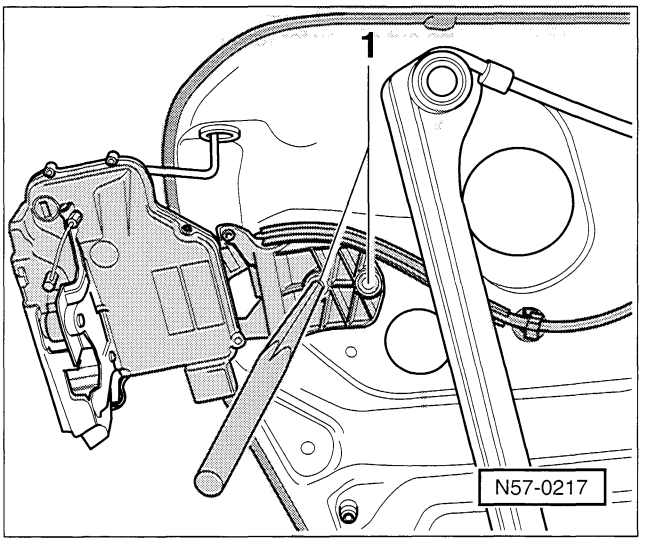


➢ Remove assembly carrier mounting bolts (**arrows**).

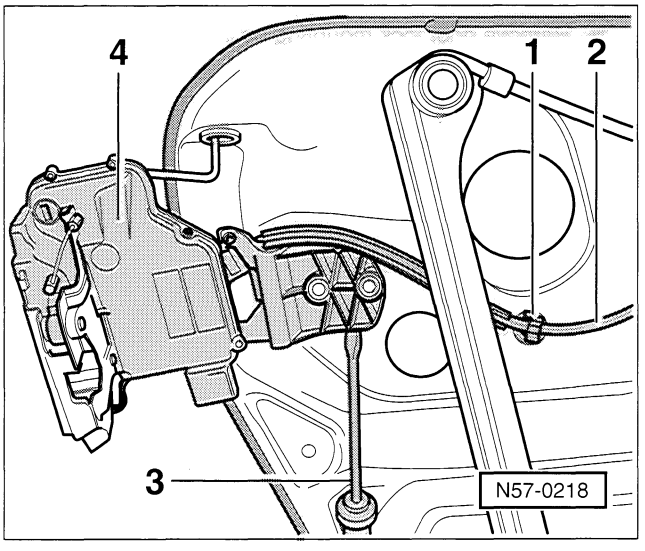
NOTE —
- *Use care to protect door speakers when removing assembly carrier.*
- *Experience indicates that 2-door vehicles will usually have 11 bolts around the perimeter and 4-door vehicles will be equipped with 10.*

– Pull top of door assembly carrier from door, lift and pull out of door toward hinges.

– Turn assembly carrier and pull off connection to door lock.



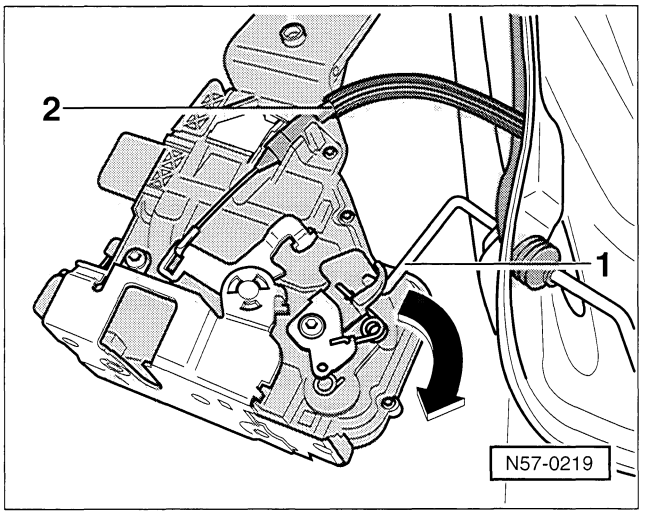
➤ Drive out door lock securing clips (**1**) with a drift.



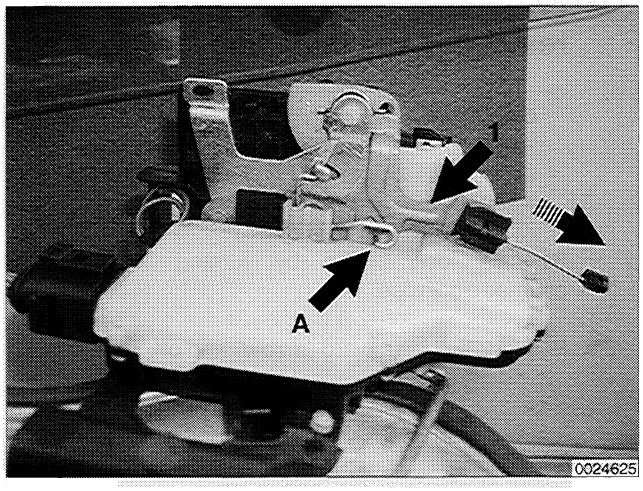
➤ Disconnect inside release cable (**2**) from clip (**1**) on assembly carrier and carefully pry door lock off assembly carrier (**4**) using a screwdriver (**3**).

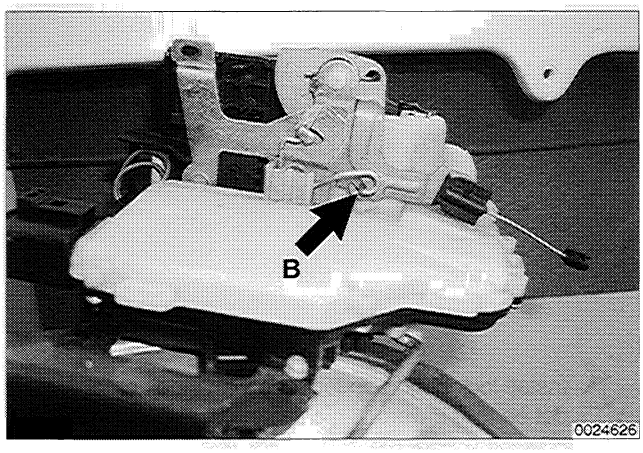
NOTE —

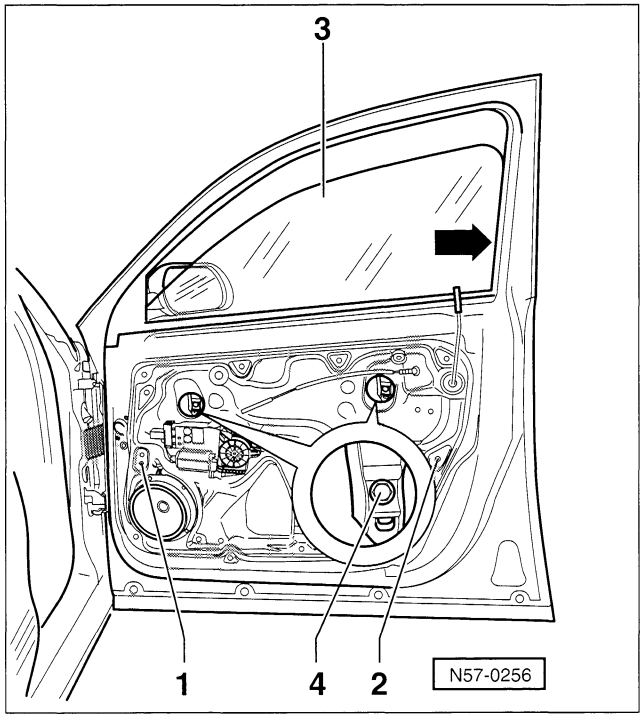
The door lock retaining bracket is a separate part. It is not part of the items supplied with the door lock. It is secured to the door lock with a bolt and a pop rivet.



➤ Disconnect door lock rod (**1**) and inside release cable (**2**) to remove door lock from assembly carrier.







Door lock, installing

➢ Pull lock operating lever (**1**) in direction of **dashed arrow**. With a small screwdriver or needle-nose pliers, carefully hook spring (**A**) into slot on operating lever.

➢ Spring (**B**) should be positioned as shown before proceding.

NOTE —
Connecting the operating lever locks the mechanism and prevents incorrect attachment of the outside handle cable during later reassembly.

– Attach door lock rod and inside release cable.

– Attach door lock to door assembly carrier.

– Insert assembly carrier in door.

➢ Install assembly carrier mounting bolts and tighten bolts **1** and **2** first. Position door window (**3**) into window guide (**arrow**) and tighten window glass securing clamps (**4**).

Tightening torques

- Assembly carrier to door . . . . . 8 Nm (71 in-lb)
- Window glass securing clamp bolts
  Plastic clamp . . . . . 9 Nm (80 in-lb)
  Aluminum clamp . . . . . 11 Nm (7 ft-lb)

NOTE —
Window glass securing clamps, originally made with stamped steel and plastic, are now being supplied in cast aluminum. The new clamps are available from your Volkswagen parts department and have been designed to resist breakage.

– Adjust window glass, as necessary in securing clamps and re-tighten.

– Remainder of installation is the reverse of disassembly.

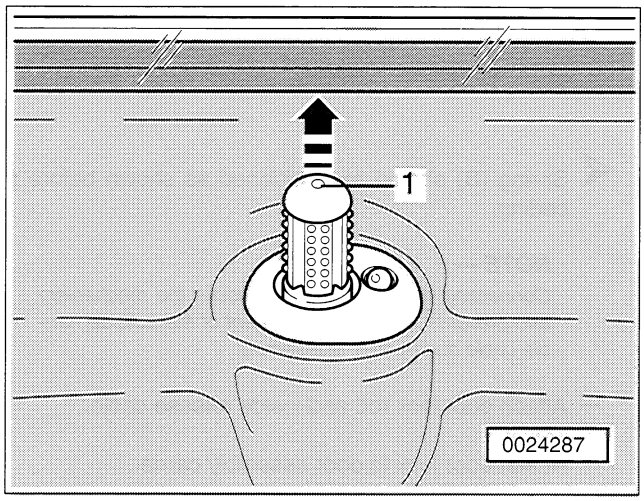
– Check operation of window before final installation of door trim panel.

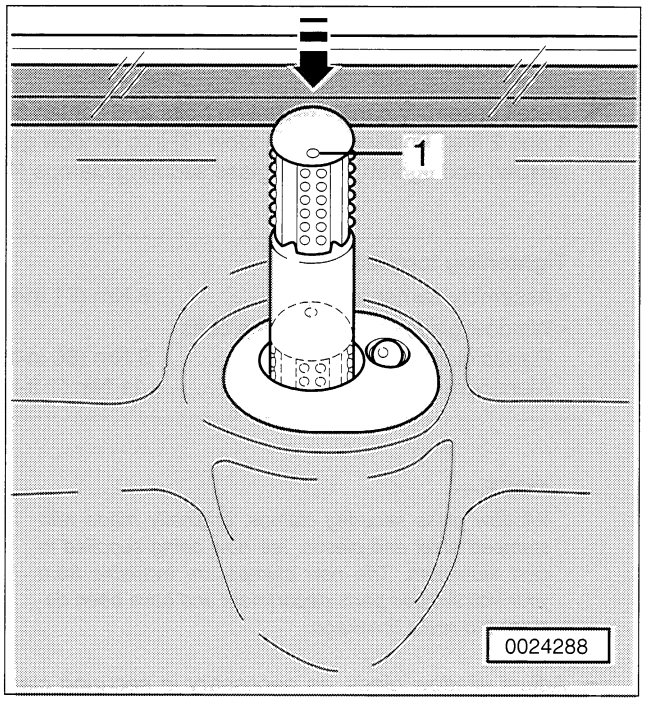
Lock button, right front and left rear, removing and installing

CAUTION —
Failure to follow this procedure may result in loosening of the locking rods in the doors requiring complete disassembly to repair.

– Remove lock button by turning ½ turn (180°) counter-clockwise.

➤ Pull lock button upward (**arrow**) and off.





➤ Install lock button on lock rod with index mark (**1**) (small dot on top) toward vehicle interior.

– Push lock button onto lock rod until fluted section is flush with door trim.

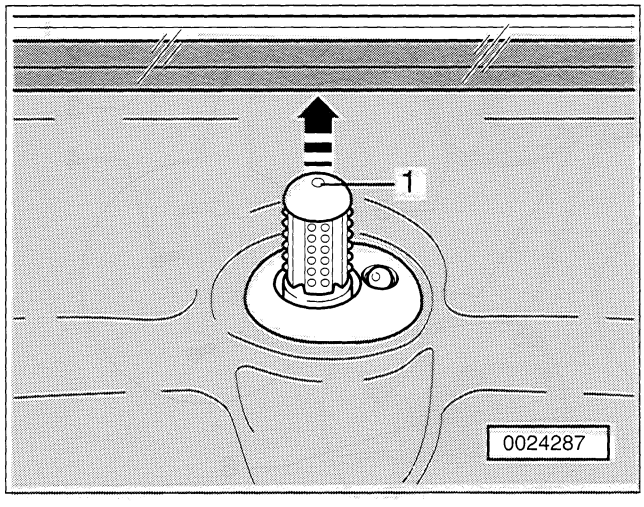
– Turn lock button ½ turn (180°) counter-clockwise.

NOTE —
Lock button in the locked position can be flush with the door trim panel to approximately 2 mm (0.078 in.) above door trim panel.

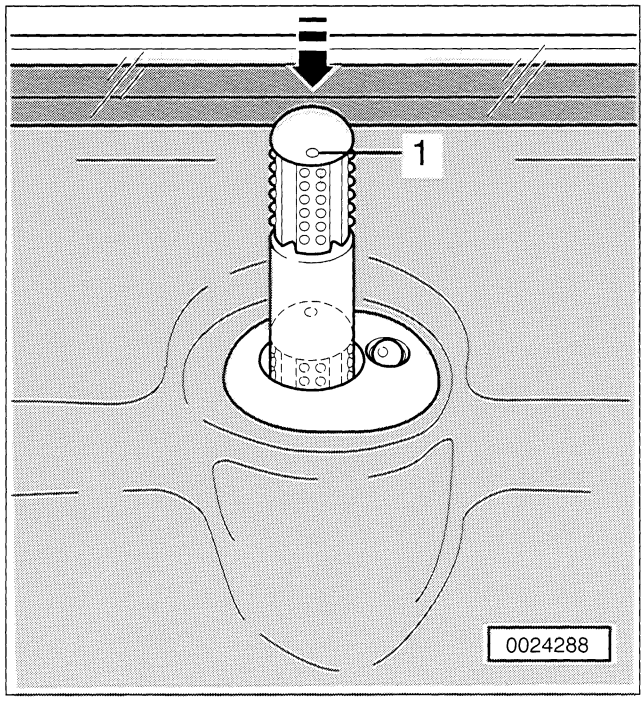
Lock button, left front and right rear, removing and installing

CAUTION —
Failure to follow this procedure may result in loosening of the locking rods in the doors requiring complete disassembly to repair.

– Remove lock button by turning ½ turn (180°) clockwise.



➤ Pull lock button upward (**arrow**) and off.



➤ Install lock button on lock rod with index mark (**1**) (small dot on top) toward vehicle interior.

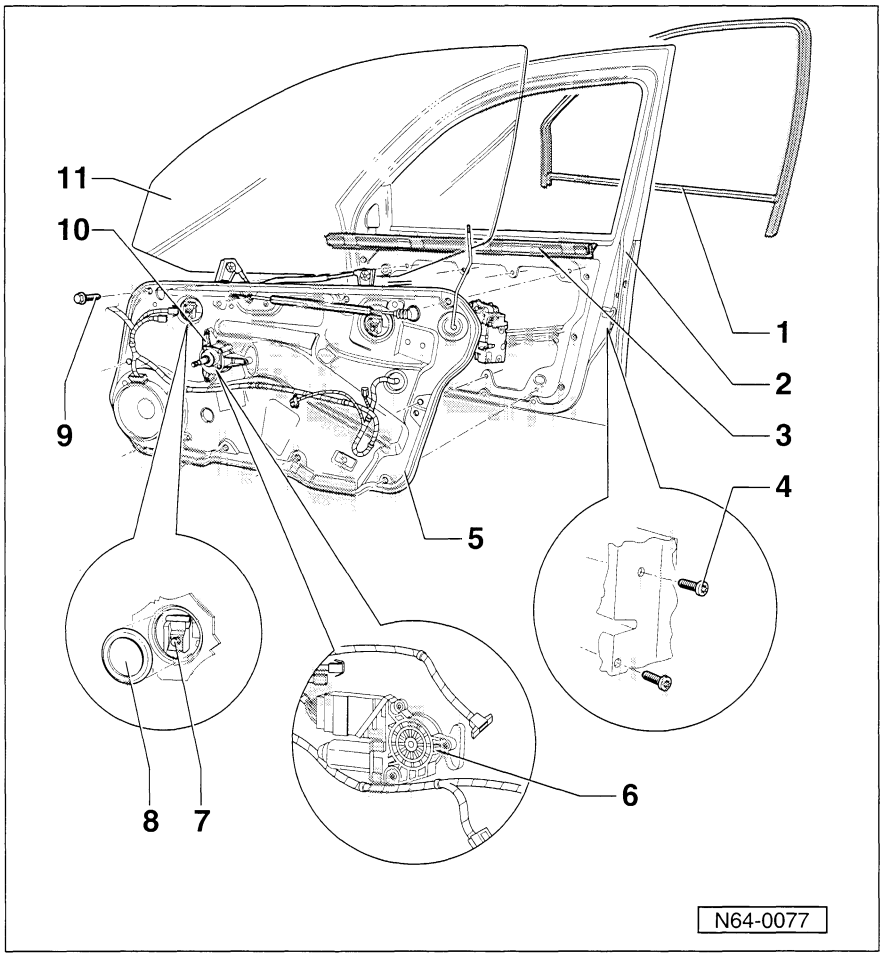
– Push lock button onto lock rod until fluted section is flush with door trim.

– Turn lock button ½ turn (180°) clockwise.

NOTE —
Lock button in the locked position can be flush with the door trim panel to approximately 2 mm (0.078 in.) above door trim panel.

Door window assembly

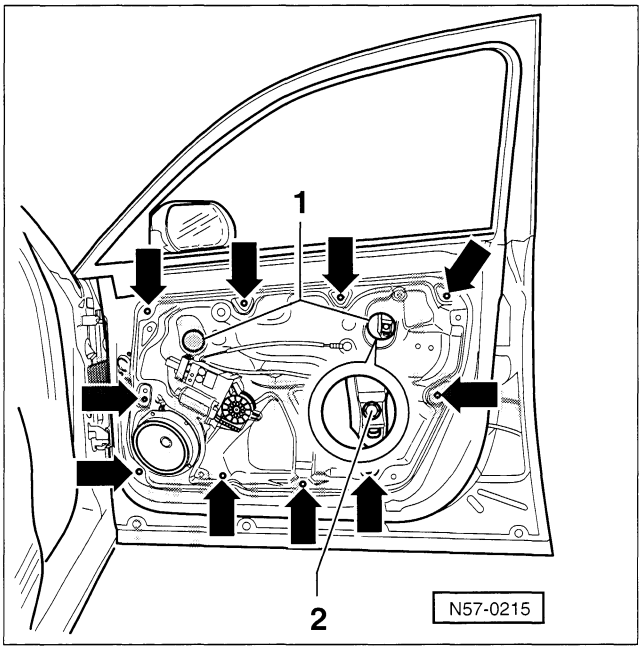
1. **Window channel**
   - Pushed into door frame opening
2. **Door**
3. **Window slot seal, inner**
   - Pushed onto door frame
4. **Bolt**
   - Tighten to 20 Nm (15 ft-lb)
   - Install with locking compound
5. **Door assembly carrier**
   - Window regulator is part of assembly carrier
6. **Motor for window regulator**
   - Attached to carrier assembly from the front
7. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
8. **Cover cap**
9. **Bolt**
   - Tighten to 8 Nm (71 in-lb)
10. **Crank drive for manual window regulator**
    - Attached to carrier assembly from the front
11. **Door window**



Door window glass, removing

NOTE —
Window glass must be operable in order to remove door assembly carrier. Any malfunction that prevents the windows (manual or power) from being lowered must be corrected before proceeding.

– Remove door trim panel. See **70 Trim–Interior**.



➢ Pry out sealing plugs (**1**) in door assembly carrier to gain access to window glass securing bolts (**2**).

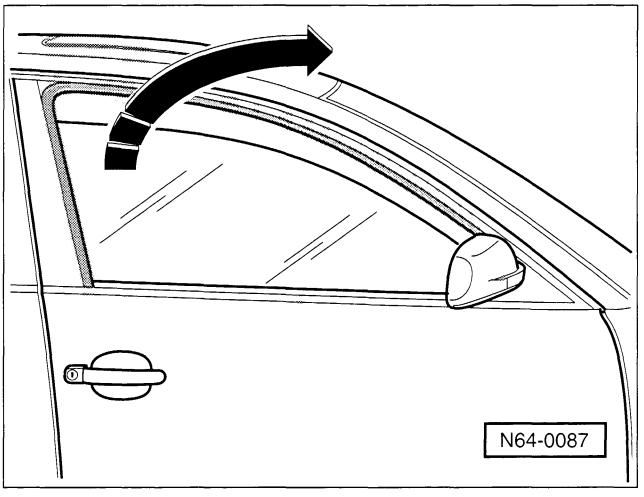
– Lower window until window glass securing bolts are accessible.

NOTE —
If the power window motor is not working it can be removed to allow the window to be slid down.

– Loosen window glass securing bolts and carefully press glass securing clamps apart.

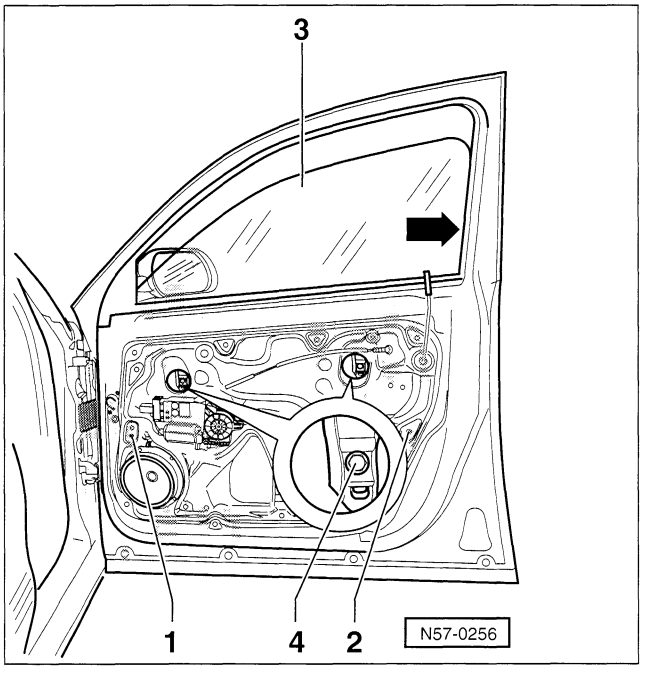
NOTE —
If glass is being replaced due to breakage, remove door assembly carrier as given earlier and remove all broken shards of glass to prevent rattling noises in door.

– Carefully lower the window regulator.



➢ Lift the window glass up and pivot forward (**arrow**).

– Place removed window glass in a secure location.



Door window glass, installing

– Slide forward part of window glass into opening and pivot glass downward, reversing the removal procedure.

– Raise window regulator until window glass securing bolts are visible in access holes on door assembly carrier.

➢ Gently press window (**3**) in direction of **arrow** and tighten securing clamp bolts (**4**).

Tightening torques

- Assembly carrier to door . . . . . 8 Nm (71 in-lb)
- Window glass securing clamp bolts
  Plastic clamp . . . . . 9 Nm (80 in-lb)
  Aluminum clamp . . . . . 11 Nm (7 ft-lb)

NOTE —

Window glass securing clamps, originally made with stamped steel and plastic, are now being supplied in cast aluminum. The new clamps are available from your Volkswagen parts department and have been designed to resist breakage.

– Remainder of installation is the reverse of disassembly.

– Check operation of window before final installation of door trim panel.

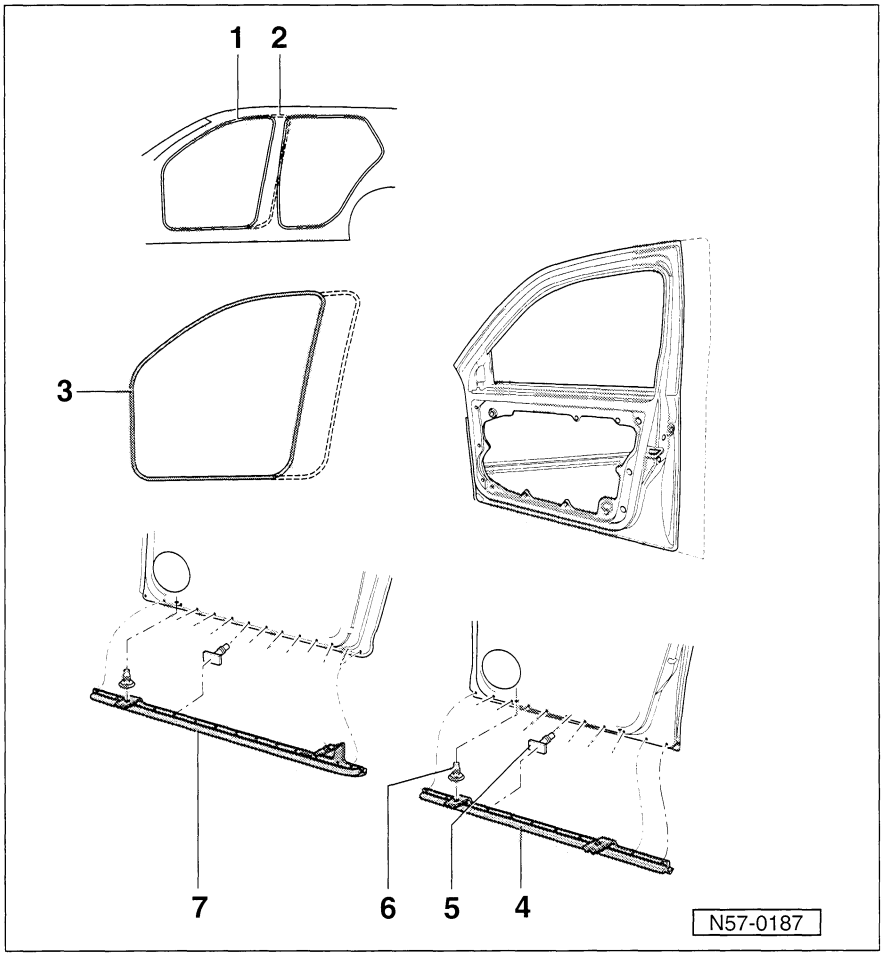
Door seals

The door seals are originally installed using a sealant on the door flange and rolling the seal on.

If the door seals are removed the sealant will spread on the inside of the seal and the flanks will be bent out slightly. If seal is then reinstalled it may not fit tightly and seal properly. Therefore each seal that is completely removed should be replaced by a so called "hammer blow" seal.

NOTE —
Consult an authorized Volkswagen parts department for the correct replacement seal.

When seals have only been partially removed, squeeze the flanks together before reinstalling.



1. **Door inner seal, 4-door**
   - Start at upper radius of door cut-out when installing seal
2. **Door inner seal, 2-door**
   - Start at B-pillar trim when installing seal
3. **Door inner seal**
4. **Door outer seal, 4-door**
5. **Clip**
   - Inserted into door seal
6. **Clip**
   - Inserted into door seal
7. **Door outer seal, 2-door**

NOTE —
- *Interior trim must be removed to remove door seals, see **70 Trim-Interior**.*
- *It may be necessary to loosen the instrument panel to remove A-pillar trim.*

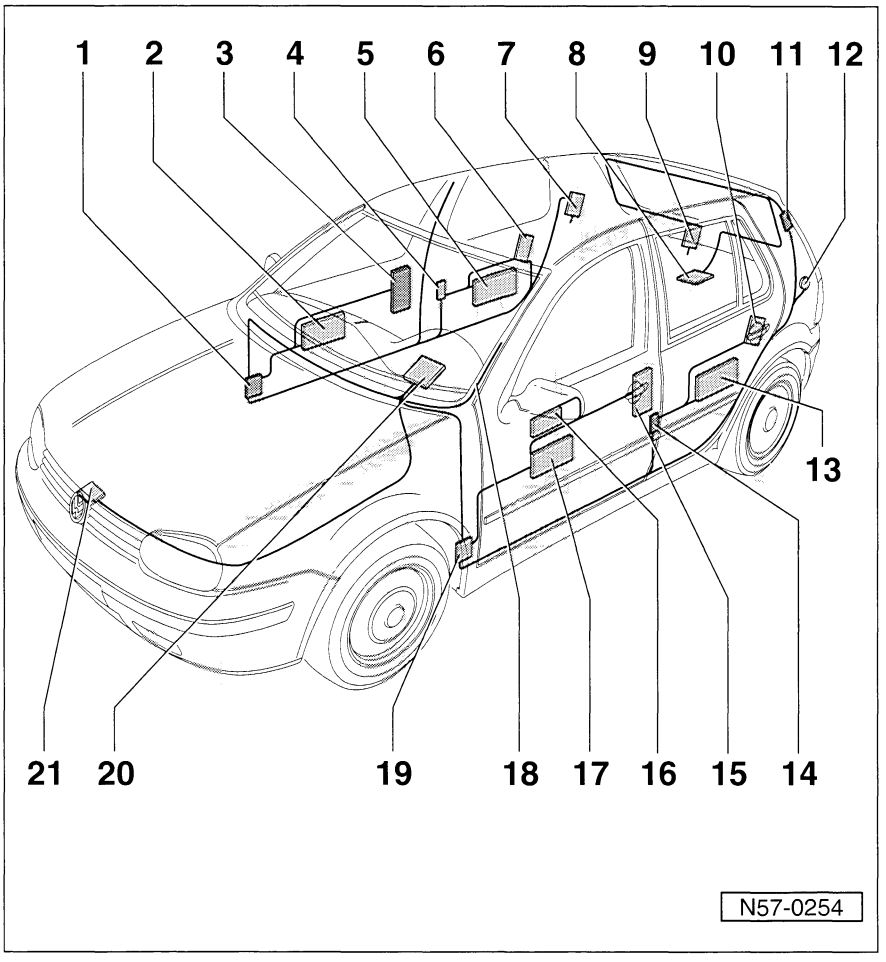
COMFORT SYSTEM

The vehicles covered by this manual are available with central locking, anti-theft alarm system, keyless remote system and power mirrors. This combination of inter-connected systems is known as the Comfort System.

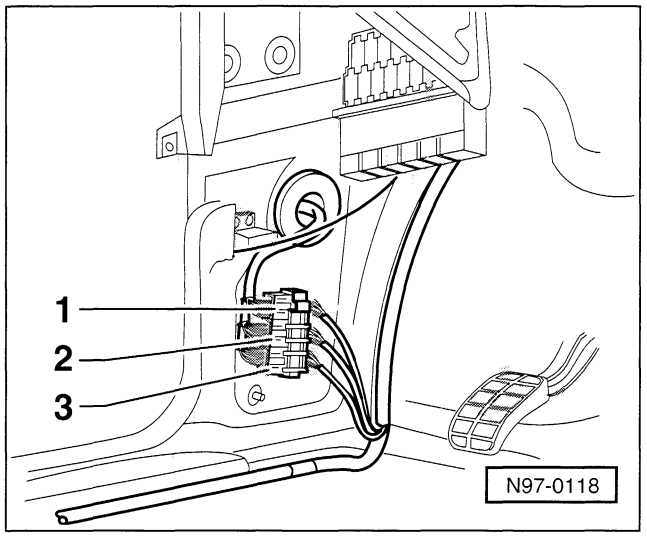
NOTE —

- *The comfort system features built-in diagnostic circuitry that detects and stores Diagnostic Trouble Code (DTC) information. When the system detects a fault, a DTC is generated and stored in the comfort system central control module memory. This may result in failure of the system to operate properly. Proper diagnosis of fault codes can be accessed through the data link connector using Volkswagen scan tool VAG 1551/1552 or equivalent.*
- *Additional diagnostic information is available in a data-stream format to aid in troubleshooting. This valuable information can only be accessed by scan tools such as the Volkswagen VAG 1551/1552 or equivalent. Evaluation and interpretation of this information fall outside the scope of this service manual.*
- *Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See* **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*

Comfort system and central locking, component overview



1. **Connector station**
   - Location: right side lower A-pillar, see **Connector station in A-pillar**
2. **Door control module, front right**
   - For comfort system only
   - Integrated into window motor
3. **Lock unit, front right**
   - Secured to assembly carrier
   - Electric central locking is integrated into door lock module
4. **Connector station**
   - Location: lower B-pillar
5. **Door control module, right rear**
   - For comfort system only
   - Integrated into window motor
6. **Door lock, right rear**
   - Secured to assembly carrier
   - Electric central locking is integrated into door lock module
7. **Motor, fuel tank filler flap (V155)**
   - Location: under C-pillar trim
8. **Rear lid lock**
   - Bolted to rear lid
   - Remove with special socket T 10010
9. **Rear lid actuator**
   - Bolted to rear lid
   - Remove with special socket T 10010
10. **Door lock, left rear**
    - Secured to assembly carrier
    - Electric central locking is integrated into door lock module
11. **Connector station**
    - Location: rear roof area, covered by roof trim
12. **Anti-theft alarm horn**
    - Location: in area of C-pillar, covered by trim
13. **Door control module, left rear**
    - For comfort system only
    - Integrated into window motor
14. **Connector station**
    - Location: lower B-pillar
15. **Door lock, left front**
    - Secured to assembly carrier
    - Electric central locking is integrated into door lock module
16. **Controls**
    - Installed in door trim
17. **Door control module, left front**
    - For comfort system only
    - Integrated into window motor
18. **Antenna for radio frequency remote control**
    - Under left A-pillar trim
19. **Connector station**
    - Location: lower A-pillar, covered by trim in footwell
20. **Central control module**
    - Bolted to bracket on steering column under instrument panel
21. **Hood lock**
    - Contact switch for anti-theft alarm
    - Location: in lock carrier

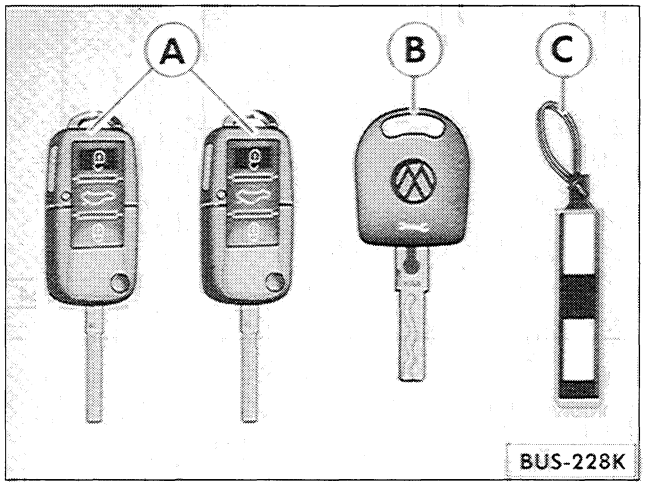


Connector station in A-pillar

Connector station is located in the front footwell behind trim panel. Driver side shown, passenger side is a mirror image of above.

Terminal identification:

1. Central locking
2. Electric windows, red
3. Electric mirror adjustment, blue



Keys and remote control

Three keys and a key tag are provided with most Volkswagens covered by this manual.

- **A** - Two folding master keys with remote control
- **B** - One valet key
- **C** - One key tag.

Some vehicles may also have a master key that does not have the remote control feature. It will be similar in appearance to **B** above and open the same locks as **A**.

The master keys fit all the locks on the vehicle and allow you to open/close the vehicle and set the anti-theft alarm system. The valet key is for the driver's door the steering ring/ignition lock only. The lockable glove compartment and rear lid cannot be opened with this key. The key tag contains the key number that is needed to obtain replacement keys from your Volkswagen dealer. It is advisable to record the number and keep the key tag in a secure location (not in vehicle). If you sell the vehicle, you should also give the buyer the key tag.

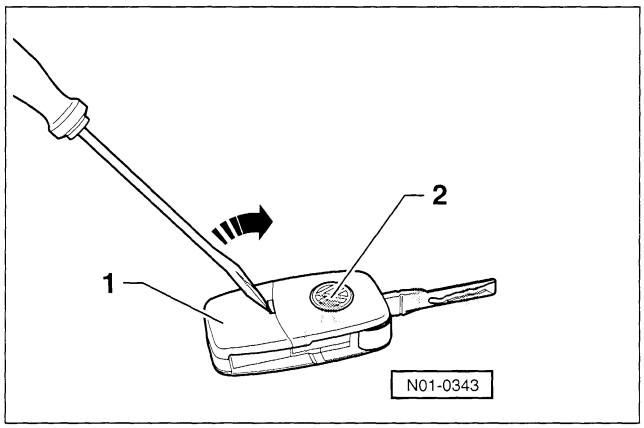
The remote control portion of the master key allows you to do the following without having to use the key:

- Lock the vehicle and arm the alarm
- Unlock the vehicle and disarm the alarm
- Use the selective unlock feature (open driver's door only)
- Switch on the interior lights (later models only)
- Open or unlock the rear lid (varies by model year)
- Activate the "panic function"

Details about the operation of the remote control can be found in the glovebox owner's manual. If your vehicle is missing the glovebox owner's manual a replacement one can be purchased from the publisher or Volkswagen.

As a security feature, if the vehicle has been unlocked using the keyless remote transmitter and a door is not opened within approximately 30 seconds, the system will re-lock all of the doors and re-arm the alarm system.

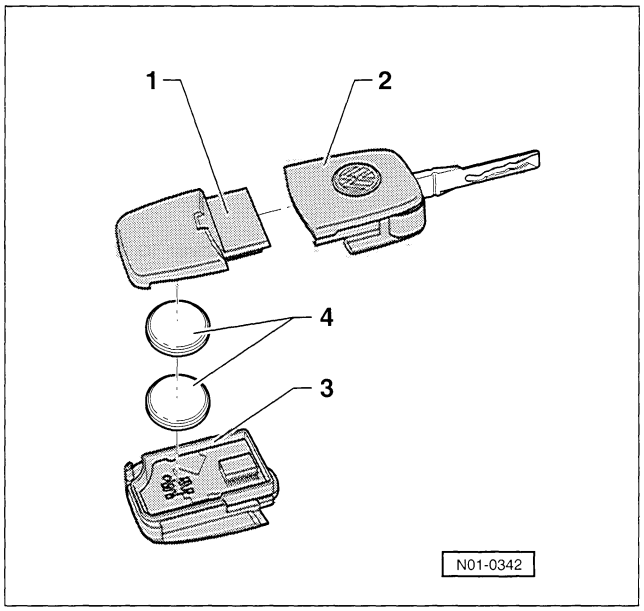
Remote control batteries, changing (through 04/2001)



The remote transmitter and the batteries are located in the master key.

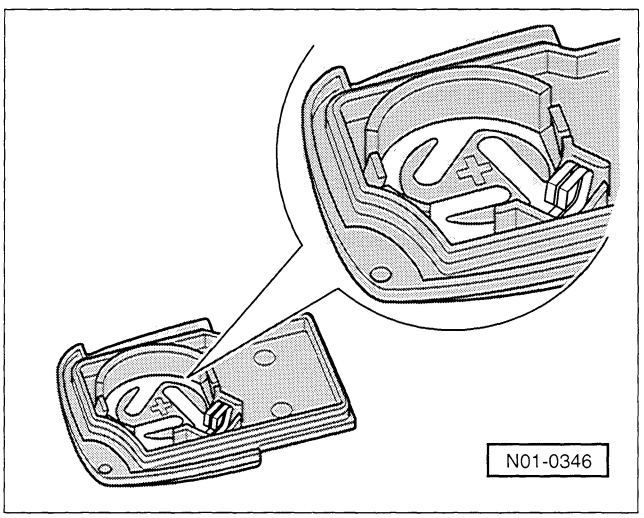
➤ Carefully separate the remote control using a small flat blade screwdriver.

NOTE —
To avoid damage to plastic finish it is helpful to pry on the side of the remote in the key recess.



➤ Carefully pry off transmitter unit upper part (**1**) from the lower part (**3**). Do not damage rubber gasket.

– Remove batteries (or single battery, if applicable) and replace with battery of same specification.



➤ Be sure to orient battery positive side (+) properly (positive terminal is marked in housing).

– Apply light pressure on battery to engage it in radio remote controller.

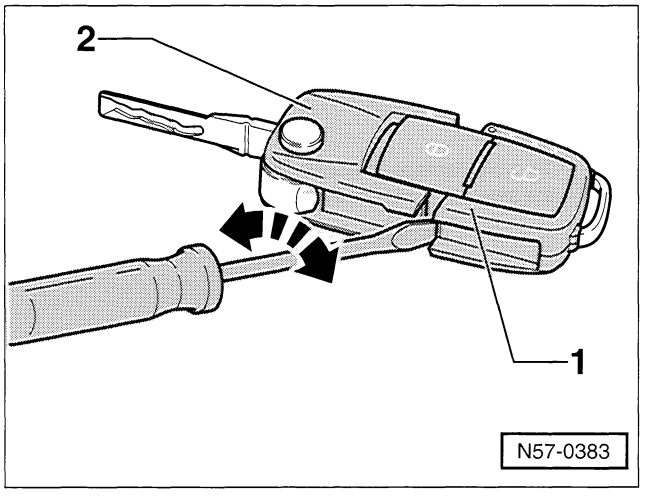
– Join cover and radio remote container, taking care not to damage seal.

– Assemble radio remote container and key in reverse order of removal.

– Check function of remote.

Remote control battery, changing (from 05/2001)

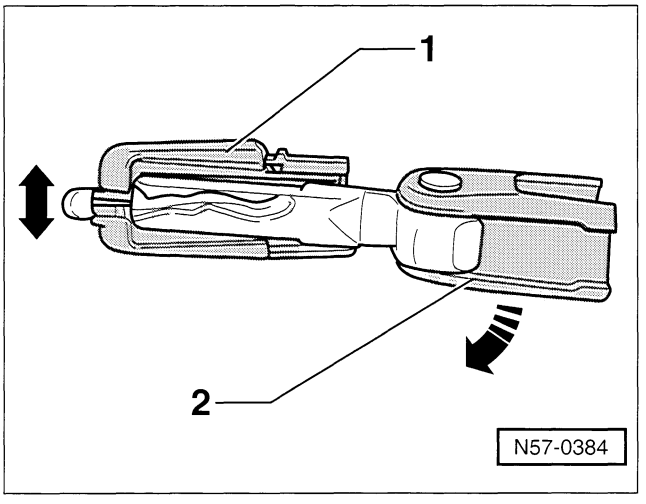
The remote transmitter and the battery are located in the master key.



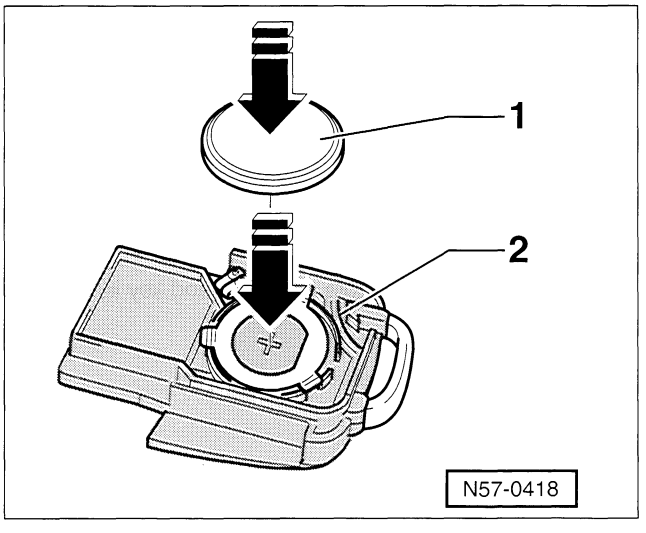
NOTE —

The radio remote container (1) may have an LED that will light up when using the remote. If the LED does not light the battery needs replacement.

- Carefully separate the remote control using a small flat blade screwdriver. Pry in the slit between the radio remote container (**1**) and key (**2**).
- Turn screwdriver in direction of **arrow** to separate the radio remote container from key.



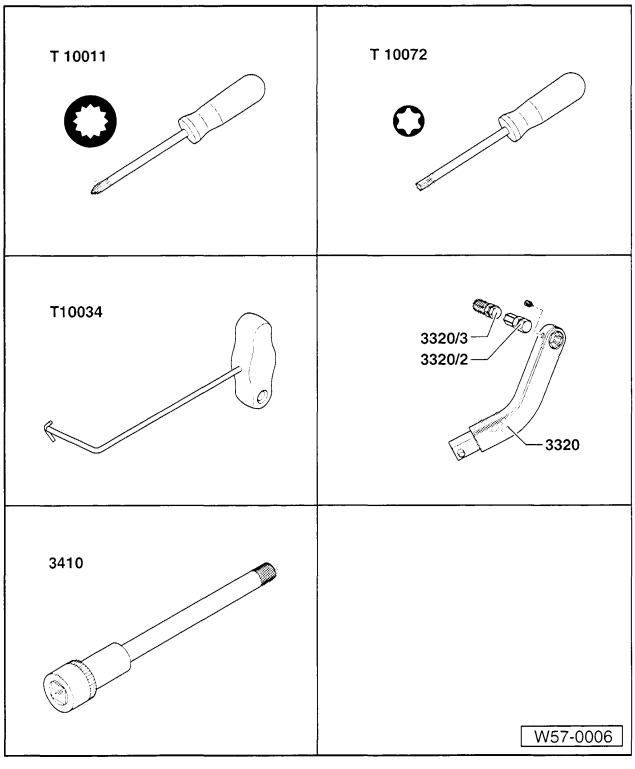
- Pry apart radio remote container (**1**) using profile of key (**2**).
- If necessary use a small screwdriver to unclip battery from retaining clips.



- Place battery (**1**) with the positive terminal facing down into radio remote container (**2**) (positive terminal is marked in housing).
- Apply light pressure on battery to engage it in radio remote control container.
- Join cover and radio remote container, taking care not to damage seal.
- Assemble radio remote container and key in reverse order of removal.
- Check function of remote.

58 Rear Doors

GENERAL 58-1
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DOORS 58-1
Rear door assembly 58-2
Door, removing and installing 58-3
Door, adjusting 58-3
Door handle and lock assembly 58-4
Door handle, removing and installing 58-5
Rear door windows, removing and installing 58-6
Door lock, removing 58-11
Door lock, installing 58-13
DOOR SEALS 58-14
Rear door seals 58-14



GENERAL

This repair group covers removal and installation of rear door assemblies, rear door glass and window regulators, and service to rear door lock assemblies. For removal of door trim panels see **70 Trim–Interior**.

WARNING —
Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using a VAG 1551/1552 or equivalent scan tool.

58

Special tools

Various special tools are specified for door service

- Socket wrench T10011 (outside door handle removal)
- Socket wrench T10072 (outside door handle removal)
- Assembly tool T10034 (outside door handle installation)
- Box spanner 3320/2 and 3320/3 for 3320 (door removal, installation, adjustment)
- Socket 3410 (door adjustment)

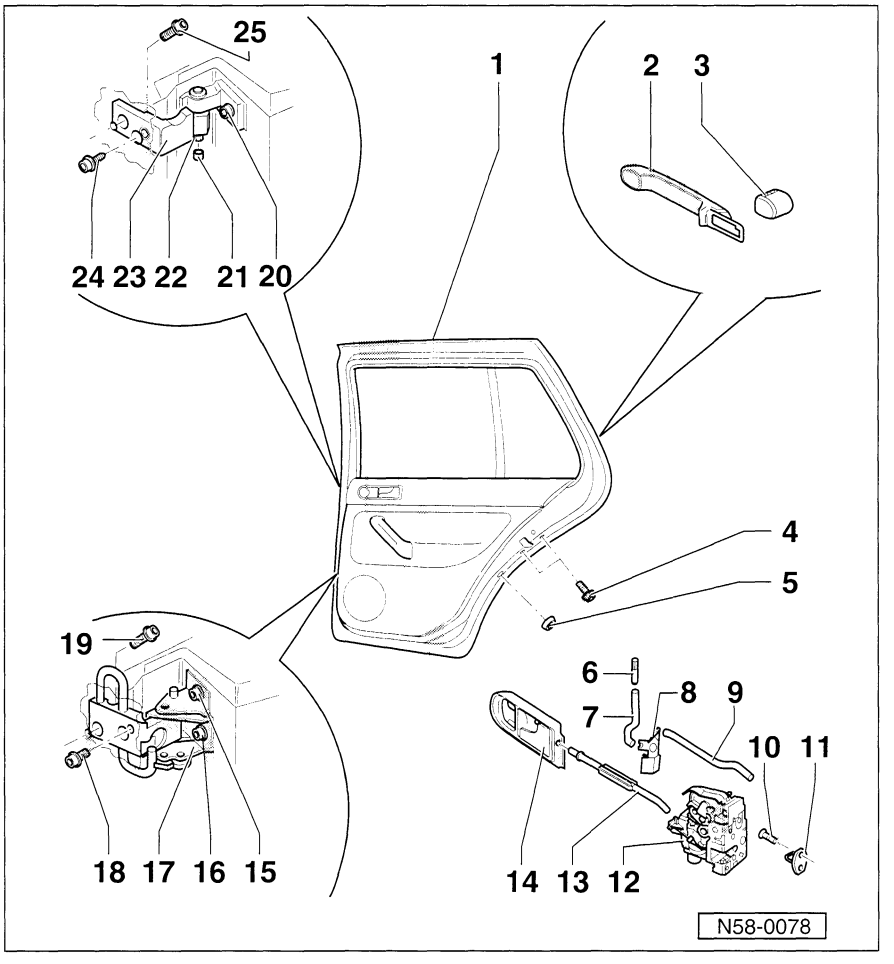
DOORS

The doors are designed with a split hinge that can be slid apart. After disconnecting the appropriate electrical connectors and the door check, the complete door can easily be removed from the vehicle as required. Most of the internal components of the doors including the window regulators and window glass are assembled into a modular assembly known as a door assembly carrier.

Rear door assembly

NOTE —
Always replace the hinge bolts if loosened.

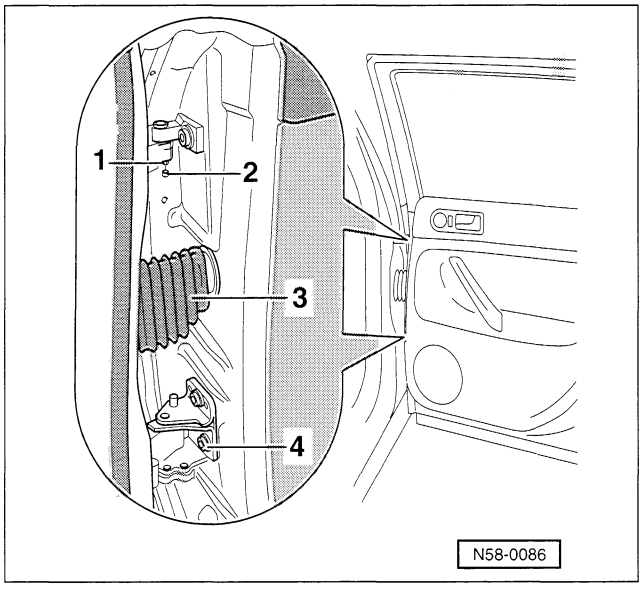
1. **Door**
2. **Door handle with base**
3. **Lock cylinder housing**
4. **Bolt**
   - Tighten to 18 Nm (13 ft-lb)
   - Install with locking compound
5. **Cover cap**
6. **Locking button**
   - For removal, see **57 Front Doors**
7. **Locking rod**
8. **Bell crank**
9. **Locking rod**
10. **Bolt**
    - Tighten to 20 Nm (15 ft-lb)
11. **Striker plate**
12. **Door lock assembly**
13. **Bowden cable**
14. **Interior release handle**
15. **Multi-point socket head bolt**
    - M8 x 28
    - Tighten to 20 Nm (15 ft-lb) + ¼ turn (90°)
    - Always replace bolt after loosening
16. **Multi-point socket head bolt**
    - M8 x 28
    - Only remove this bolt from hinge to remove door
    - Tighten to 20 Nm (15 ft-lb) + ¼ turn (90°)
    - Always replace bolt after loosening
17. **Door hinge with check**
    - Hinge is divided
18. **Multi-point socket head bolt**
    - M8 x 28
    - Install from inside vehicle
    - Remove B-pillar lower trim, see **70 Trim–Interior**
    - Tighten to 20 Nm (15 ft-lb) + ¼ turn (90°)
    - Always replace bolt after loosening



19. **Multi-point socket head bolt**
    - M8 x 28
    - Tighten to 20 Nm (15 ft-lb) + ¼ turn (90°)
    - Always replace bolt after loosening
20. **Multi-point socket head bolt**
    - M8 x 28
    - Tighten to 20 Nm (15 ft-lb) + ¼ turn (90°)
    - Always replace bolt after loosening
21. **Cover cap**
22. **Bolt**
    - Tighten to 13 Nm (10 ft-lb)
23. **Door hinge**
    - Hinge is divided
24. **Multi-point socket head bolt**
    - M8 x 22
    - Install from inside vehicle
    - To loosen or tighten bolt, remove B-pillar lower trim, see **70 Trim–Interior**
    - Tighten to 20 Nm (15 ft-lb) + ¼ turn (90°)
    - Always replace bolt after loosening
25. **Multi-point socket head bolt**
    - M8 x 28
    - Tighten to 20 Nm (15 ft-lb) + ¼ turn (90°)
    - Always replace bolt after loosening

Door, removing and installing

– Remove lower B-pillar upper and lower trim, see **70 Trim–Interior**.



➤ Disconnect harness connectors under rubber boot (**3**) on B-pillar.

> ***CAUTION —***
> *Do not close door with harness connectors between door and B-pillar. They will be crushed.*

– Pry off cover cap (**2**) and remove bolt (**1**) from upper hinge.

– Remove lower bolt (**4**) from hinge. Always replace this bolt upon installation.

– Carefully lift door upward and out of hinge brackets.

– Installation is the reverse of removal.

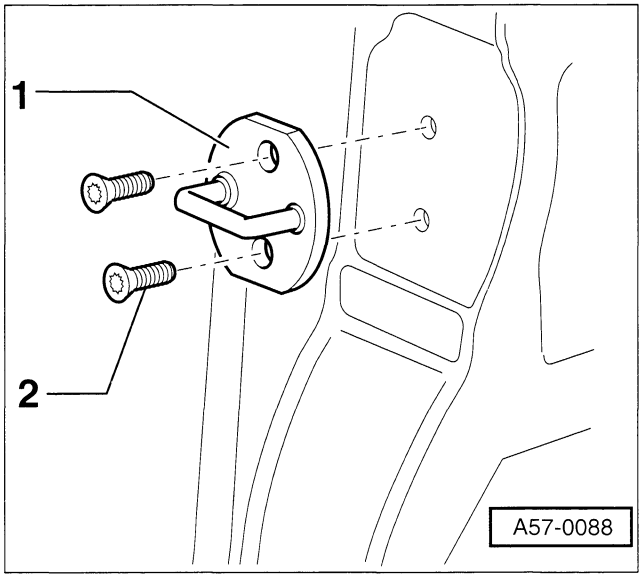
Tightening torques

- Upper hinge bolt . . . . . 13 Nm (10 ft-lb)
- Lower hinge bolt (always replace) . . . . . 20 Nm (15 ft-lb) + ¼ turn (90°)

Door, adjusting

For proper door adjustment, door hinge must be loosened at pillar. Other measures, such as aligning door upward, are not effective. Excess pressure thereafter will again cause door to sag. For this, door adjusting wrench 3320 with box spanner 3320/2 must be used. If it should be necessary that door hinge must be loosened at B-pillar from inside, VW special tool, socket insert 3410 can be used to do this. To do so, lower B-pillar trim must be removed, see **70 Trim–Interior**.

Door, adjusting striker plate



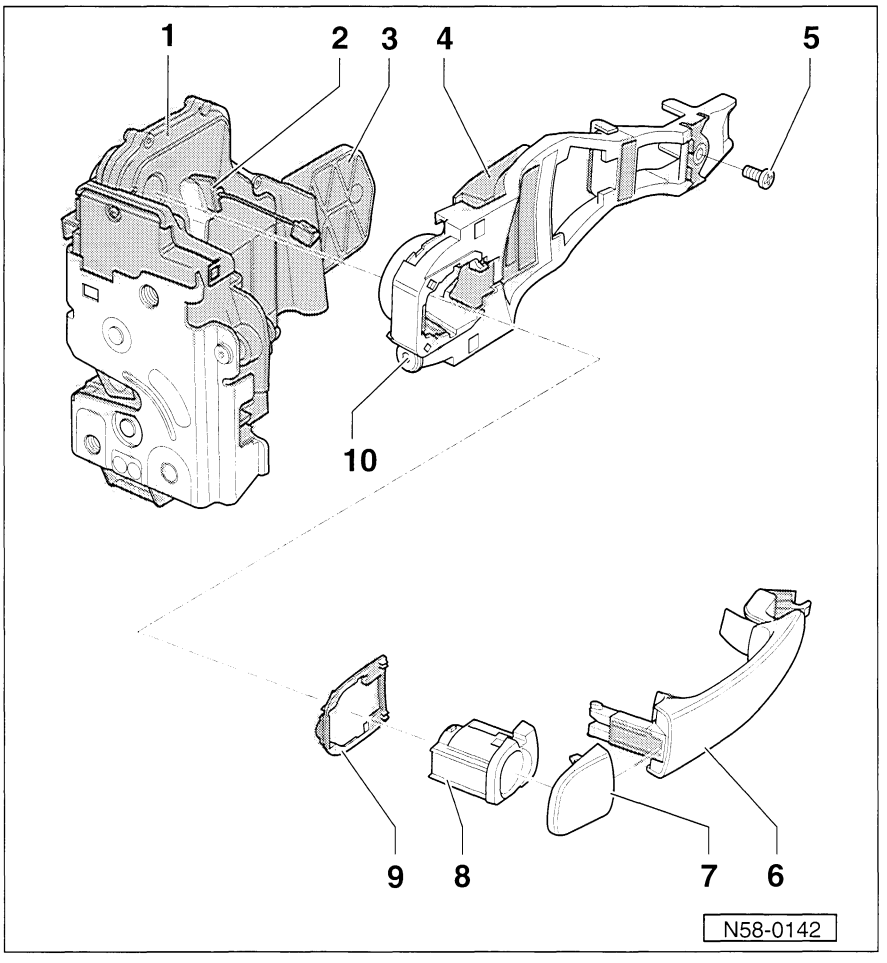
➤ Loosen bolts (**2**) and move striker plate (**1**) until door shell is flush with contour of body. Tighten bolts.

Tightening torque

- Striker plate to door pillar . . . . . 20 Nm (15 ft-lb)

> ***NOTE —***
> *Striker plate adjustment is only used to align the door inward or outward, not vertically. Door should not move up or down when closed or opened. If this occurs, vertical alignment of striker is incorrect*

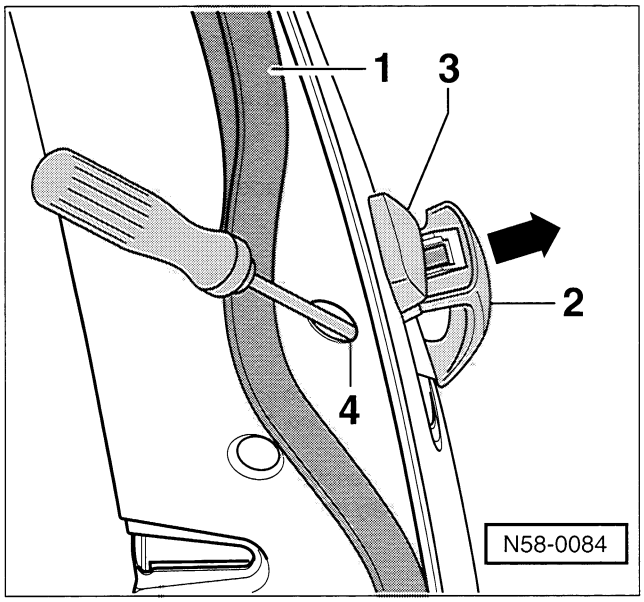
Door handle and lock assembly



1. **Door lock**
   - The door lock can only be removed with the carrier assembly
2. **Cable**
   - Outside door handle release
3. **Retaining bracket**
   - Bolted and riveted to carrier assembly and door lock
   - Not supplied with replacement door lock
4. **Handle bracket**
   - Removing:
     Door handle, lock cylinder housing and assembly carrier are removed first
     Remove screw (**5**) and slide bracket slightly to rear and remove from door
5. **Screw**
6. **Door handle with base**
7. **Lock cylinder cover (trim)**
8. **Lock cylinder housing**
9. **Gasket**
10. **Multi-point socket head bolt**
    - Requires either special socket tool T10011, or T10072 (Torx T20), see **Special tools** given earlier
    - Loosening this bolt releases the lock cylinder housing, allowing it to be pulled out of handle bracket.
    - Bolt must not be threaded in without lock cylinder housing installed or locking ring may fall into door

NOTE —

Loosen multi-point socket head bolt only. If bolt is removed, door lock must be removed to realign.



Door handle, removing and installing

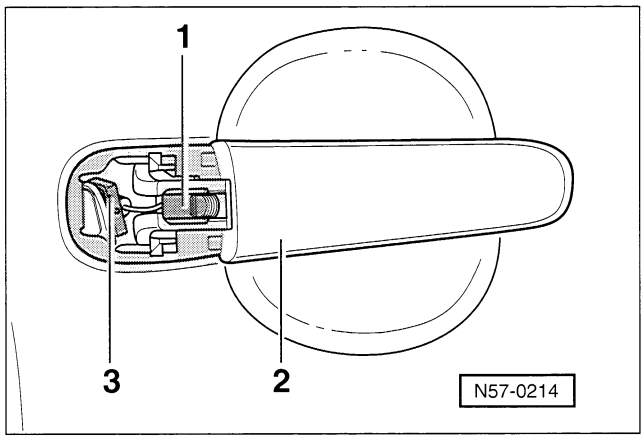
Pull door seal (**1**) away from door edge in area of door handle.

– Pull door handle (**2**) in direction of **arrow** to open position and hold. Unscrew door handle mounting screw (**4**) until lock cylinder (**3**) is released. Use VW special socket tool T10011 or T10072 (Torx T20), as applicable to remove mounting screw (**4**).

NOTE —

- *Loosen multi-point socket head bolt only. If bolt is removed, door lock must be removed to realign.*
- *For more information on the various special tools, see* **Special Tools** *given earlier in this section.*

– Pull out lock cylinder housing at right angles to door.

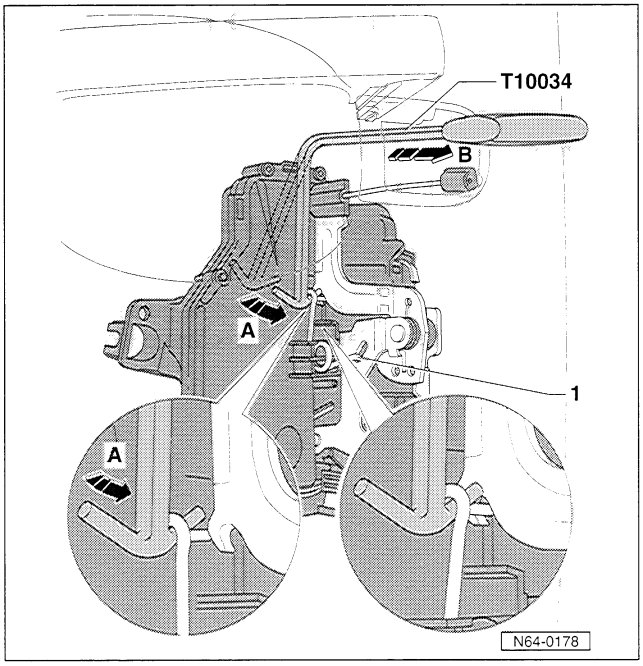


Remove cable clip (**1**) from door handle lock release with a pick or a small screwdriver.

– Swing rear of door handle out of door, pivoting from front of handle.

NOTE —

- *By pivoting door handle out, door handle spring is tensioned and locked. After door handle is installed, spring tension is released.*
- *When installing door handle, do not pull lock operating lever (**3**).*



Installing

NOTE —

Replacement door handles are supplied finished in primer only and must be painted prior to installation.

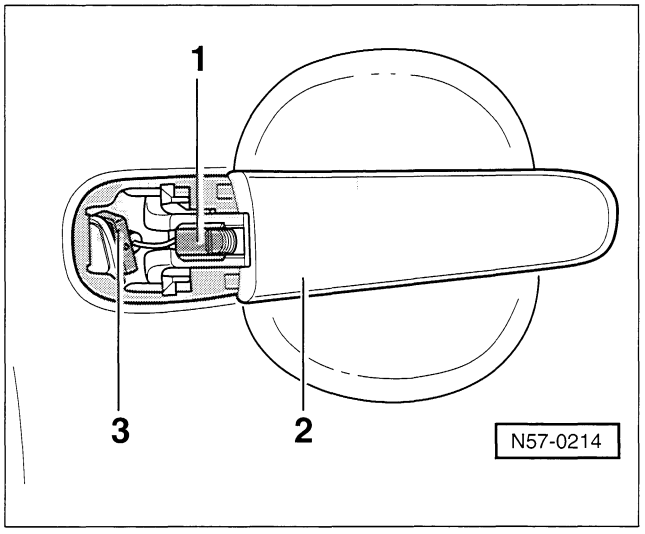
Place Volkswagen special tool T10034 through (**arrow A**) door handle opening and hook it under lock spring (**1**).

NOTE —

For more information on the various special tools, see **Special Tools** *given earlier in this section.*

– Position lock spring up into door lock mechanism by pulling special tool outward (**arrow B**).

– Slip front of door handle into door opening and swing rear of door handle into position against door.



- Snap cable clip (**1**) into slot and engage in door handle (**2**), taking care not to pull cable tight.
- Install lock cylinder housing in door handle mounting bracket at right angles.
- Install screw in mounting bracket and tighten with multi-point screwdriver.

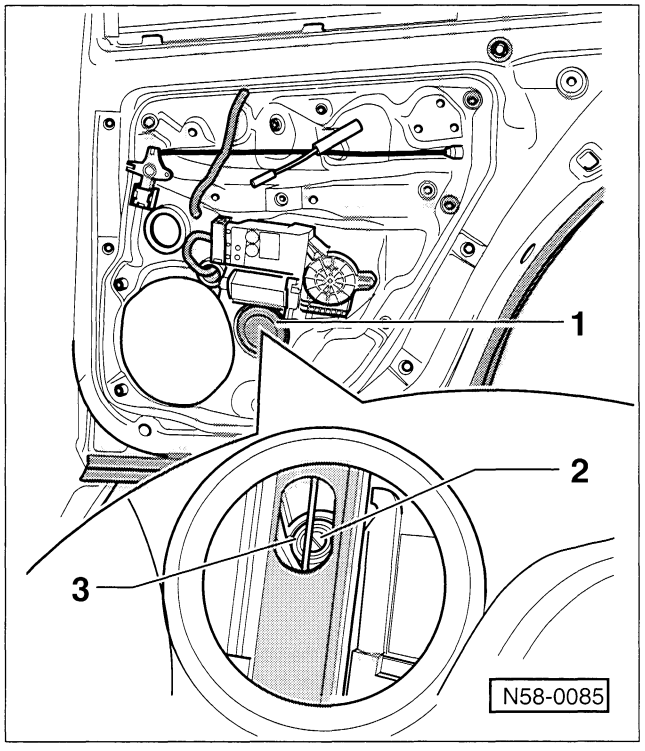
  The door handle locates in the lock cylinder housing with an audible click.

  NOTE —
  *When installing cable clip, do not pull lock operating lever (**3**) while pushing on door handle (**2**).*

- Check door handle function. Door will not open if bowden cable is not correctly installed and adjusted.

Rear door windows, removing and installing

- Remove door trim panel. See **70 Trim–Interior**.



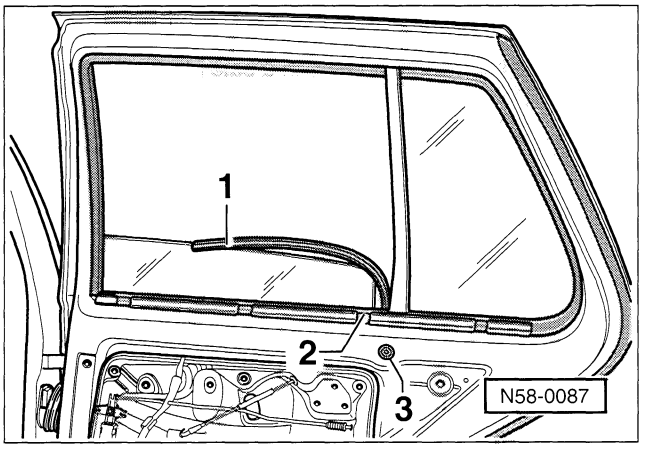
- Pry out sealing plug (**1**) in door assembly carrier to gain access to window glass securing bolts.
- Lower window until window glass spreader pin (**2**) and spreader plug (**3**) are accessible through cut-out in window regulator.

  NOTE —
  If the power window motor is not working it can be removed to allow the window to be slid down.

- Thread a 5 mm bolt (approx. 70 mm long) into the window spreader pin and pull pin out from spreader plug.
- Thread an 8 mm bolt (approx. 80 mm long) into spreader plug.

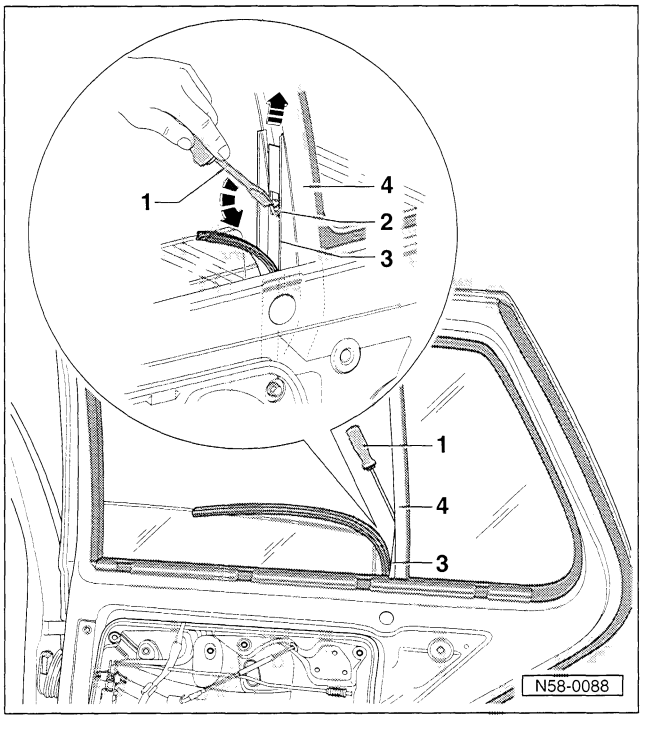
  NOTE —
  Use only light pressure when threading bolt into spreader plug or the plug may fall into the door.

- Pull spreader plug out from window guide and window while pressing regulator bowden cable out of way with a screwdriver.

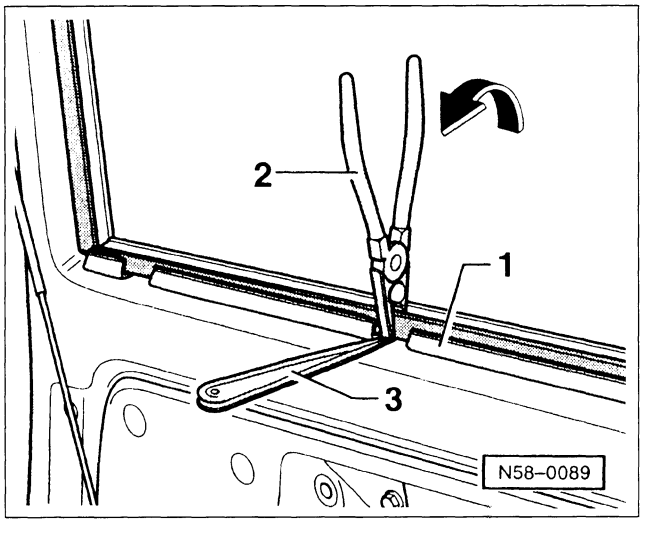


- Pull window seal (**1**) away from quarter window frame down to door window shaft seal (**2**).

- Pry out cover cap (**3**) and remove quarter window mounting bolt.

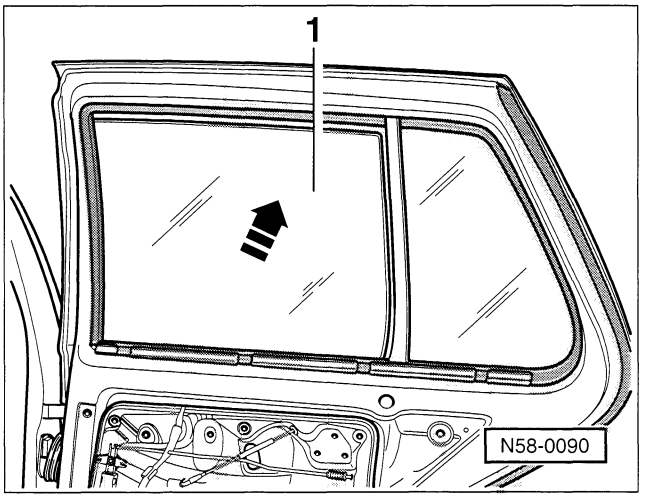


- Use screwdriver to lift locking tab (**2**) at bottom of quarter window frame. Pull out filler piece (**3**) from quarter window frame (**4**).



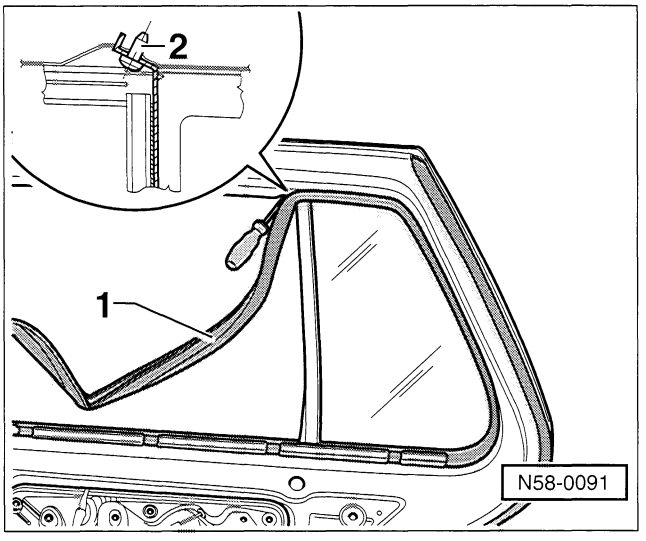
- Grip window shaft inner seal (**1**) with pliers (**2**). Rotate pliers in direction of arrow while lifting seal out of door flange. Use of a plastic wedge (**3**) is advised.

NOTE —
Use of a plastic wedge will help window shaft seal pull away and prevent damage to door from pliers.



➤ Slide door window upward and pull inward out of door.

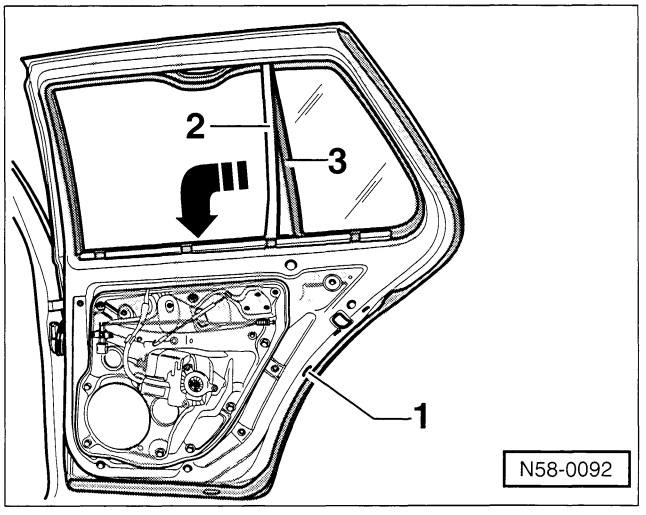
– Place door window glass in a safe place.



➤ Continue with quarter widow removal by pulling window frame guide (**1**) down near quarter window frame. Remove screw (**2**) at top of frame, if installed.

NOTE —

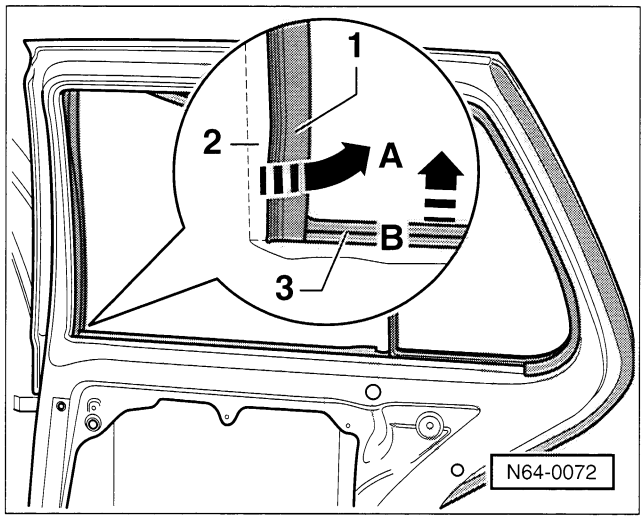
The screw at the top of the quarter window frame is gradually being discontinued by the factory. The quarter window frame without a screw is just clipped into the top of door.



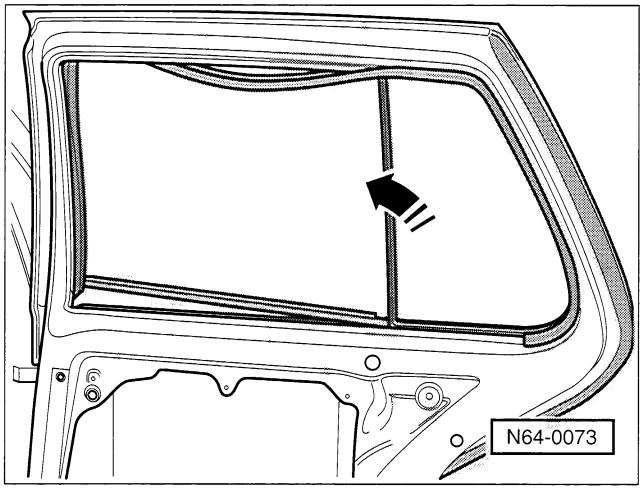
➤ Remove bolt (**1**) and pivot quarter window frame (**2**) off from quarter window seal (**3**). Pull quarter window frame down from upper window guide.

NOTE —

If the rear door window and quarter window frame are being removed in order to remove the door lock assembly, proceed to **Door lock, removing** *at this point. To continue with removal of rear quarter window proceed with the steps below.*



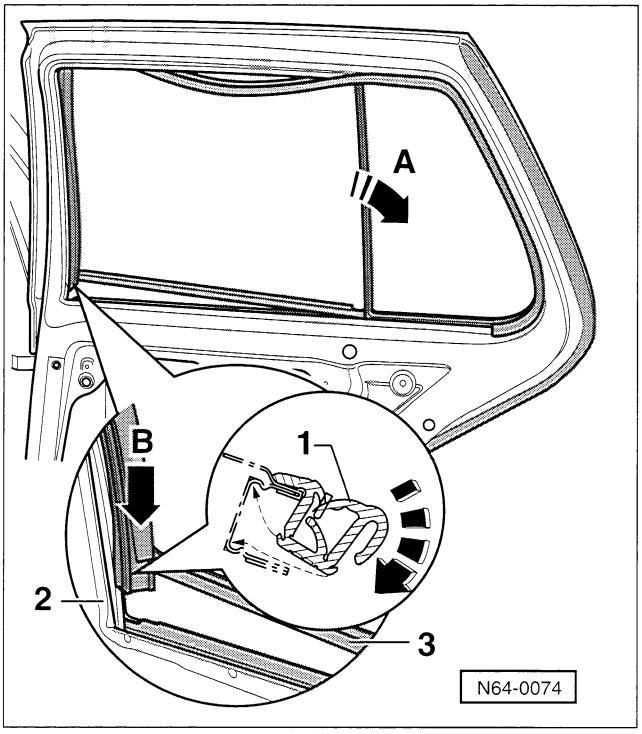
➤ Pull off window guide (**1**) from door flange (**2**) by rotating 90° (**arrow A**). Remove window shaft seal upward (**arrow B**).



➤ Remove quarter window from door by rotating (**arrow**) out of door frame.

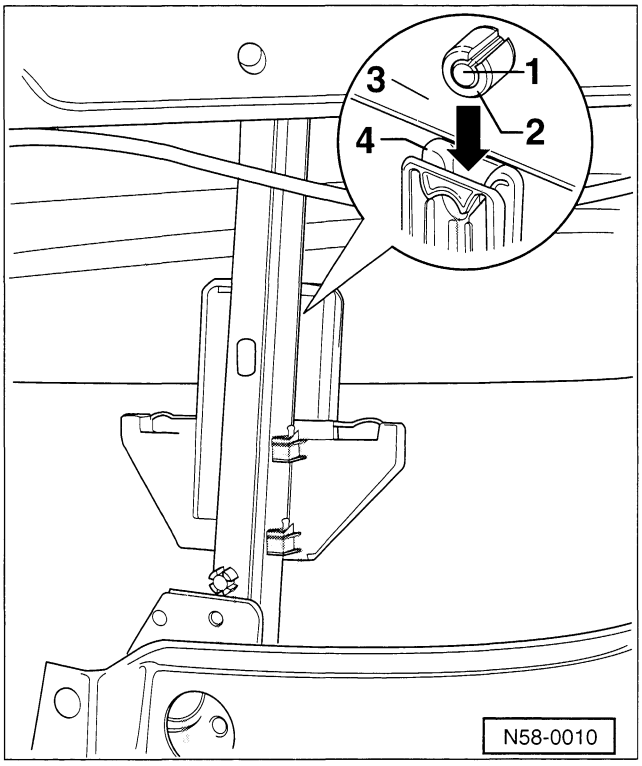
– To install quarter window, insert into door frame.

NOTE —
Dishwashing soap can be used as a lubricant to help install the quarter window.



➤ Insert quarter window (**arrow A**). Install window guide (**1**) into window shaft by rotating down 90° (**arrow**) from exterior. Press bottom of window shaft seal downward (**arrow B**) onto door flange (**2**) and press into door frame.

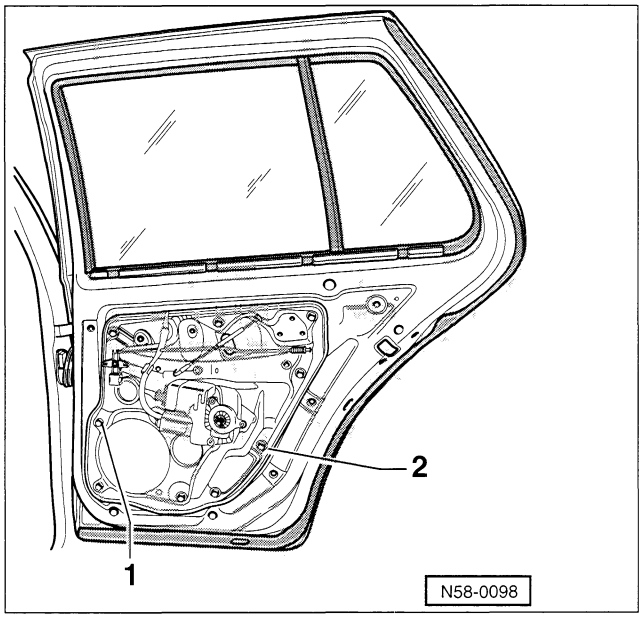
– Install quarter window frame and door window guide in reverse order of removal.



➢ Install door window into door and insert spreader plug (**2**) and spreader pin (**4**) into window.

- Position spreader plug projection on each side of window.
- Guide window into door.
- Insert window into lift rail guide slot (**4**).
- Lightly tap top of window so that window is positioned properly in lift rail (**arrow**).

– Guide electrical wiring through boot in door and secure retaining clips in door panel.



➢ Loosely install all door carrier assembly bolts, then tighten bolts (**1** and **2**). Tighten remaining bolts to specification.

Tightening torque

- Assembly carrier to door . . . . . 8 Nm (71 in-lb)

– Check for proper operation of door window before installing interior door panel.

Door lock, removing

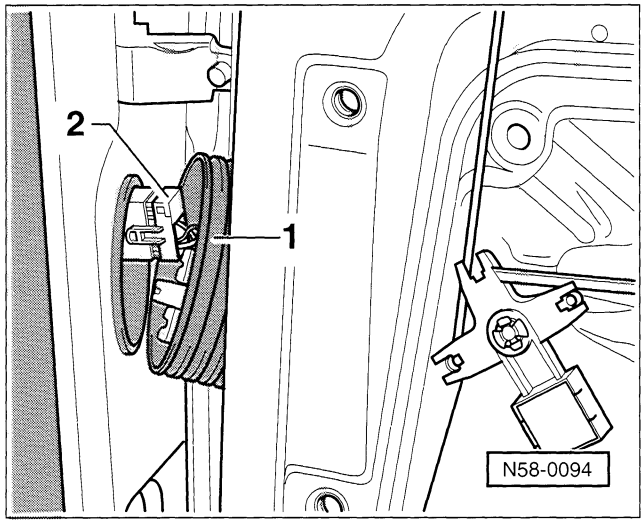
The window regulator, door glass, door speaker and door lock are secured to the door assembly carrier. The door lock can only be removed after the door assembly carrier is removed. Additionally, the rear door window and the rear quarter window frame must also be removed for sufficient clearance in door to remove lock unit.

– Remove door trim panel. See **70 Trim–Interior**.

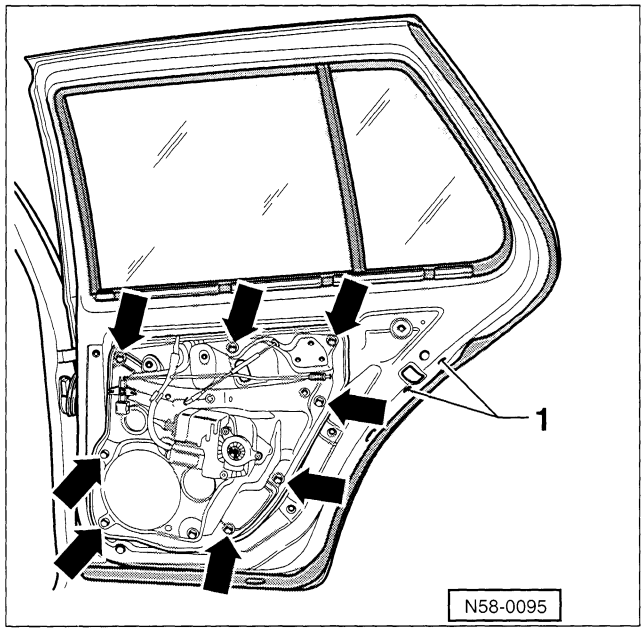
– Remove lock cylinder housing as described earlier, see **Door handle, removing**.

– Remove door window, window guide on quarter window frame and quarter window frame as described above.

NOTE —
It is not necessary to remove the rear quarter window.



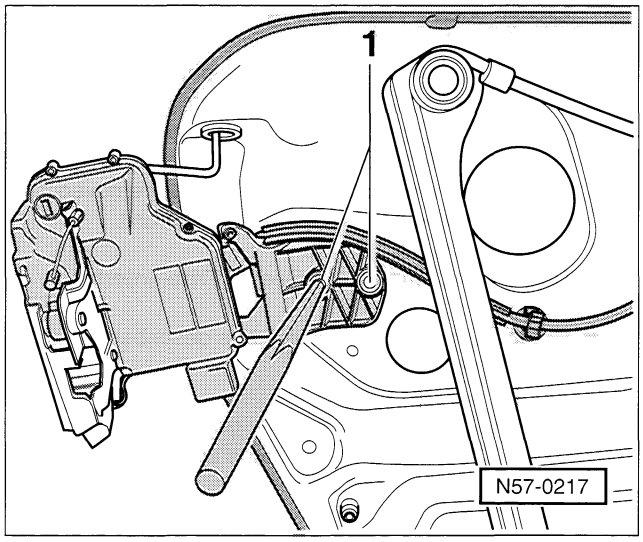
➤ Pull rubber boot (**1**) off from B-pillar in door jamb and disconnect harness connectors (**2**) under boot.



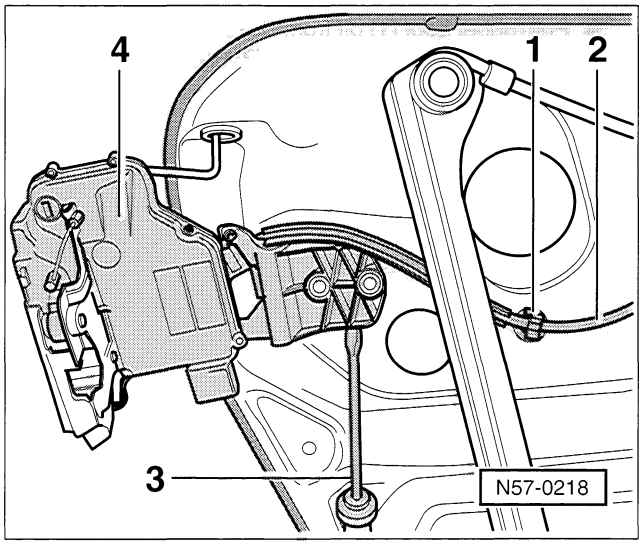
➤ Remove assembly carrier mounting bolts (**arrows**) and mounting bolts (**1**) for lock assembly.

– Pull top of assembly carrier off from door, lift and pull out of door toward hinges.

– Turn assembly carrier and release wiring clips from reinforcing plate in door. Pull wiring out of boot and remove assembly carrier with door lock assembly attached.



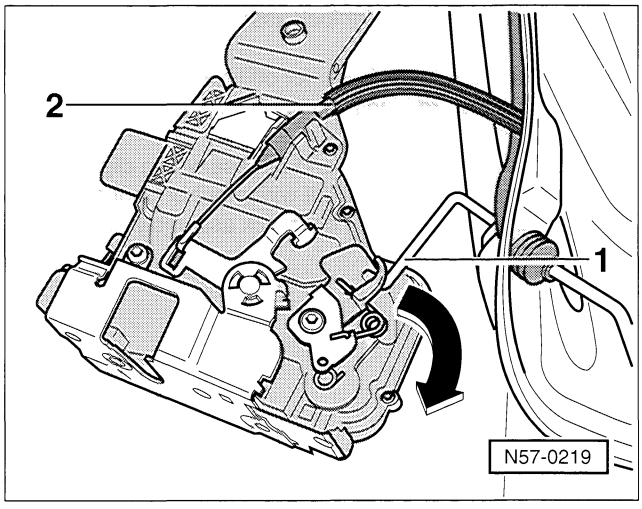
Drive out door lock securing clips (**1**) with a drift.



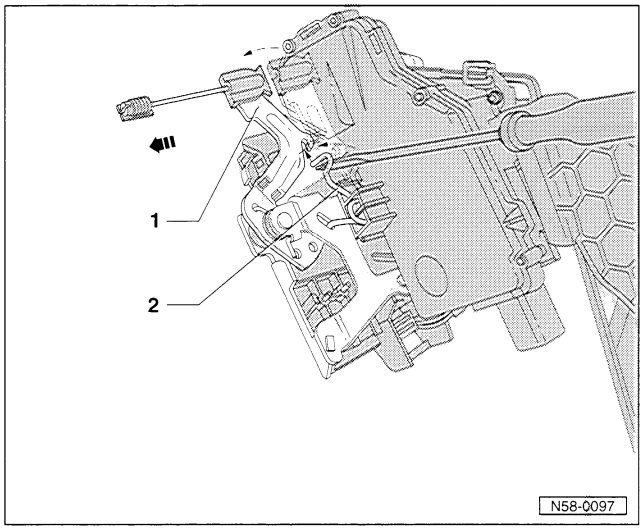
Disconnect inside release cable (**2**) from clip (**1**) on assembly carrier and carefully pry retaining bracket for door lock (**4**) off carrier using a screwdriver (**3**).

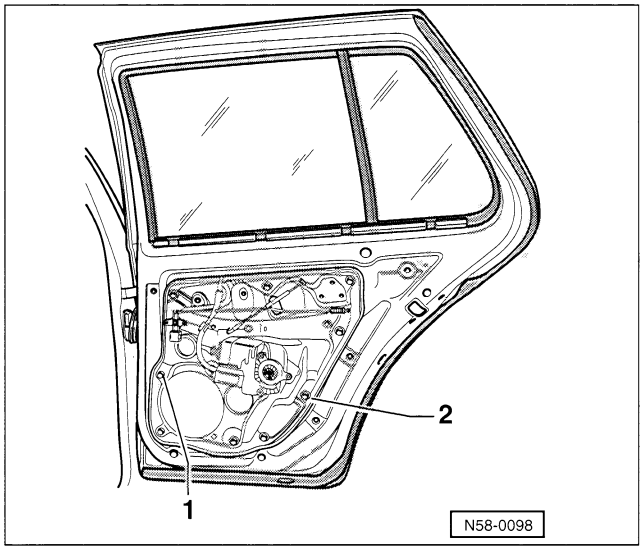
NOTE —

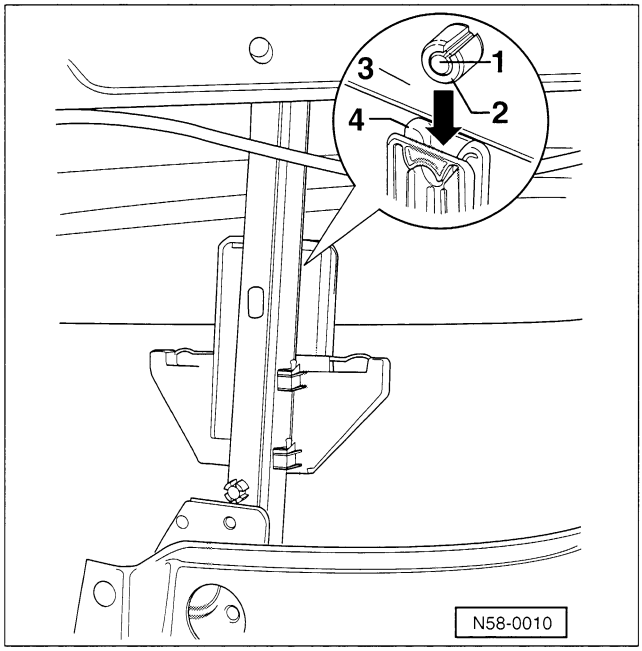
The door lock retaining bracket is a separate part. It is not part of the items supplied with a replacement door lock. It is secured to the door lock with a bolt and a pop rivet.



Disconnect door lock rod (**1**) by turning door lock in direction of arrow. Unsnap inside release cable (**2**) and remove from eyelet in lever.







Door lock, installing

Pull lock operating lever (**1**) in direction of arrow. Hook spring (**2**) into slot on operating lever, small arrows.

NOTE —
Connecting the operating lever locks the mechanism and prevents incorrect attachment of the outside handle cable later.

– Attach door lock rod and inside release cable.

– Attach door lock to door assembly carrier.

– Insert assembly carrier in door.

Loosely install all door carrier assembly bolts and then tighten two bolts (**1** and **2**). Tighten remaining bolts to specification.

Tightening torque

- Assembly carrier to door . . . . . 8 Nm (71 ft-lb)

– Guide electrical wiring through boot into door. Secure all wiring retaining clips and install rubber boot between door and B-pillar.

– Install quarter window frame and door window guide in reverse order of removal, see **Rear windows, removing and installing**.

Install door window into door and insert spreader plug (**2**) and spreader pin (**1**) into window.

- Position spreader plug projection on each side of window.
- Guide window into door.
- Insert window into lift rail guide slot (**4**).
- Lightly tap top of window so that window is positioned properly in lift rail (**arrow**).

– Remainder of installation is the reverse of disassembly.

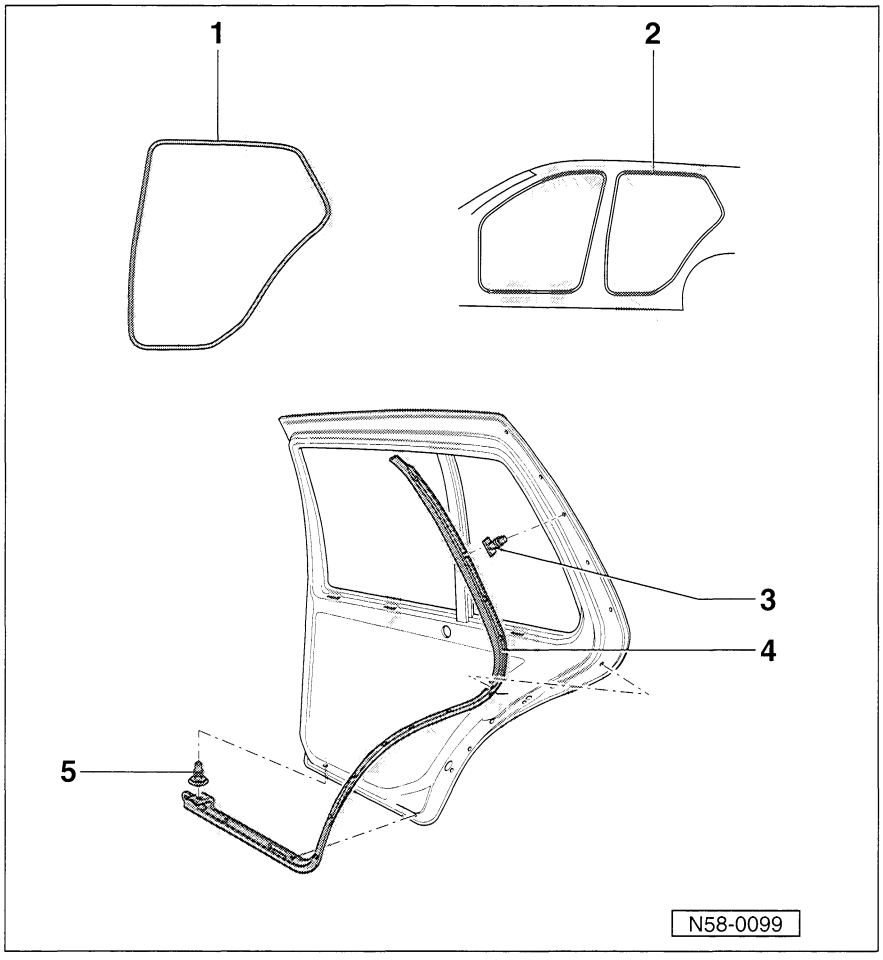
– Check operation of window before final installation of door trim panel.

DOOR SEALS

Various interior trim pieces must be removed to replace the door seals, see **70 Trim–Interior**.

Rear door seals

1. **Inner door seal**
   - Start at upper radius of door cut-out when installing
2. **Inner door seal for 4-door models**
3. **Clip**
   - Inserted in door seal
4. **Outer door seal**
5. **Clip**
   - Inserted in door seal



60 Sunroof

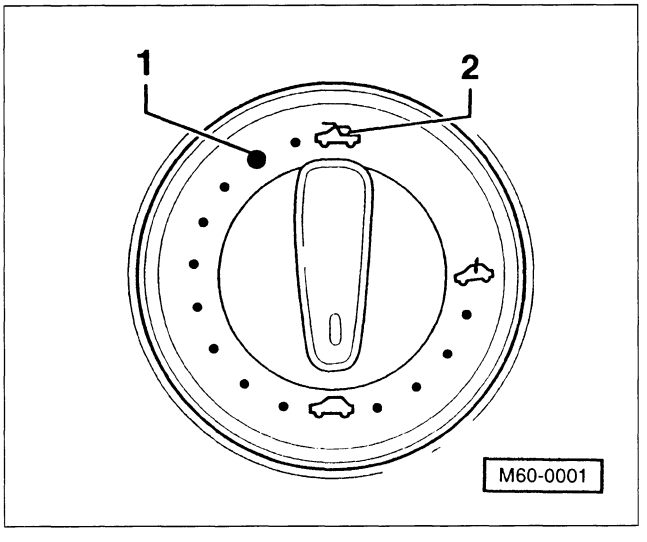
GENERAL 60-1
Function 60-1
Distinguishing features 60-1

SUNROOF, SERVICING 60-3
Glass panel, removing and installing 60-3
Glass panel, adjusting height 60-6
Sliding headliner, removing. 60-7
Drive motor for sunroof, adjusting ("0" position). 60-8
Sunroof switch, removing 60-9
Webasto sunroof assembly. 60-10
Sunroof parallel movement, checking and adjusting (Webasto) 60-11
Panel seal, replacing (Webasto) 60-11
Wind deflector, removing (Webasto) 60-11
Rockwell/Meritor sunroof assembly 60-12
Sunroof parallel movement, checking and adjusting (Rockwell/Meritor) . . 60-13
Panel seal, adjusting and replacing (Rockwell/Meritor) 60-13
Wind deflector, removing (Rockwell/Meritor) . . 60-13
Front water drain hoses, cleaning 60-14
Rear water drain hoses, cleaning 60-14

GENERAL

The power sunroof is a two-way design that tilts open or slides back into the roof. The sunroof is a glass panel with an interior sliding shade (headliner). An electronic control unit is combined with the sunroof motor and regulates the motor operation.

Function



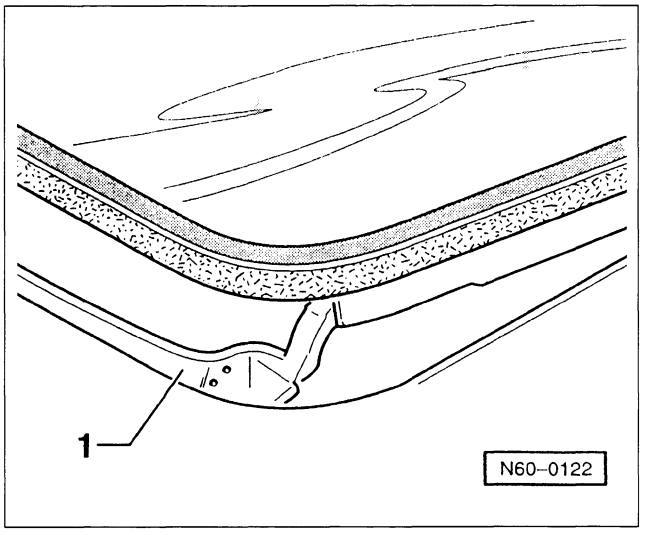
The sunroof is opened and closed by switching the ignition on and turning the rotary switch. In addition, the sunroof may be tilted or closed by pushing or pulling the switch. After switching off the ignition the sunroof can be opened or closed until either the driver's or front passenger's door is opened. Marks on the rotary switch are for preset opening positions of the glass panel. Comfort position (**1**) prevents wind noises that are more noticeable than in the fully open position (**2**). Any other intermediate opening position can be selected by turning the switch clockwise. To tilt or close the sunroof, push or pull the switch until desired position is reached.

Additionally, there is an emergency lock function in the sunroof switch. If there are lock problems, the sunroof can be locked by pressing the pre-selector actuator, which must be in the "sunroof closed" position. During emergency lock function the closing force limiter of the sunroof is switched off.

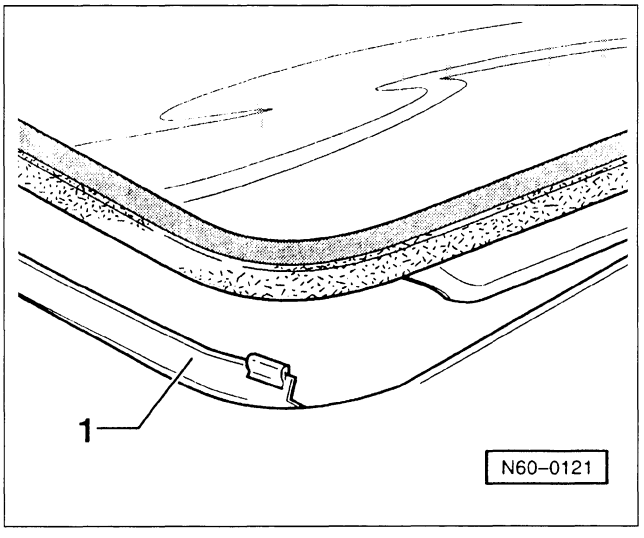
The drive for the sunroof is also protected by a running time limit to prevent overheating. This protection mechanism responds after an uninterrupted actuation of approx. 2 minutes. After a cool down phase the mechanism is then operational again.

Distinguishing features

There are two different sunroofs which have been installed in the vehicles covered by this manual. They are supplied by Webasto and Rockwell/Meritor. While there are no functional or operational differences between the sunroofs it is important to know which type is installed before doing any maintenance, repair, or ordering replacement parts. When replacing a complete sunroof it can be either type. To determine which type of sunroof is installed, tilt open the rear of the sunroof with operating switch and observe the water channel.



➢ Webasto sunroofs have a water channel (**1**) that is connected with a glass cover at rear edge.



➢ Rockwell/Meritor sunroofs do not have a glass cover to connect the water channel (**1**).

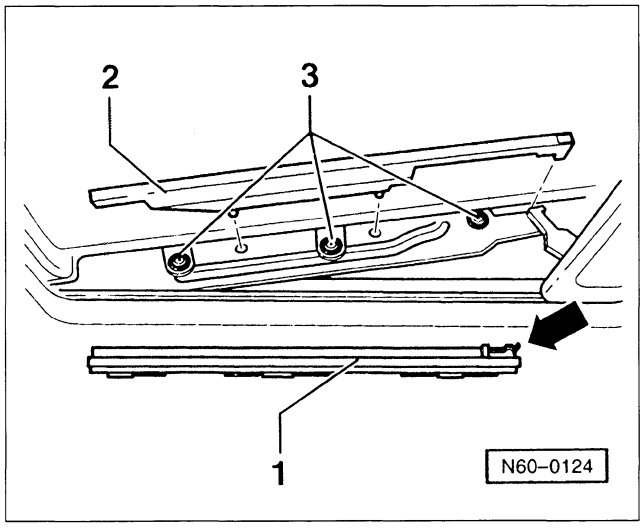
SUNROOF, SERVICING

Glass panel, removing and installing

– Slide sliding headliner to rear position.

– Tilt sunroof open.

Webasto sunroof (through 08/2002 prod.)

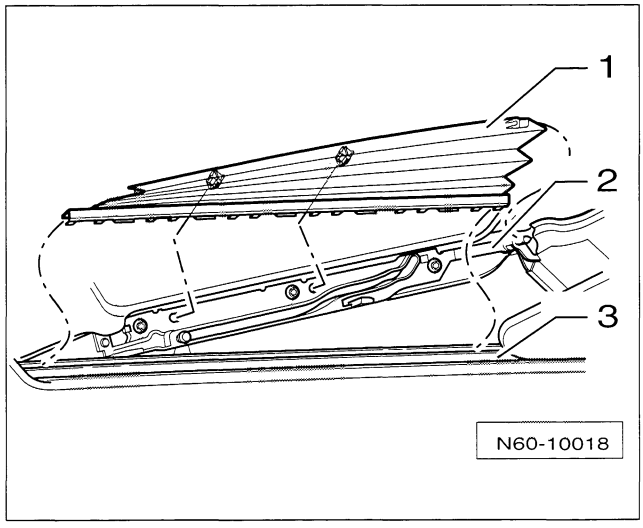


➢ Unclip lower trim (**1**) at rear and slide trim forward to remove.

1. Lower trim
2. Upper trim
3. Glass panel mounting screws

– Unclip upper trim (**2**) at front and in center and remove at rear.

Webasto sunroof (from 09/2002 prod.)

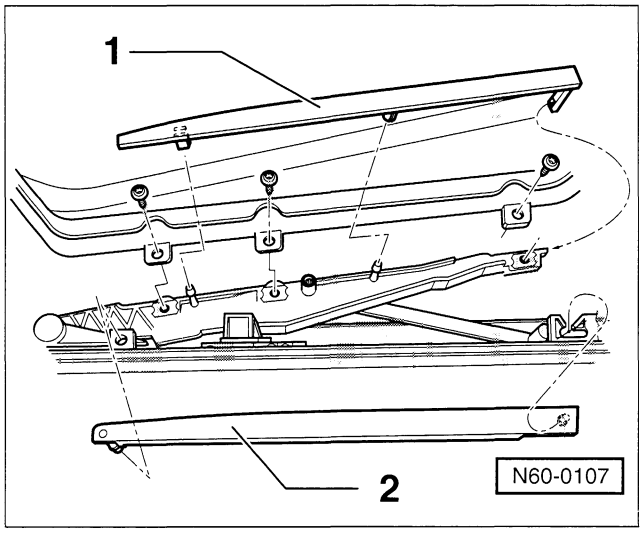


➢ Unclip lower trim (**1**) from securing rails (**3**).

1. Lower trim
2. Glass panel for sunroof
3. Securing rails

– Unhook lower trim (**1**) at top rear, from glass panel (**2**).

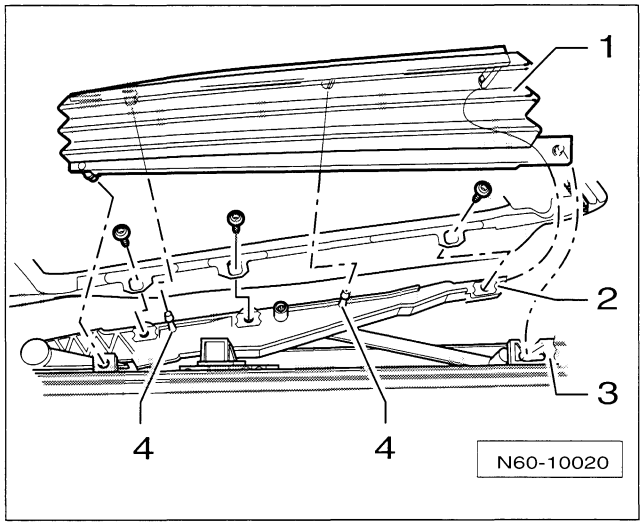
– Remove lower trim (**1**).



Rockwell/Meritor sunroof (through 08/2002 production)

Unclip lower trim (**2**) at front and pull inward to center of vehicle and unhook at rear.

1. Upper trim
2. Lower trim
3. Glass panel mounting screws



Rockwell/Meritor sunroof (from 09/2002 production)

Unclip lower trim (**1**) lower part of slotted guide rail (**3**).

1. Lower trim
2. Top rear retaining clip
3. Slotted guide rails
4. Securing pins

– Remove lower trim (**1**) from securing pins (**4**).

– Unhook lower trim (**1**) at top rear (**2**).

– Remove lower trim (**1**).

Glass panel, removing and installing, continued for all models

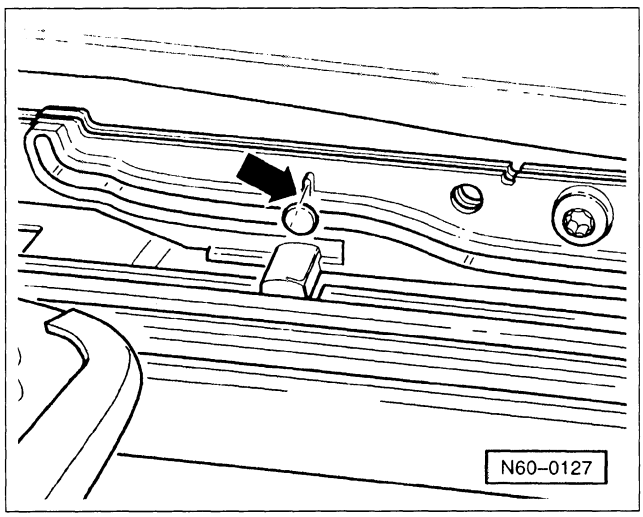
– Unclip front and center of upper trim and unhook at rear.

– Remove glass panel mounting screws (Torx insert T 25) as shown in previous illustrations.

– Remove glass panel upward.

NOTE —
For Rockwell/Meritor sunroofs, the sunroof must not be moved to the "Open" position when removed. The water channel will not be compressed by the glass panel and can jam inside the roof.

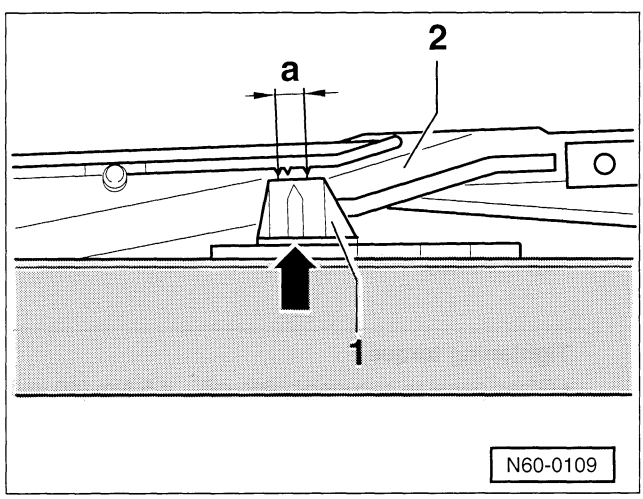
– Before installing glass panel, ensure that the sunroof switch is in the "0" position (sunroof closed).



Webasto sunroof

Align guide rail pin with marking tab (**arrow**).

Rockwell/Meritor sunroof



Align mark (**arrow**) on rear guide (**1**) within marks (dimension **a**) on the slotted guide rail (**2**).

NOTE —
On Rockwell/Meritor sunroofs, the slotted guide rail must be located in the guide rails (cannot be moved by hand). If not, adjust parallel movement as shown later, see **Rockwell/Meritor sunroof assembly**.

continued for all models

– Position glass panel from above and install mounting screws on each side, do not tighten fully.

– Perform height adjustment described below, then tighten glass panel mounting screws to final torque.

Tightening torque
- Glass panel to securing/guide rail . 4.5 Nm (40 in-lb)

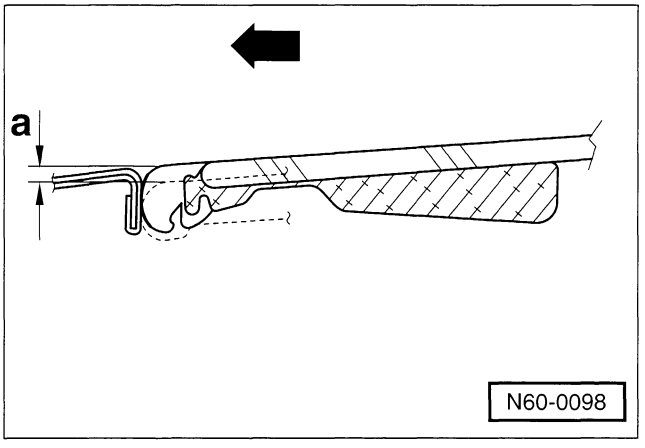
– Install trim pieces (lower and upper, as applicable) after performing height adjustment to glass panel, as described below.

Glass panel, adjusting height

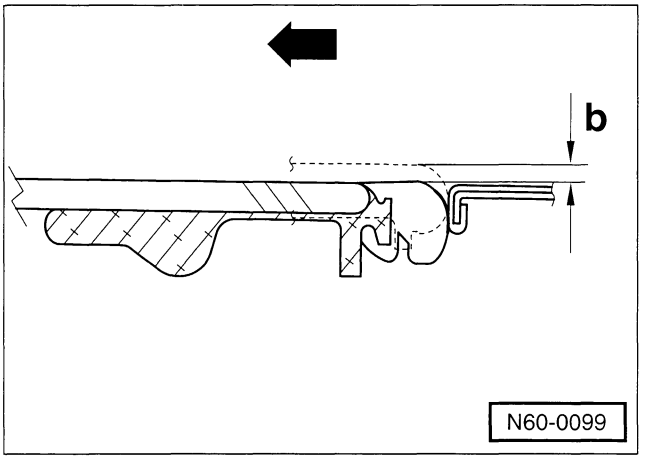
– Tilt sunroof open and slide headliner to rear.

– Remove upper and lower trim pieces and loosen glass panel mounting screws as described previously, see **Glass panel, removing and installing**. Do not remove glass panel.

– Run glass panel into closed position, then open and close again. (The correct order is important for adjustment).



➢ Front of sunroof panel should be 1 mm (dimension **a**) lower than body (roof). **Arrow** indicates direction of travel.



➢ Rear of sunroof panel should be 1 mm (dimension **b**) higher than body (roof). **Arrow** indicates direction of travel.

– Tighten glass panel mounting screws and replace trim pieces.

NOTE —
Always tighten left and right-hand glass panel screws symmetrically.

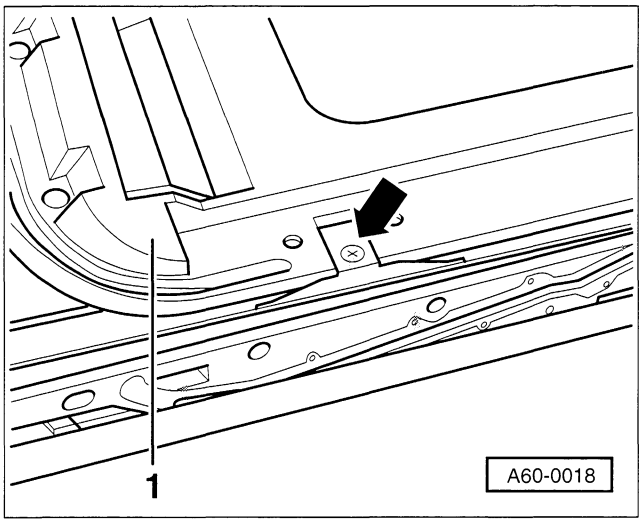
Tightening torque

- Glass panel to securing/guide rail . 4.5 Nm (40 in-lb)

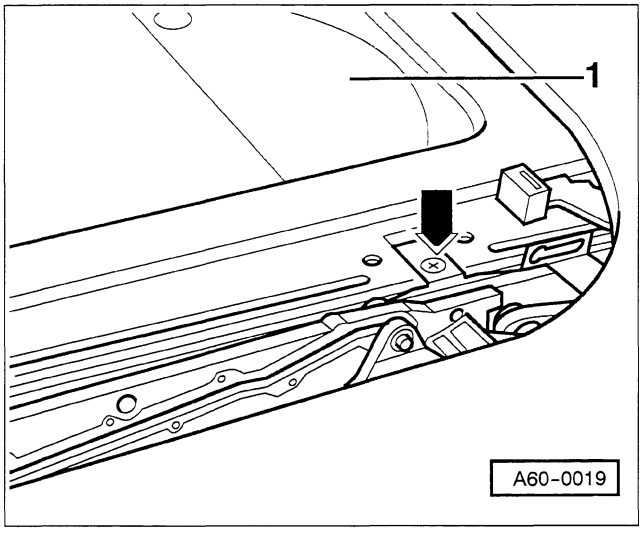
Sliding headliner, removing

– Remove sunroof glass panel as described earlier.

– Slide headliner to rear.



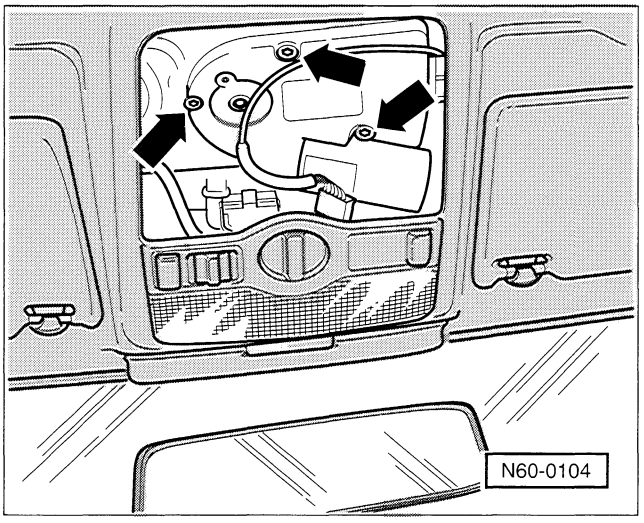
➢ Remove front mounting bolts (**arrow**) on left and right-hand sides of headliner. Pull slide out forward over stop (**1**).



➢ Remove rear mounting bolts (**arrow**) on left and right-hand sides of headliner. Pull out slide to rear and remove sliding headliner (**1**).

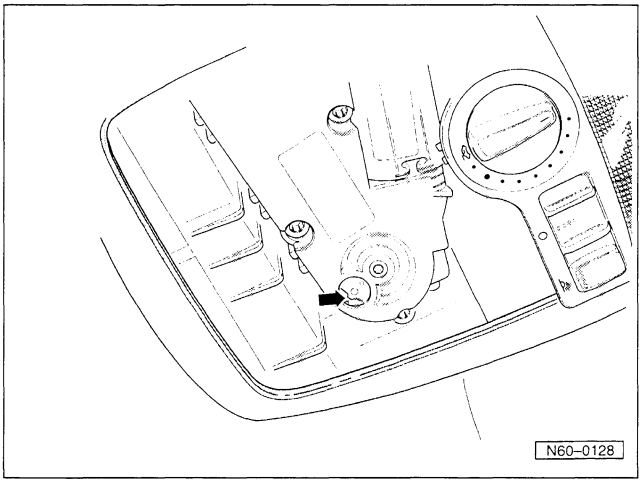
Drive motor for sunroof, adjusting ("0" position)

It is necessary to adjust the "0" position if the drive motor was removed when not in "0" position or if the sunroof was locked by emergency actuation or opened in that mode.



➢ If not already done, pry out trim panel for drive motor and remove drive motor mounting bolts (**arrows**) and pull drive motor down. Leave electrical harness connector attached to drive motor.

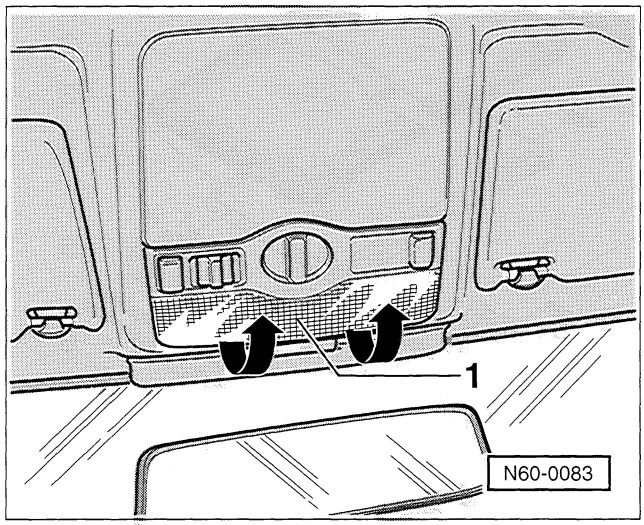
– Select "tilt roof" by turning sunroof rotary switch. Select "closed roof" by turning sunroof rotary switch. Select "opened roof" with sunroof rotary switch. Select "closed roof" again with sunroof rotary switch.



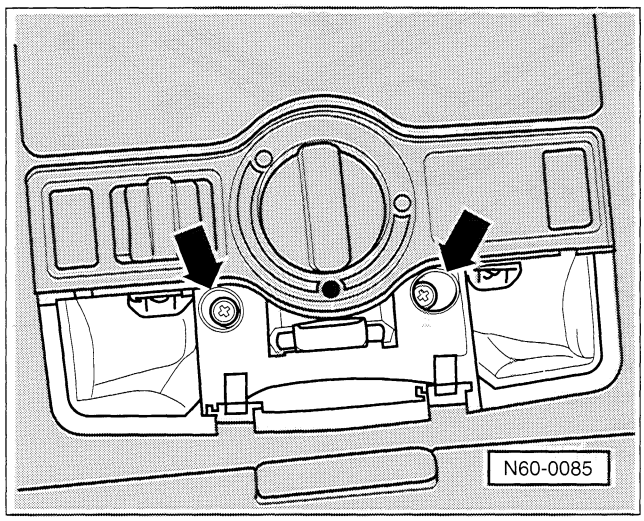
➢ "0" position can checked by looking through the small window in the motor. If the two notches align (**arrow**), the motor is at the "0" position.

– Install drive motor in "0" position. Be sure that sunroof is closed before installing motor.

Sunroof switch, removing



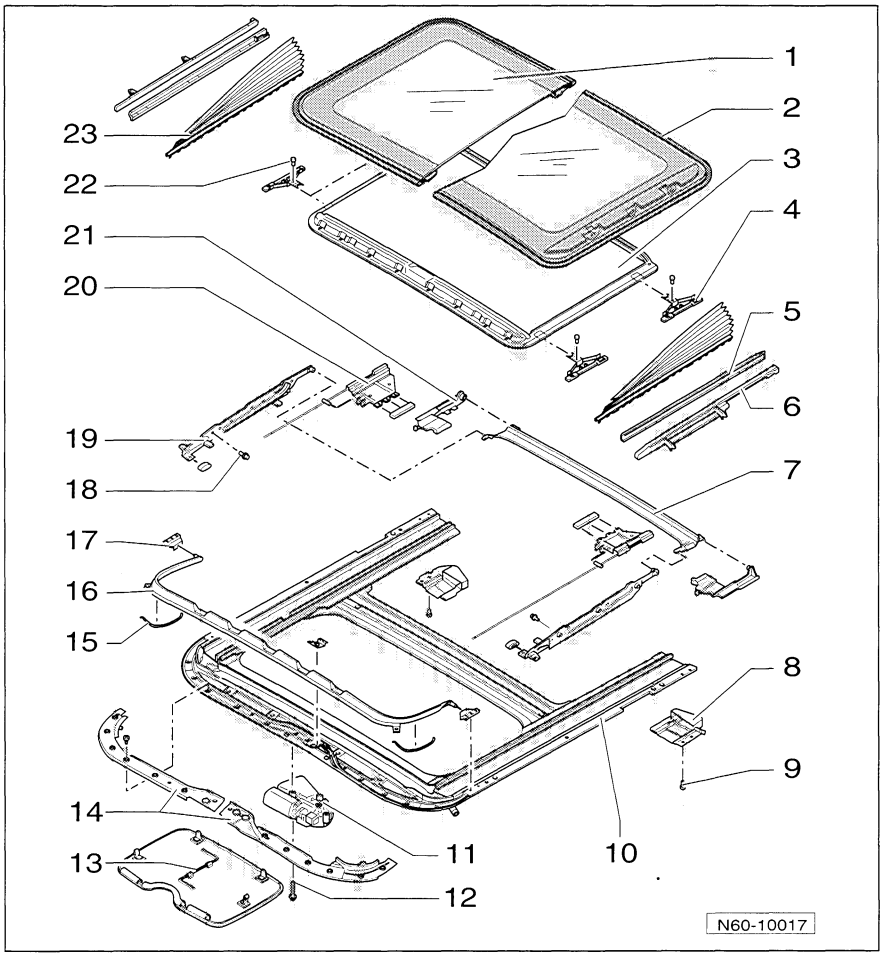
➢ Unclip dome light lens (**1**) at front and remove in direction of **arrows**.



➢ Remove switch mounting screws (**arrows**) and pull out sunroof switch.

– Disconnect harness connector and remove switch.

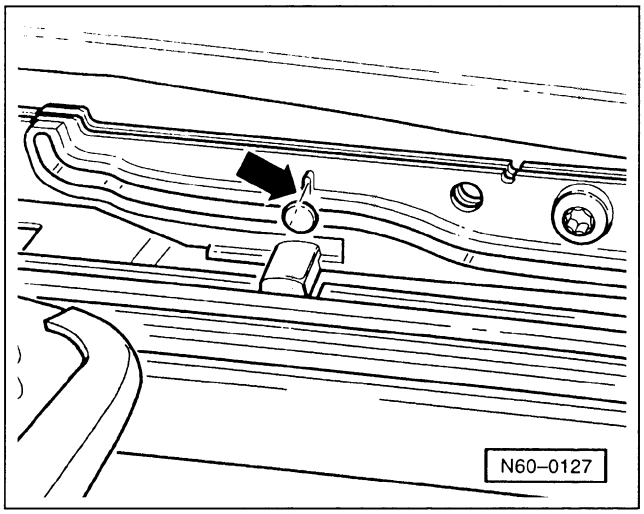
Webasto sunroof assembly



1. **Glass panel for sunroof**
   - Single pane safety glass
   - Parallel movement, checking and adjusting, see **Sunroof parallel movement, checking and adjusting**
2. **Panel seal**
   - Replacing, see **Panel seal, replacing**
3. **Sliding headliner**
4. **Slider**
5. **Lower trim**
   - Through 08/2002 production
6. **Upper trim**
   - Through 08/2002 production
7. **Water channel**
   - Removed together with slotted guide rail
8. **End piece**
   - Use butyl adhesive sealing cord (VW part no. AKL 450 005 05) to seal
9. **Bolt**
   - Tighten to 3.5 Nm (31 in-lb)
10. **Carrier unit**
    - U-frame with guide channels
    - If required, guide channels are to be greased with special grease, G 000 450 02 only
11. **Drive motor**
12. **Bolt**
13. **Cover**
    - With Allen key for emergency opening
14. **Channel cover**
15. **Wind deflector spring**
16. **Wind deflector**
    - Removing, see **Wind deflector, removing**
17. **Wind deflector mount**
18. **Glass panel mounting screw**
    - Torx T25
    - Tighten to 4.5 Nm (40 in-lb)
19. **Slotted guide rail**
20. **Guide with cable**
21. **Slotted water channel**
22. **Countersunk screws**
    - Micro encapsulated
    - Always replace
    - Tighten to 3.5 Nm (31 in-lb)
23. **Trim pieces**
    - Installed on vehicles from 09/02 production
    - Trim pieces and trim must not be swapped with each other during sunroof assembly replacement. Clearance for mechanical components is otherwise not guaranteed.

Sunroof parallel movement, checking and adjusting (Webasto)

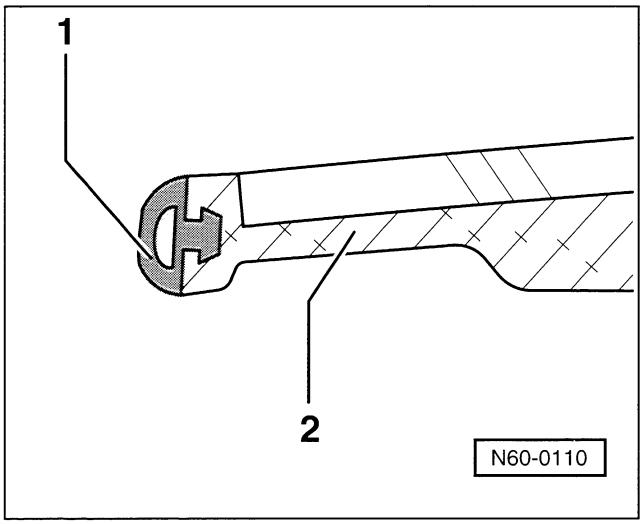
– Remove sunroof glass panel.



➢ Guide rail pin must align with marking tab (**arrow**).

– To adjust, remove sunroof drive motor and check for "0" position.

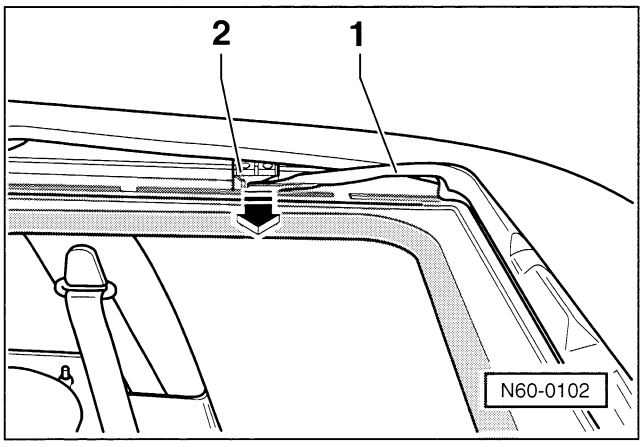
Panel seal, replacing (Webasto)



➢ Pull seal (**1**) off glass panel.

– Center new seal in glass panel (**2**) and press in.

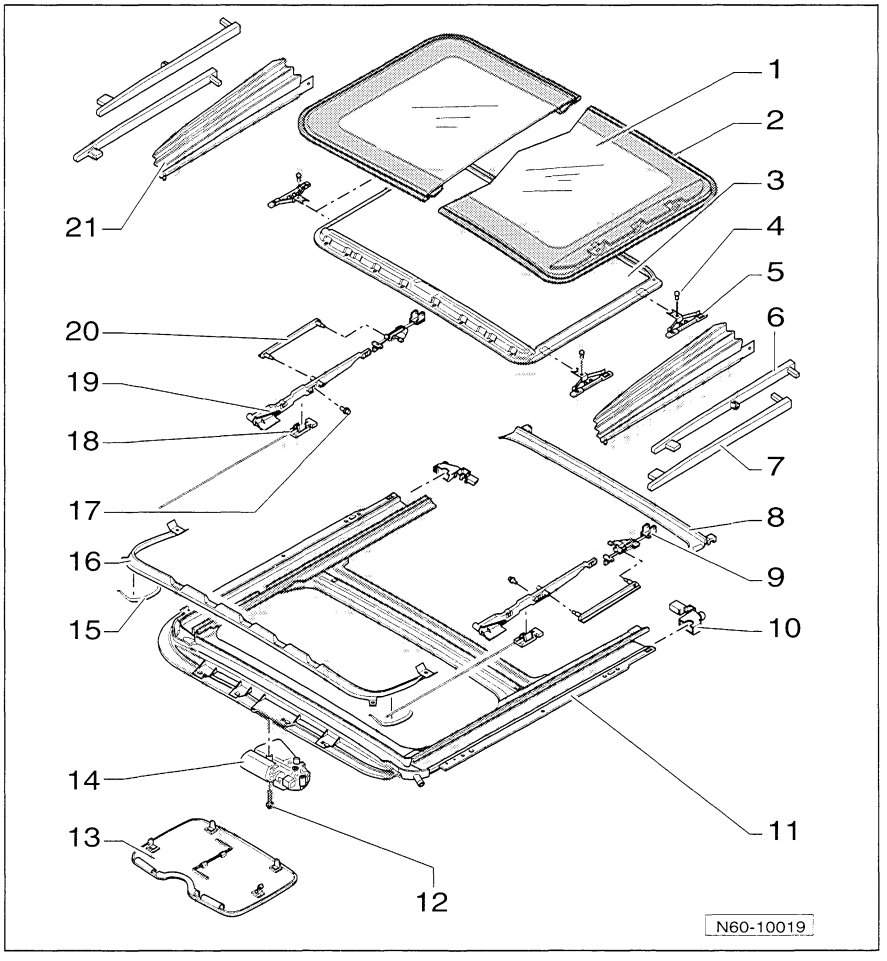
Wind deflector, removing (Webasto)



➢ Press wind deflector (**1**) down while pulling out both side guides (**2**) toward center of vehicle.

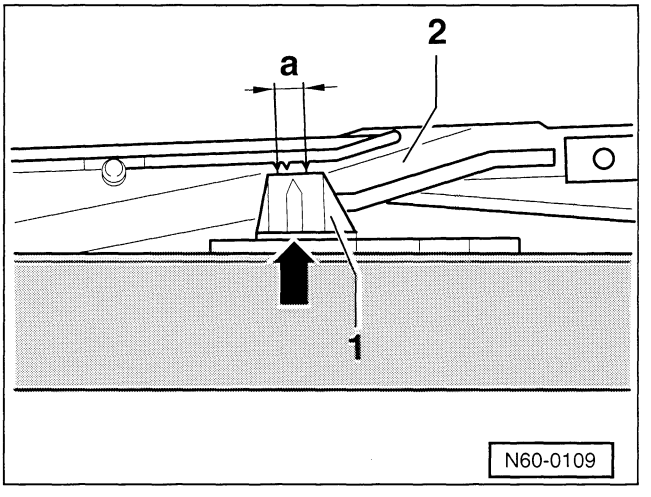
– Remove wind deflector.

Rockwell/Meritor sunroof assembly



1. **Glass panel for sunroof**
   - Single pane safety glass
   - Parallel movement, checking and adjusting, see **Sunroof parallel movement, checking and adjusting**
2. **Panel seal**
   - Adjusting/replacing, see **Panel seal, adjusting and replacing**
3. **Sliding headliner**
4. **Countersunk screws**
   - Micro encapsulated
   - Always replace
   - Tighten to 3.5 Nm (31 in-lb)
5. **Slide**
6. **Upper trim**
   - Through 08/2002 production
7. **Lower trim**
   - Through 08/2002 production
8. **Water channel**
   - Removed together with slotted guide rail
9. **Guide locking hook**
10. **End piece**
    - Use butyl adhesive sealing cord (VW part no. AKL 450 005 05) to seal
11. **Carrier unit**
    - U-frame with guide channels
    - If required, guide channels are to be greased with special grease, G 000 450 02 only
12. **Bolt**
    - Tighten to 3.5 Nm (31 in-lb)
13. **Cover**
    - With Allen key for emergency opening
14. **Drive motor**
15. **Wind deflector spring**
16. **Wind deflector**
    - Removing, see **Wind deflector, removing**
17. **Glass panel mounting screw**
    - Torx T25
    - Tighten to 4.5 Nm (40 in-lb)
18. **Rear guide**
    - Removed with slotted guide rail
19. **Slotted guide rail**
20. **Spacer**
    - Removed with slotted guide rail
21. **Trim pieces**
    - Installed on vehicles from 09/02 production
    - Trim pieces and trim must not be swapped with each other during sunroof assembly replacement. Clearance for mechanical components is otherwise not guaranteed.

Sunroof parallel movement, checking and adjusting (Rockwell/Meritor)



– Remove sunroof glass panel.

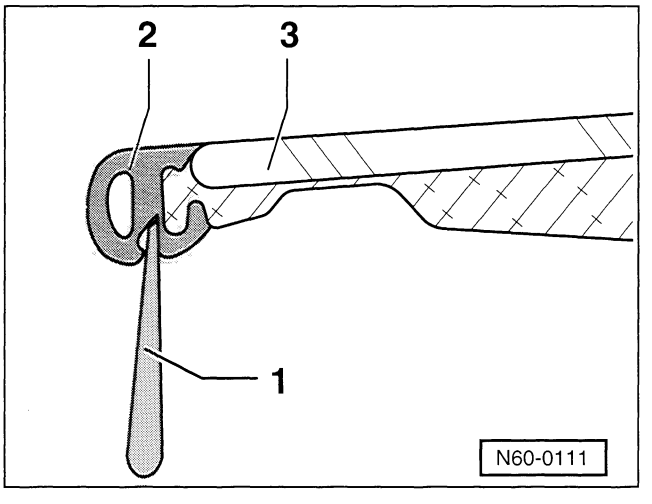
➢ The mark (**arrow**) on the rear guide upper section (**1**) must lie within the marks (dimension **a**) on the guide rail. Check both sides.

– The slotted guide rail (**2**) must be located in the guide (cannot be moved by hand).

– To adjust, remove drive motor and slide guide upper part (**1**) from front to rear, centering between marks.

– Install drive motor in "0" position and check adjustment.

Panel seal, adjusting and replacing (Rockwell/Meritor)



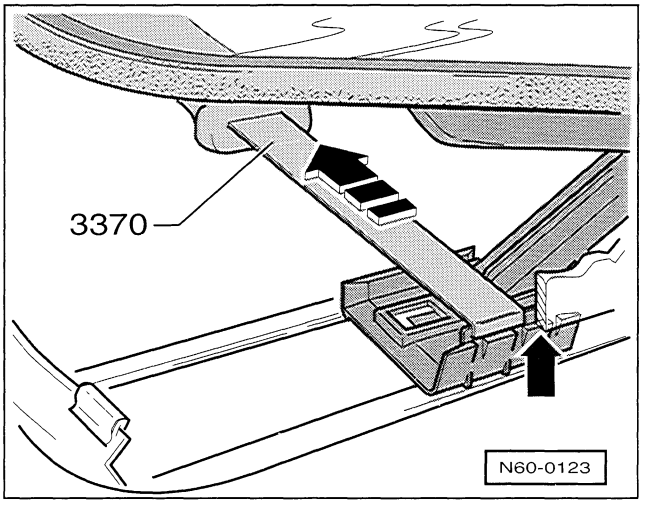
➢ Glass panel (**3**) must be removed to adjust panel seal.

– Check for uniform spacing between panel seal (**2**) and body using a 0.3 mm thick strip of paper (i.e. business card).

– Use a wedge (**1**) to push panel seal apart if spacing is too thin, or to push seal closer if spacing is too large.

– To replace seal, pull off from glass panel and install new seal from bottom to top, starting at rear center.

Wind deflector, removing (Rockwell/Meritor)

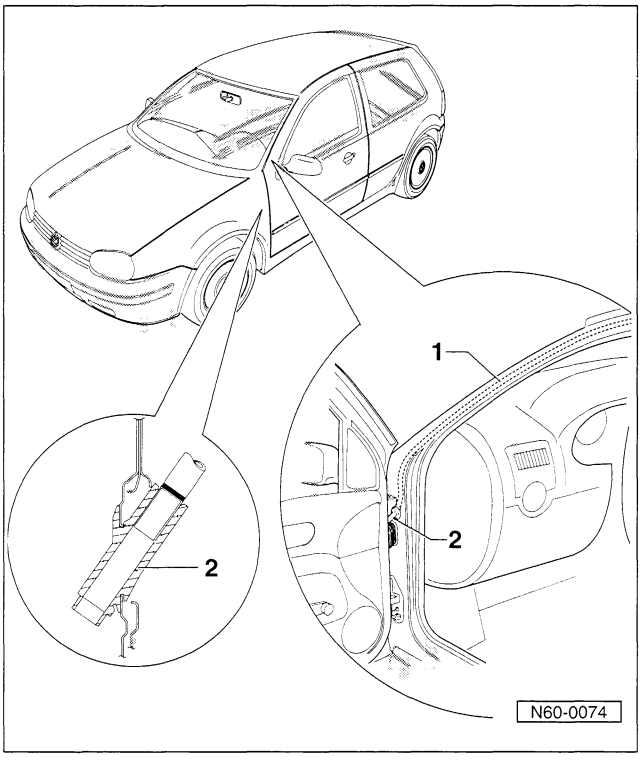


– Open sunroof completely.

➢ Place assembly tool 3370 between roof and wind deflector and remove deflector on right and left sides by pulling tool.

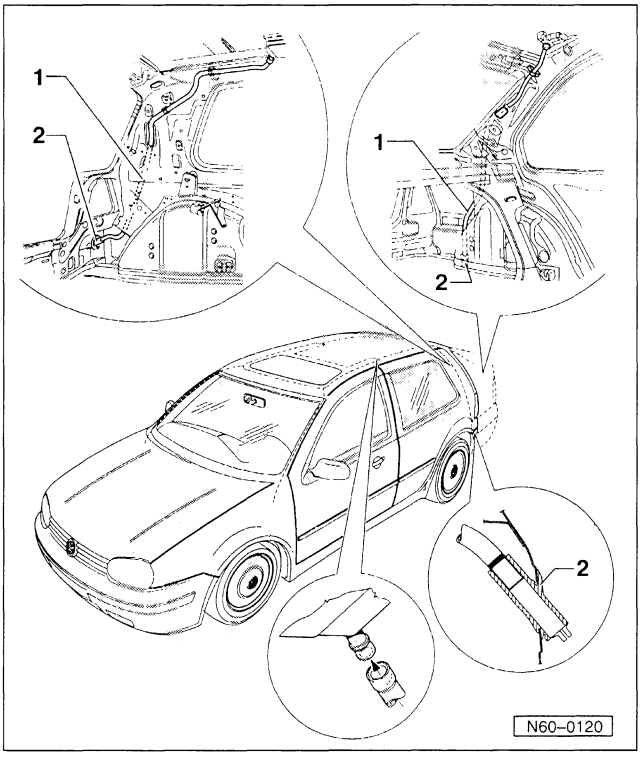
– Pry wind deflector from guide rail on left and right sides carefully with a screwdriver.

Front water drain hoses, cleaning



The front water drain hoses (**1**) are routed in the A-pillars through grommets (**2**) and empty between the door and the A-pillar. Cleaning is done from the sunroof panel opening. A flexible cable that is approx. 230 cm (90 in.) long is necessary for cleaning the drain hose.

Rear water drain hoses, cleaning



The rear water drain hoses (**1**) are routed in the C-pillars through grommets (**2**), and empty behind the bumper under the tail light cluster. Cleaning is done from the lower end of the hose. The rear bumper must be removed to clean the rear drain hoses, see **63 Bumpers**. A flexible cable that is approx. 230 cm (90 in.) long is necessary for cleaning the drain hose.

63 Bumpers

GENERAL 63-1

BUMPERS, SERVICING 63-1
Hood release lever, removing 63-1
Front bumper assembly 63-2
Front bumper beam assembly 63-3
Rear bumper assembly 63-4
Rear bumper beam assembly 63-5
Trailer hitch, assembly 63-6

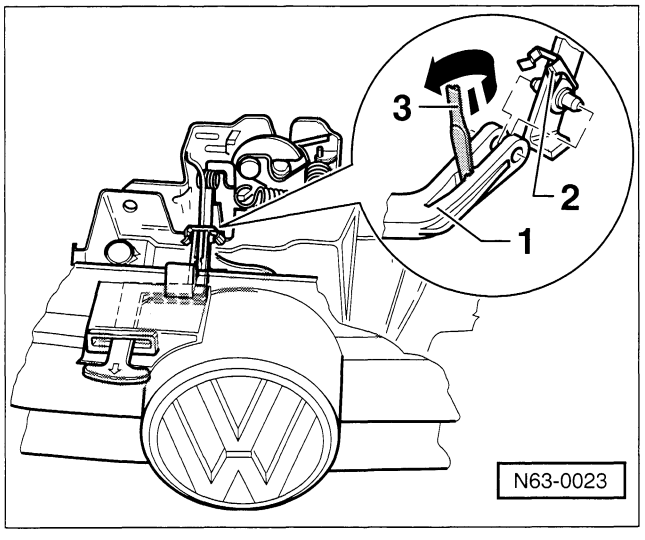
GENERAL

The bumpers consist of a cross-member that is bolted directly to the body structure. The bumper cover must first be removed to access the bumper beam. It is also necessary to remove the front bumper cover and front bumper beam to move the radiator support (lock carrier) to the service position, see **50 Body–Front**.

BUMPERS, SERVICING

Hood release lever, removing

Before removing the front bumper cover the hood release lever must first be removed.



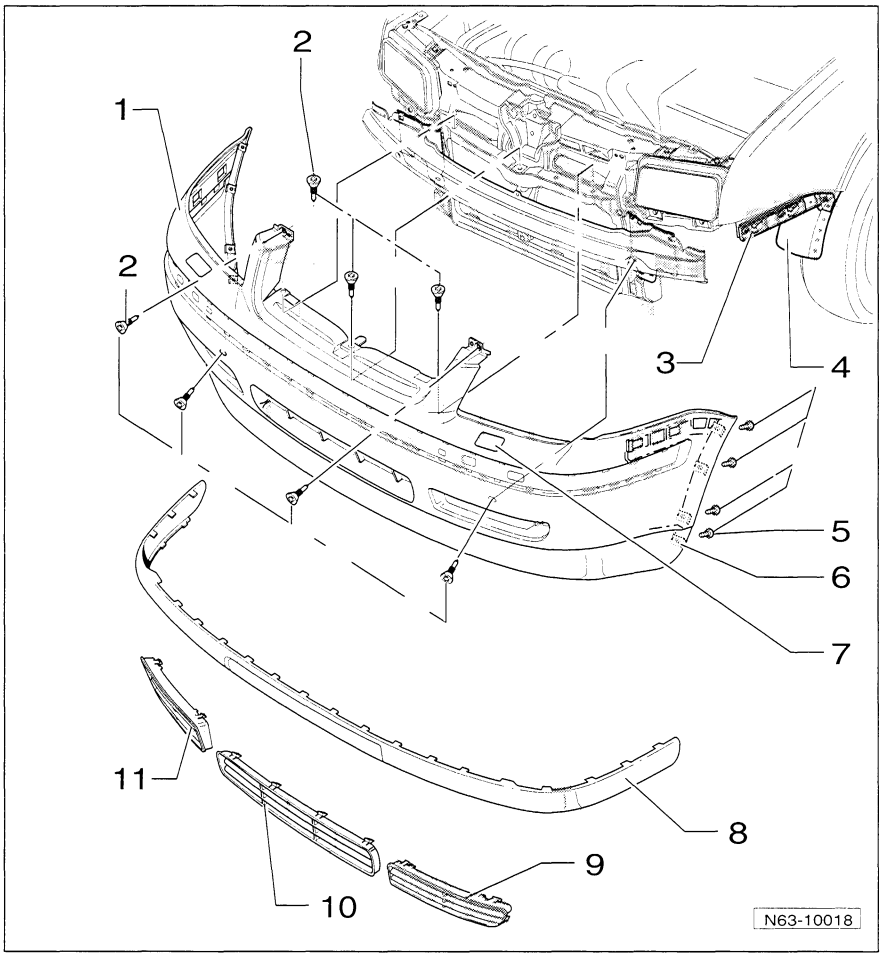
➤ Open hood and swing retaining clip (**2**) for hood release lever (**1**) upward.

– Pull release lever with a screwdriver (**3**) and remove front hood lock.

– Pull release lever and guide out of radiator support (lock carrier).

To continue with removal of front bumper cover refer to **Front bumper, assembly** on the following page.

Front bumper assembly



1. **Bumper cover**

   Removing:

   - Separate release lever from hood lock as shown previously
   - Remove radiator grille, see **66 Body–Exterior**
   - Unclip and remove headlight washer covers (**6**) as applicable
   - Remove mounting bolts from wheel housing liner (**4**)
   - Unclip left and right air guides (**9** and **11**)
   - Remove mounting bolts (**2**)
   - Remove bumper cover from left and right side guides (**3**)
   - Disconnect wiring from temperature sensor
   - Remove spoiler (**8**), as applicable

2. **Bolt**
   - Qty. 7
   - Tighten to 6.5 Nm (57 in-lb)

3. **Guide**
   - To remove/install bumper, pull out or push in parallel to guides at left and right

4. **Wheel housing liner**

5. **Screw**
   - Qty. 4 per side

6. **Speed nut**
   - Qty: 8 for Golf/Jetta
   - Qty: 10 for Jetta GLI Sport

7. **Cover for headlight washer**
   - For special models

8. **Spoiler**

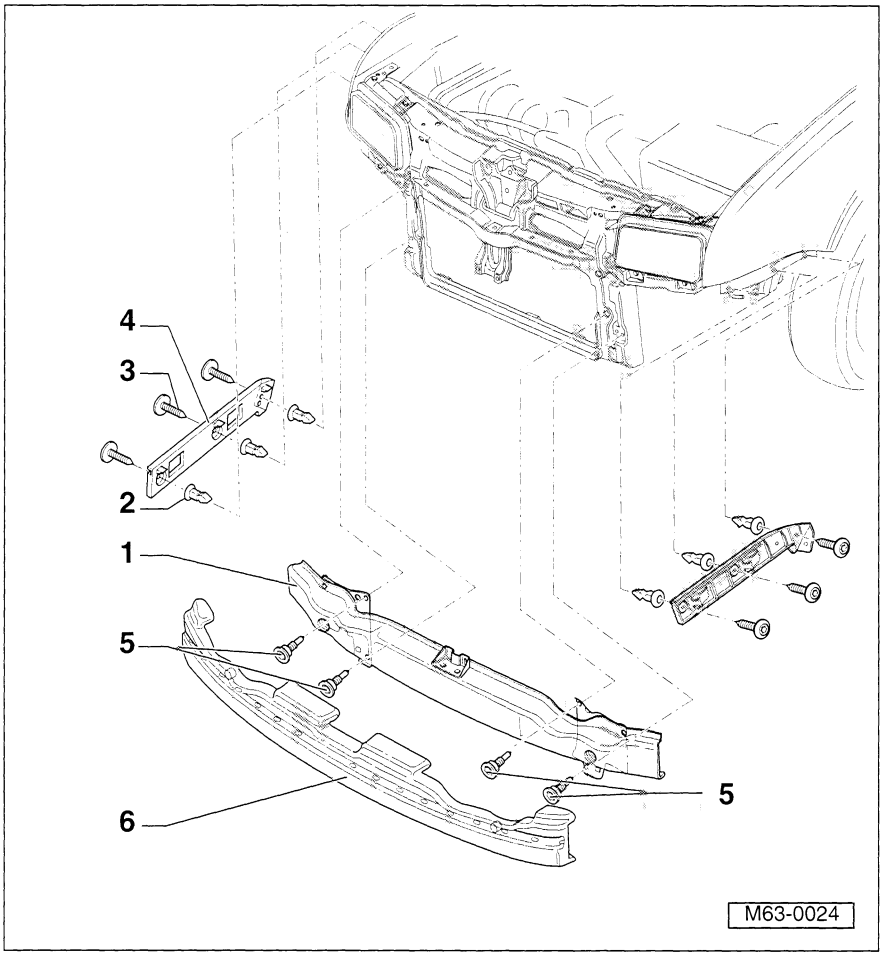
9. **Air guide grille, left**
   - Clipped into bumper cover

10. **Air guide grille, center**
    - Clipped into bumper cover

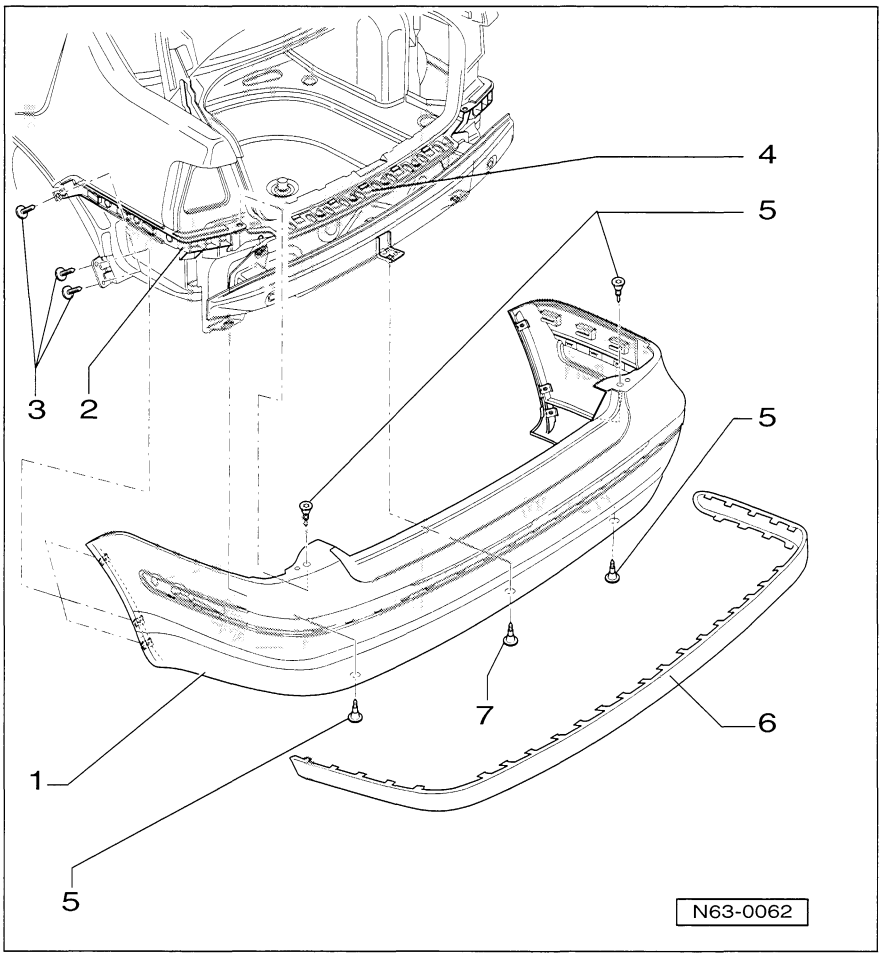
11. **Air guide grille, right**
    - Clipped into bumper cover

Front bumper beam assembly

1. **Bumper beam**
2. **Spreader nut**
   - Qty. 3
3. **Screw**
   - Qty. 3
4. **Guide**
   - To remove/install bumper, pull out or push in parallel to guides at left and right
5. **Bolt**
   - Qty. 4
   - Tighten to 8.5 Nm (75 in-lb)
6. **Impact damper**
   - Connected to bumper beam



Rear bumper assembly



1. **Bumper cover**

   Removing:

   - Remove mounting bolts from wheel housing (**3**)
   - Remove tail light assemblies, see **94 Lights, Accessories–Exterior**
   - On Golf/GTI, disconnect harness connector for license plate light under left tail light
   - Remove mounting bolts (**5**) and additional bolt (**7**) for Jetta models
   - Remove bumper cover (**1**) from left and right side guides (**2**) and mounting strip (**4**)
   - Remove impact strip (**6**) if necessary

2. **Guide**
   - To remove/install bumper, pull out or push in parallel to guides at left and right

3. **Bolt**
   - Qty: 8 for Golf/Jetta
   - Qty: 10 for Jetta GLI Sport

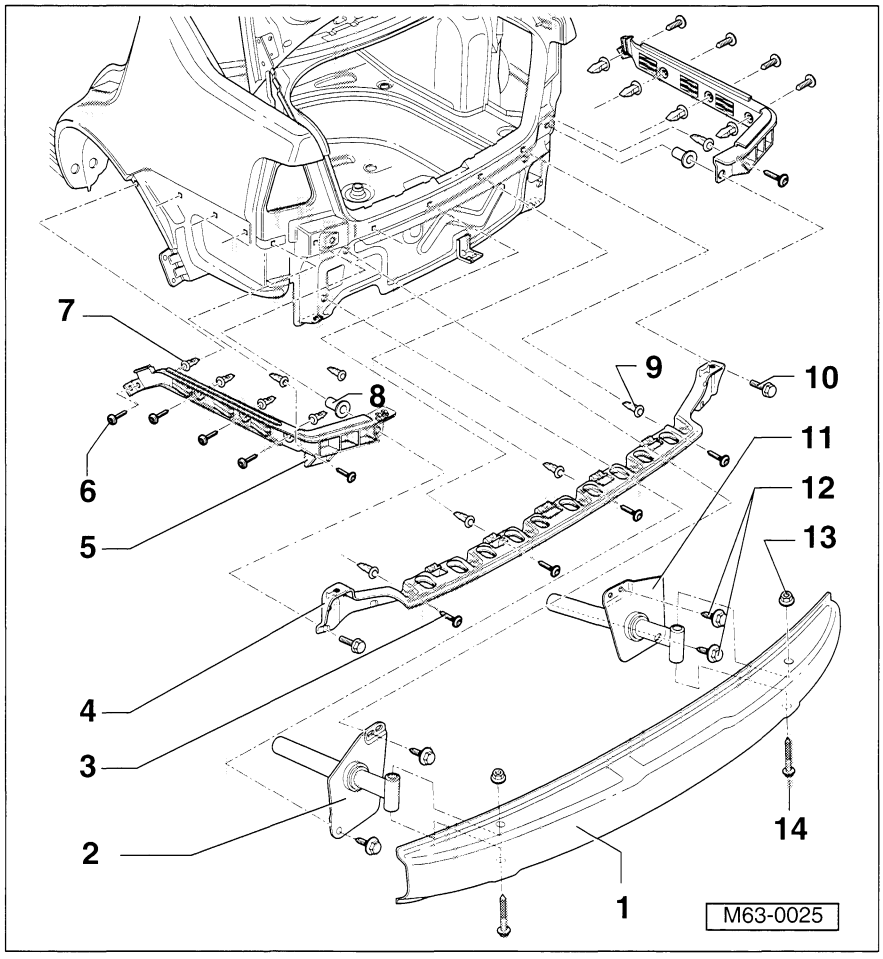
4. **Mounting strip**

5. **Bolt**
   - Qty. 4
   - Tighten to 6.6 Nm (58 in-lb)

6. **Impact strip**

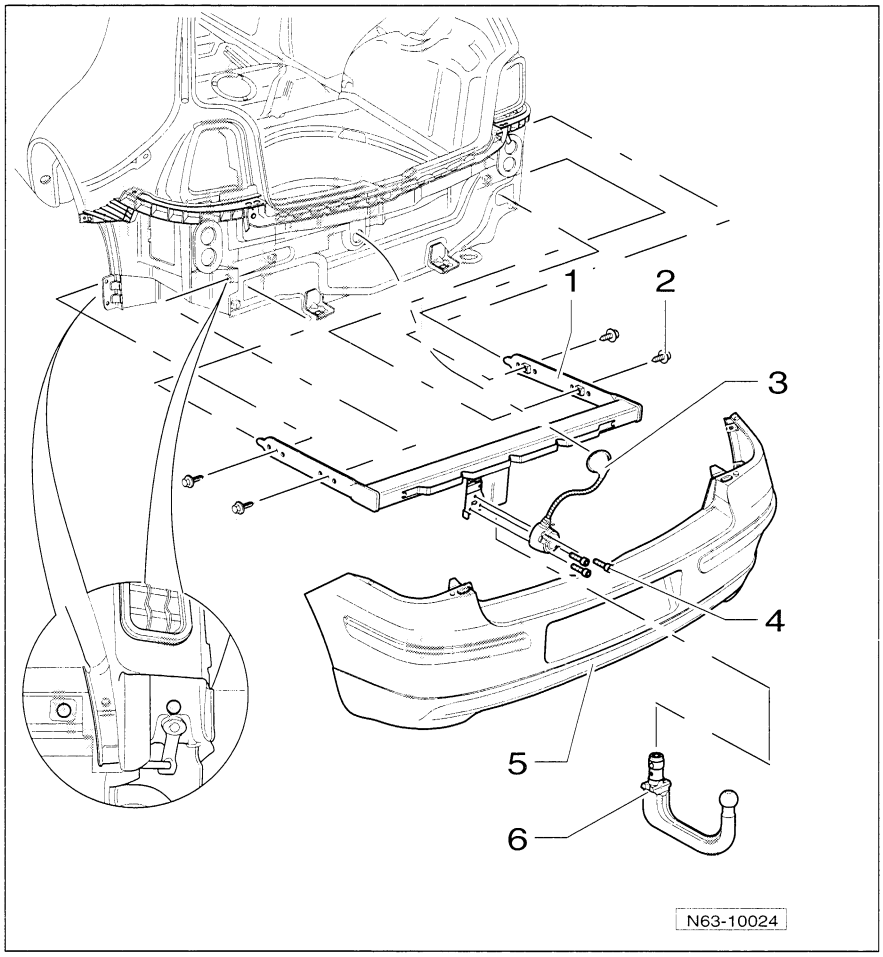
7. **Bolt**
   - Tighten to 6.6 Nm (58 in-lb)
   - Only for Jetta bumper

Rear bumper beam assembly



1. **Bumper beam**
2. **Impact absorber**
3. **Screw**
   - Qty. 4
4. **Mounting strip**
5. **Guide**
   - To remove/install bumper, pull out or push in parallel to guides at left and right
6. **Screw**
   - Qty. 10
7. **Spreader nut**
   - Qty. 10
8. **Internally threaded pop rivet**
   - Qty. 2
9. **Spreader nut**
   - Qty. 4
10. **Bolt**
    - Qty. 2
    - Tighten to 6.6 Nm (58 in-lb)
11. **Impact absorber, right**
12. **Bolt**
    - Qty. 4
    - Tighten to 20 Nm (15 ft-lb)
13. **Nut**
    - Qty. 2
    - Tighten to 50 Nm (37 ft-lb)
14. **Bolt**
    - Qty. 2

Trailer hitch, assembly



1. **Trailer hitch**

   Removing:

   - Remove ball head stud (**6**)
   - Remove wheel housing liner
   - Remove bumper cover as described earlier
   - Remove power outlet (**3**) from trailer hitch
   - Remove bolts (**2**)
   - Remove trailer hitch from body

2. **Bolt**
   - Qty: 4
   - Tighten to 60 Nm (44 ft-lb) plus ¼ turn (90°)
   - Always replace
3. **Power outlet**
4. **Bolt**
   - Qty: 3
5. **Bumper cover**
6. **Ball head stud**
   - Removable

66 Body–Exterior Equipment

GENERAL 66-1

SIDE-VIEW MIRROR 66-1
- Mirror housing, removing and installing 66-1
- Side-view mirror assembly (power mirrors) . . . 66-3
- Side-view mirror assembly (manual mirrors) . . 66-4

WHEEL HOUSING LINERS 66-5
- Front wheel housing liner 66-5
- Rear wheel housing liner 66-6

EXTERIOR MOLDINGS 66-7
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- Side moldings, overview 66-8
- Roof rail (Jetta wagon) overview 66-9
- Roof rail retaining brackets (Jetta wagon), installing 66-9

FRONT GRILLE 66-10
- Front grille assembly 66-10

SPECIAL EDITION TRIM 66-11
- Front and rear valence spoilers (GTI 337, Jetta GLI, R32) 66-11
- Sill panel extension (GTI, R32) 66-12
- Rear spoiler (GTI, R32) 66-13
- Rear spoiler stoplight, installing 66-14

GENERAL

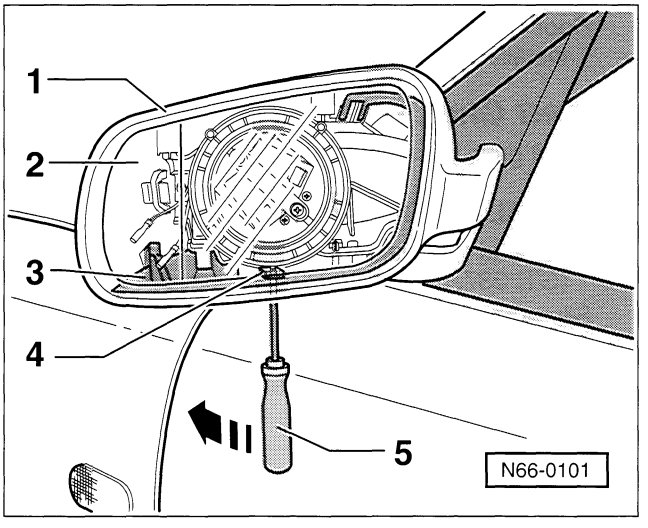
This repair group covers various exterior equipment including side-view mirrors, wheel housing liners, roof moldings and front grille trim.

66

SIDE-VIEW MIRROR

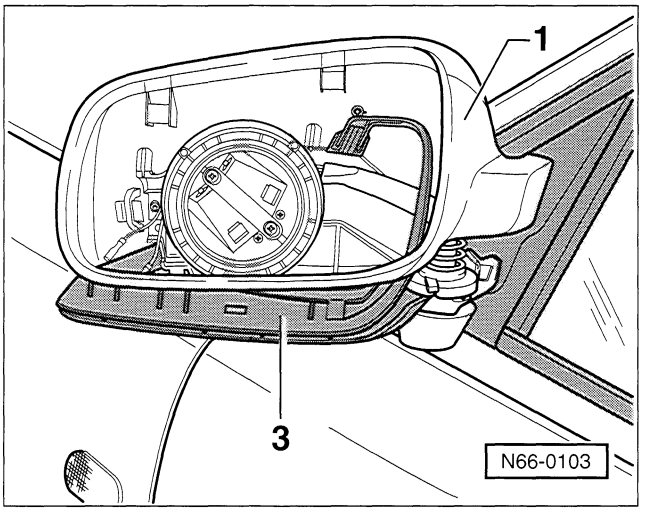
Mirror housing, removing and installing

– Fold mirror housing forward to ease removal.



➢ Position mirror glass (**2**) totally vertical to avoid catching mirror housing on glass when removing.

– Use screwdriver (**5**) in direction of **arrow** to release housing retaining clip (**4**) on bottom of actuator bracket.



➢ Pull mirror housing (**1**) upward off mirror carrier (**3**).

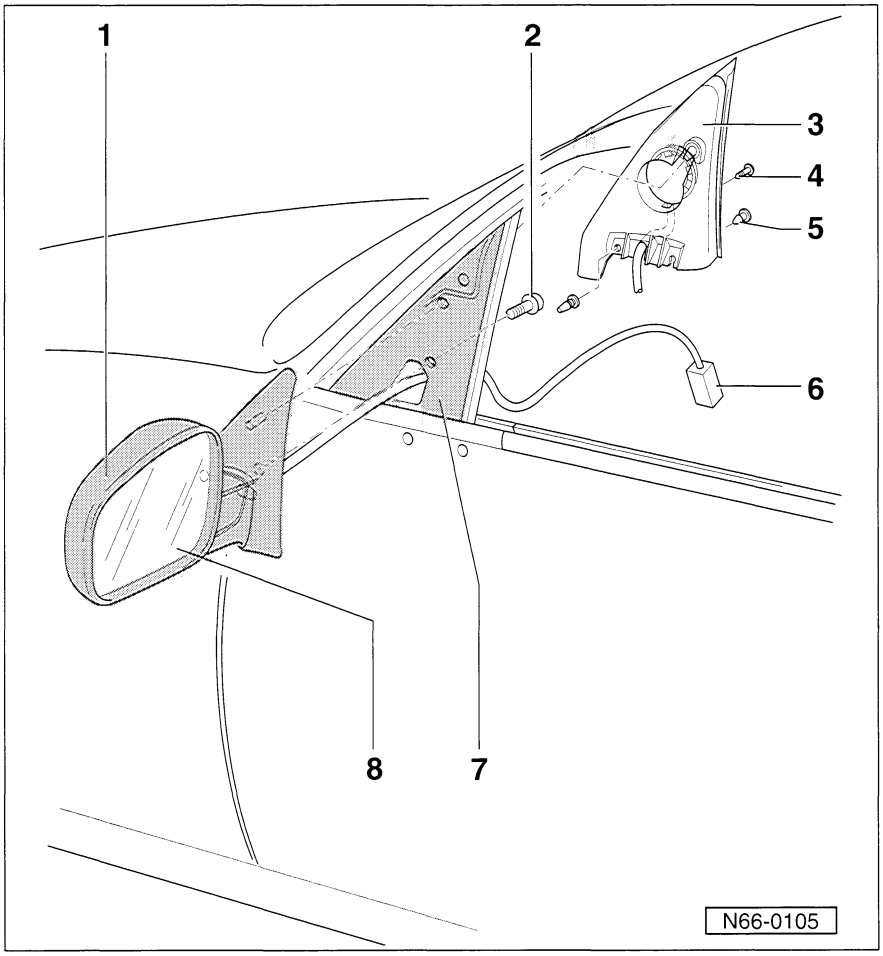
Most of the vehicles covered by this manual come equipped with power mirror adjustment. Power mirrors are adjusted with a joy stick that is installed in the driver's door panel. This joystick will adjust either the driver or passenger side mirror. An exploded view of the side-view mirror with power adjustment is provided on the following page.

Vehicles with manually adjusted mirrors have a joy stick on each front door panel that operates cables to adjust each side-view mirror. An exploded view of the manual side-view mirror assembly is shown later.

Use appropriate exploded views to further disassemble side mirror assembly.

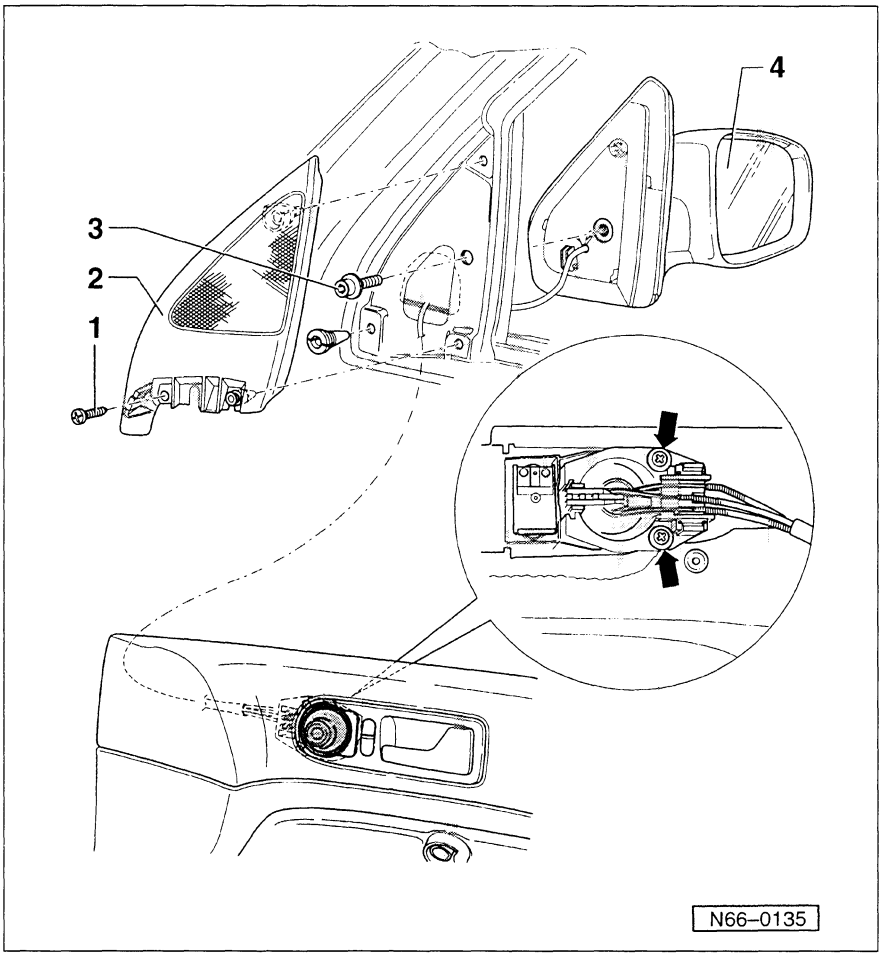
Side-view mirror assembly (power mirrors)

1. **Mirror housing**
2. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
3. **Cover**
4. **Bolt**
5. **Clip**
6. **Harness connector**
7. **Insulation**
8. **Mirror glass**
   - Removing:
     Protect inside bottom of mirror from damage with tape
     Pivot top of mirror into housing
     Pry off mirror from tab in housing using VW special tool 80-200 (pry lever) through bottom edge of glass
   - Installing:
     Position mirror glass guide studs into mounts and press center of mirror to install



Side-view mirror assembly (manual mirrors)

1. **Screw**
   - Remove front door trim to access screw, see **70 Trim–Interior**
2. **Trim piece**
   - With stereo speaker, as applicable
3. **Mounting bolt**
4. **Mirror assembly**
   - Removing:
     Remove mirror adjuster mounting bolts (**arrows**)
     Remove screw (**1**)
     Disconnect harness connector for stereo speaker
     Remove trim piece (**2**)
     Remove sound deadener from mirror base
     Remove bolt (**3**) and separate mirror assembly from door



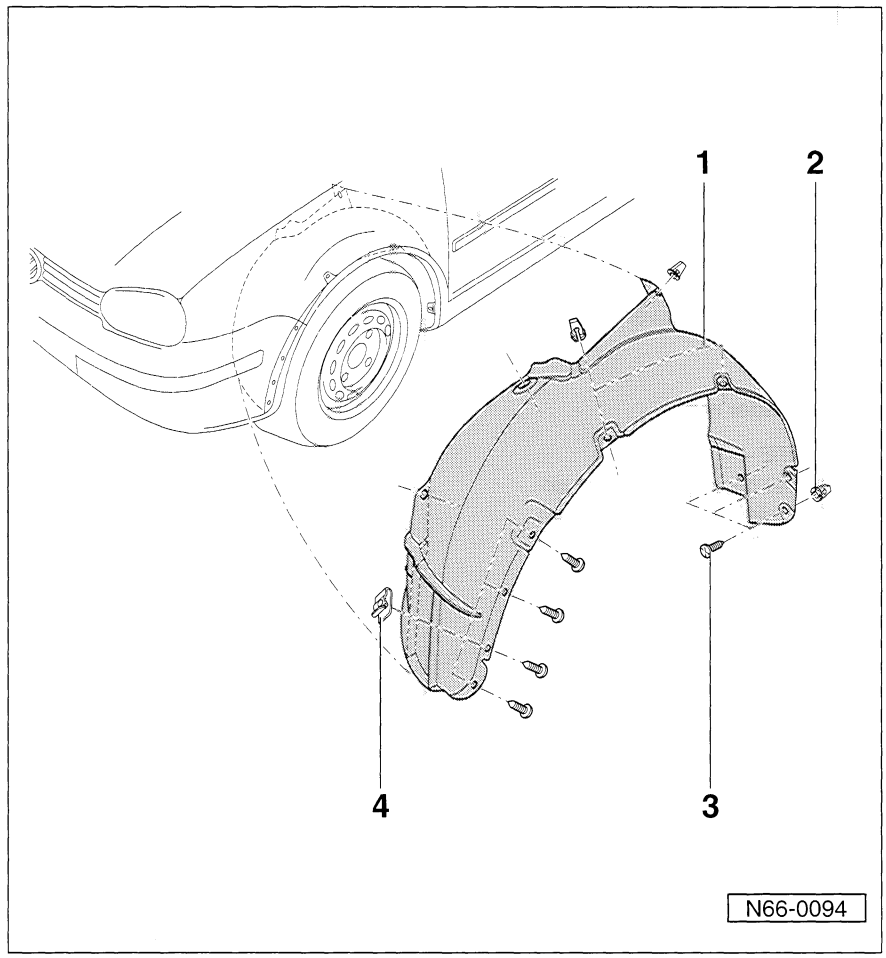
WHEEL HOUSING LINERS

Front wheel housing liner

1. **Wheel housing liner**
   - Removal:
     Remove wheel
     (when installing tighten lug bolts to 120 Nm (89 ft-lb)
     Remove screws **(3)**–(qty. 12) and wheel housing liner
2. **Spreader nut**
3. **Screw**
4. **Speed nut**
   - On bumper cover

   NOTE —

   Wheel housing liners may differ slightly depending on equipment, with regard to position and number of mounting elements.

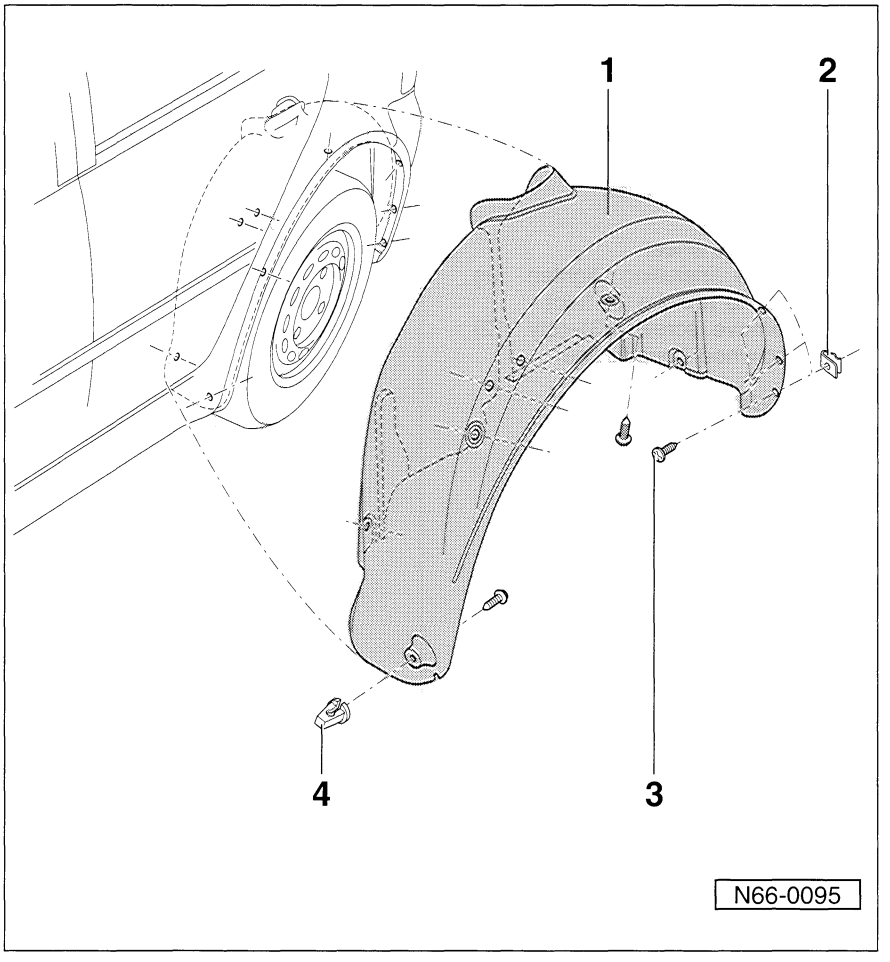


Rear wheel housing liner

1. **Wheel housing liner**
   - Removal:
     Remove wheel
     (when installing tighten lug bolts to 120 Nm (89 ft-lb)
     Remove screws (**3**)–(qty. 7) and wheel housing liner
2. **Speed nut**
   - On bumper cover
3. **Screw**
4. **Spreader nut**

   NOTE —

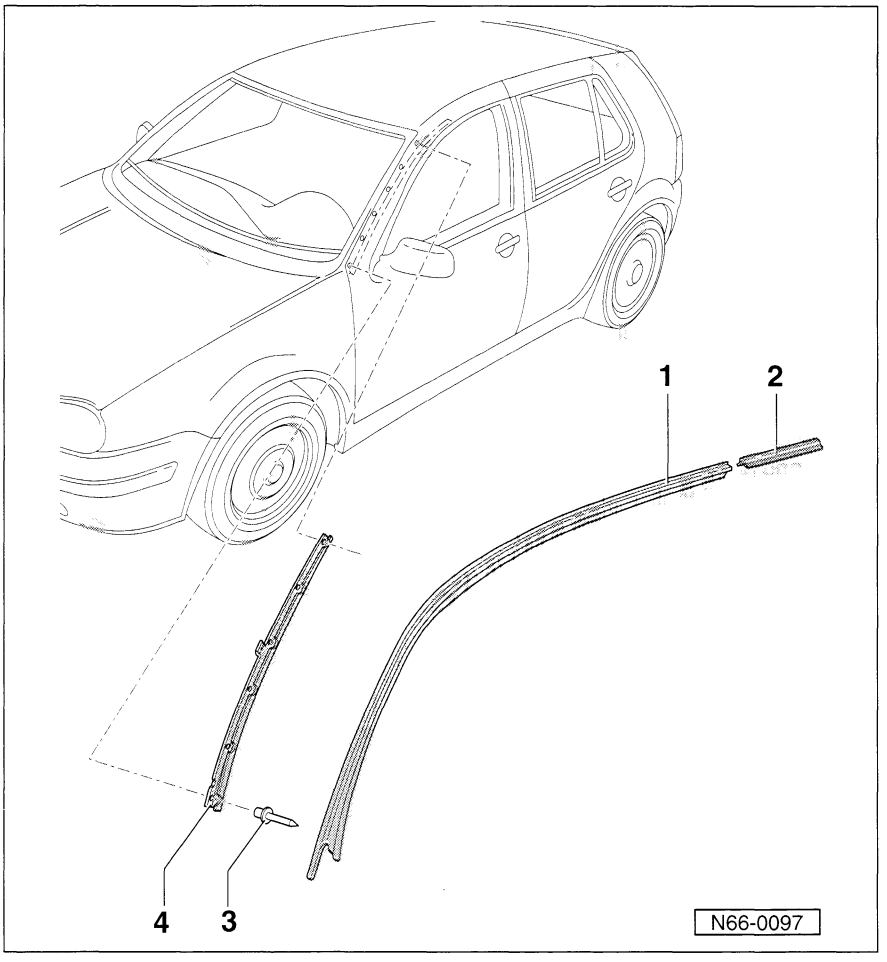
   Wheel housing liners may differ slightly depending on equipment, with regard to position and number of mounting elements.



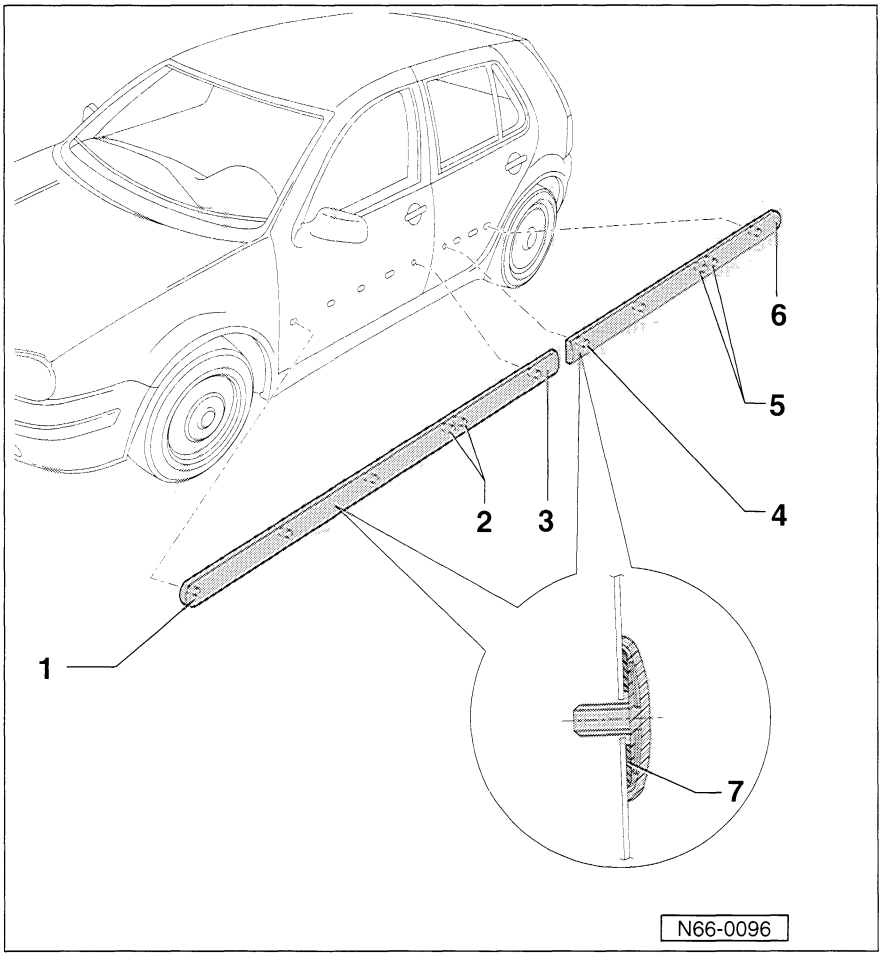
EXTERIOR MOLDINGS

Roof moldings, overview

1. **Roof molding**
   - With cover strip (**2**).
   - Do not bend roof molding
   - To remove, start at windshield, carefully pry off with soft plastic wedge
   - To install, align molding on B-pillar (2-door) or C-pillar (4-door) and assemble moving forward
2. **Cover strip**
   - Installing:
     Insert cover strip into pocket of roof molding onto stop, then press into roof channel
     A lubricant may be used to ease assembly
3. **Pop rivet**
4. **Angled strip**



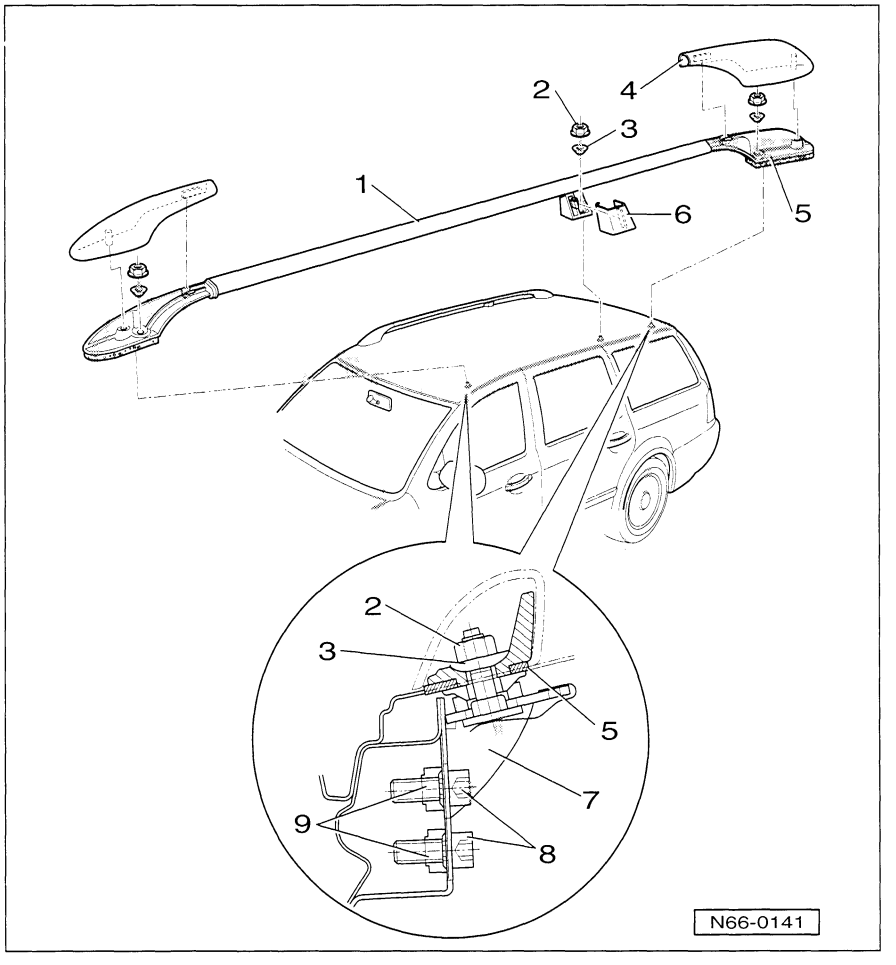
Side moldings, overview

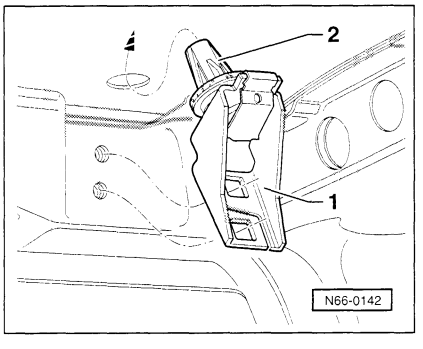


1. **Front door protective side molding**
   - Left and right-hand protective side moldings have different hole patterns
   - Self-adhesive backing
   - Warm up molding and backing with hot air blower before installing
   - Working temperature when attaching moldings should be at least 20°C (68 °F)
   - Clean exterior panels with solvent, treat with silicone remover and rub dry
   - Use locating tabs (**3** and **4**) to position molding
2. **Pins**
   - Prevents twisting of molding
3. **Locating tab**
4. **Locating tab**
5. **Pins**
   - Prevents twisting of molding
6. **Rear door protective side molding**
   - Left and right-hand protective side moldings have different hole patterns
   - Self-adhesive backing
   - Use locating tabs (**3** and **4**) to position molding
7. **Protective foil**

Roof rails (Jetta wagon), overview

1. **Roof rail**
   - Install in sequence above:
     A-pillar
     C-pillar
     D-pillar
2. **Nut**
   - Qty: 6
   - Tighten to 23 Nm (17 ft-lb)
3. **Tapered washer**
4. **Cover cap**
   - To install, first insert cap into round clip, then press into double clip
5. **Base plate**
6. **Cover cap**
   - Center when installing
   - Press cap onto roof railing base
   - Mounting holes are next to each other
7. **Angle bracket**
   - See installation details below
   - With securing pins, tapered washer, sealing ring and securing cap
8. **Retaining bracket bolt**
   - Qty: 12
   - Tighten to 20 Nm (15 ft-lb)
9. **Weld nut**

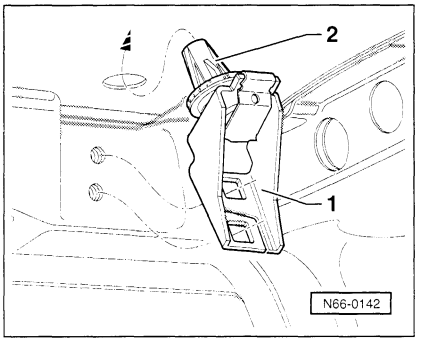




Roof rail retaining brackets (Jetta wagon), installing

➤ Guide retaining bracket (**1**) into hole in roof rack and press into hole in roof until alignment cap (**2**) locks. All catches must lock.

NOTE —
Alignment cap on retaining bracket must not be turned before locking.



➤ Press retaining bracket (**1**) onto interior side piece and attach with screws (**3**).

– Remove alignment cap (**2**) from the exterior, using accessory tool if necessary.

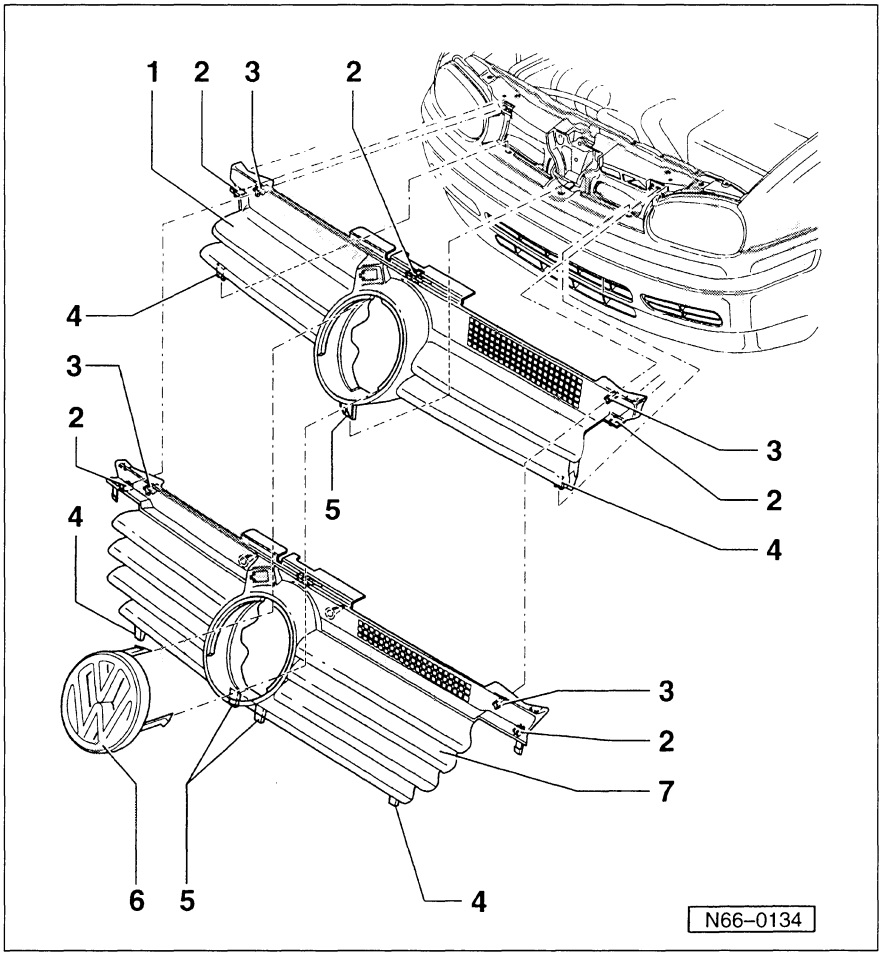
FRONT GRILLE

Front grille assembly

1. **Golf grille**
2. **Attachment clip**
3. **Pin**
4. **Locking tab**
5. **Locating tab**
6. **VW emblem**
   - Clipped onto grille
7. **Jetta grille**

To remove grille, separate hood release lever from hood lock as shown in **63 Bumpers**. Unlock attachment clips (**2**) with a screwdriver. Pull pins (**3**) out of upper radiator support and remove grille from top.

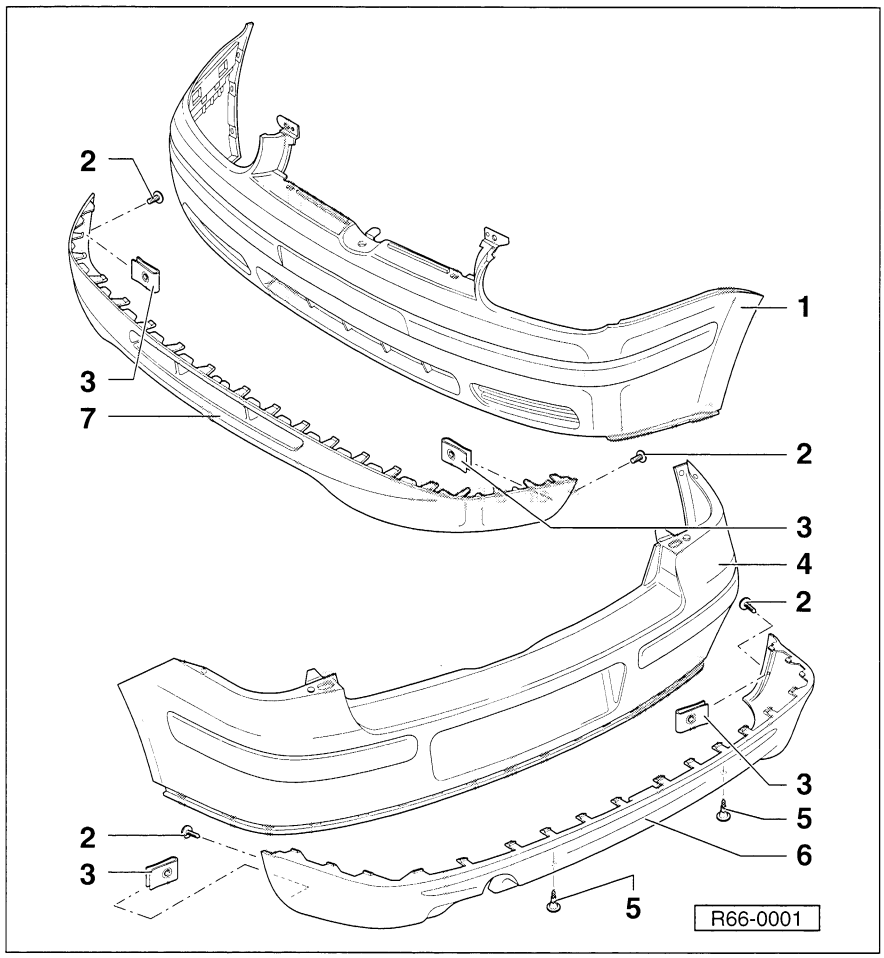
To install, align radiator grille with center locator (**5**). Insert lower tabs (**4**) in bumper cover and clip in upper area. Install pins (**3**).

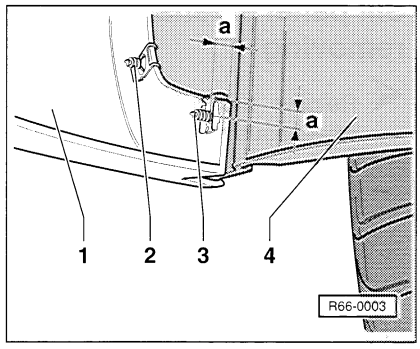


SPECIAL EDITION TRIM

Front and rear valence spoilers (GTI 337, Jetta GLI, R32)

1. **Front cover**
   - Removing and installing, see **63 Bumpers**
2. **Screw (4)**
3. **Speed nut (4)**
4. **Rear cover**
   - Removing and installing, see **63 Bumpers**
5. **Bolt (2)**
   - Tighten to 15 Nm (11 ft-lb)
6. **Rear valence spoiler**
   - Made of PUR-RIM
   - Clipped to cover and 4 screws
7. **Front valence spoiler**
   - Made of PUR-RIM
   - Clipped to cover and 4 screws





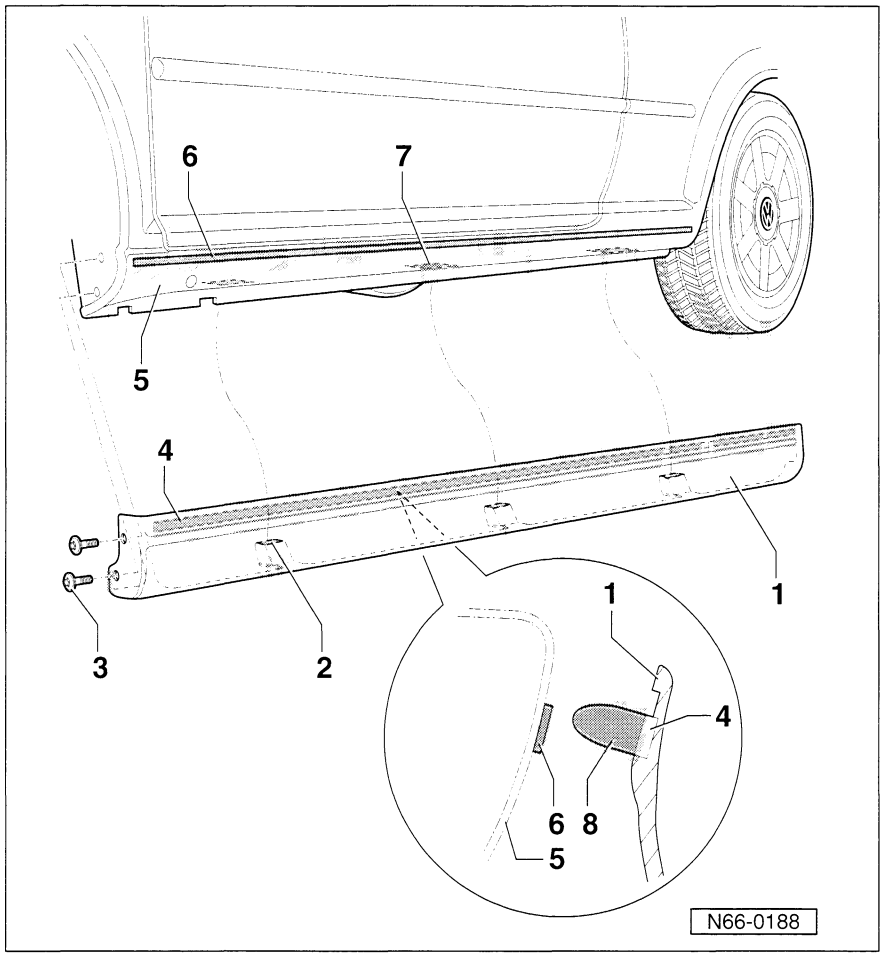
Front valence spoiler, additional mounting bolts

- Dimension (**a**) = 10mm

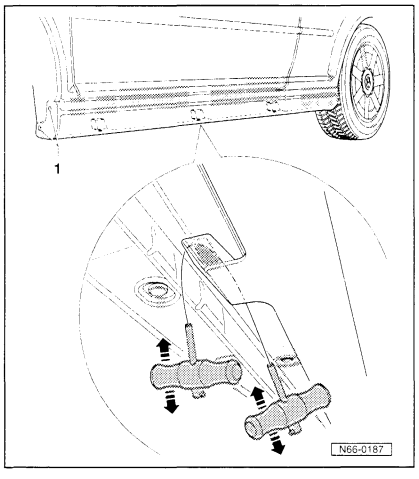
1. **Front valence spoiler**
2. **Screw and speed nut**
3. **Screw and speed nut**
4. **Front wheelhouse liner**

Sill panel extension (GTI, R32)

1. **Sill panel extension**
   - See **Sill panel extension, removing**
   - Made of PUR-RIM
2. **Lower adhesive surface on sill panel**
3. **Bolt (2)**
4. **Upper adhesive surfaces on sill panel extension**
5. **Sill panel**
6. **Upper primer surfaces on sill panel extension**
7. **Lower primer surface on sill panel**
8. **PUR adhesive sealing material**

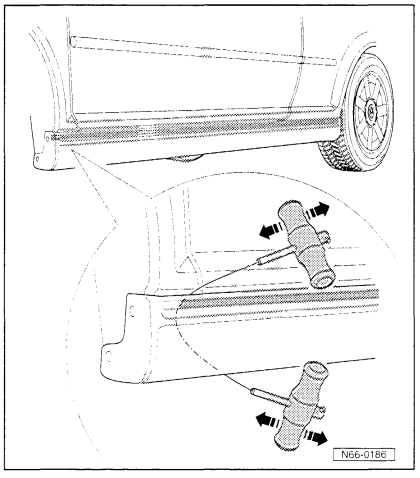


Sill panel extension, removing



➢ Remove two bolts (**1**) in front of wheel housing.

– Separate three lower adhesive surfaces of sill panel extension using pulling handles and cutting cord.

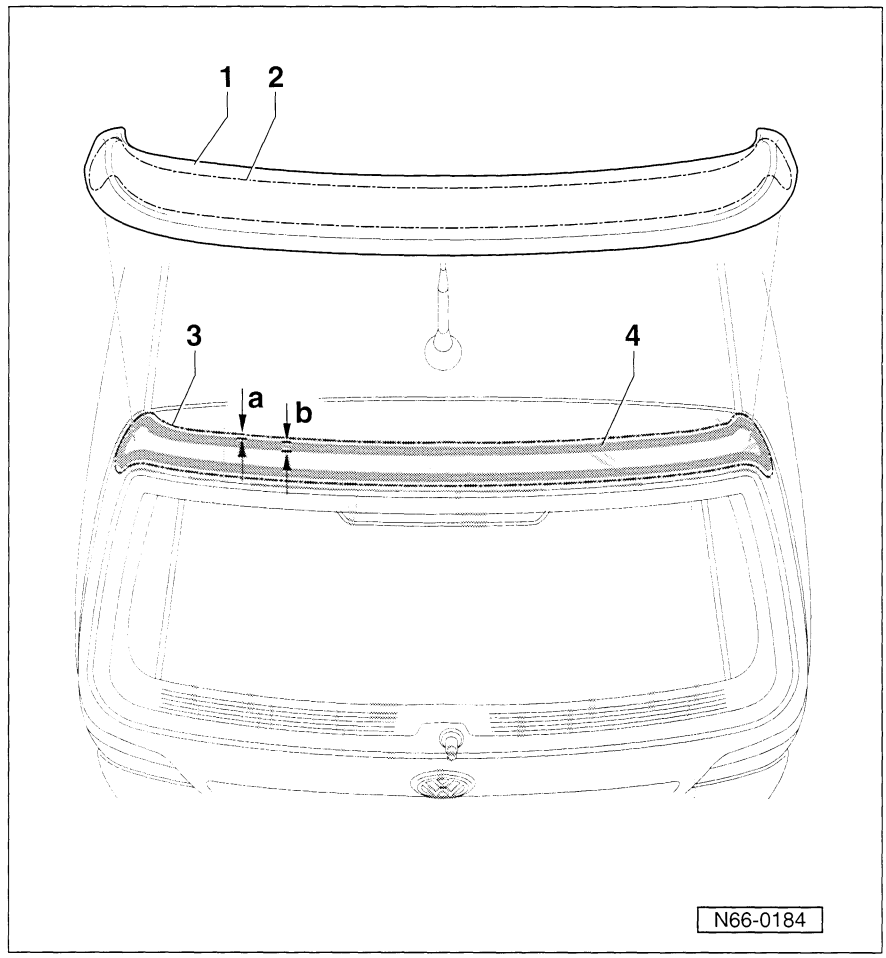


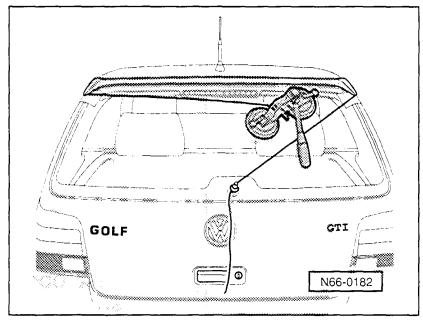
➢ Separate the upper sealing bead using pulling handles and cutting cord.

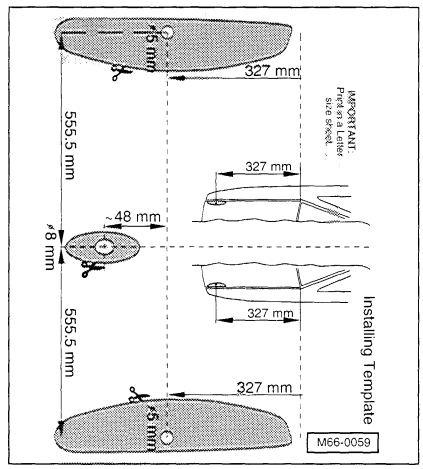
– Remove sill panel extension.

Rear spoiler (GTI, R32)

1. **Rear spoiler**
   - Full size installation template included with factory technical bulletin
   - For technical bulletins and more detailed installation instructions, consult Official Factory Repair Manual, electronic edition
   - Made of PUR-RIM
2. **Primer/adhesive surface on spoiler**
3. **Circumference of fitted roof spoiler**
4. **Primer/surface material on tailgate**







Rear spoiler, removing

- Position spooling device as shown and secure cord end.
- Place cutting cord around spoiler so that cord lies along outer edge of joint between spoiler and tailgate and secure other cord end on wiper shaft
- Protect surrounding painted surfaces and gap between roof and tailgate with tape.

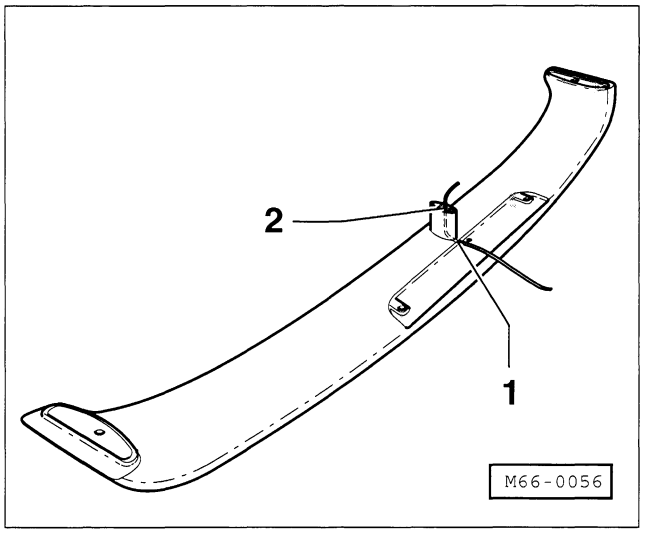
Rear spoiler installation template (reduced)

– Cut out full sized template and paste to rear lid using dimensions included at left.

– Use a soft pencil or crayon to draw outline of gray shapes on rear lid.

– Remove installation template.

– Apply scotch tape to outer borders of outlined areas.



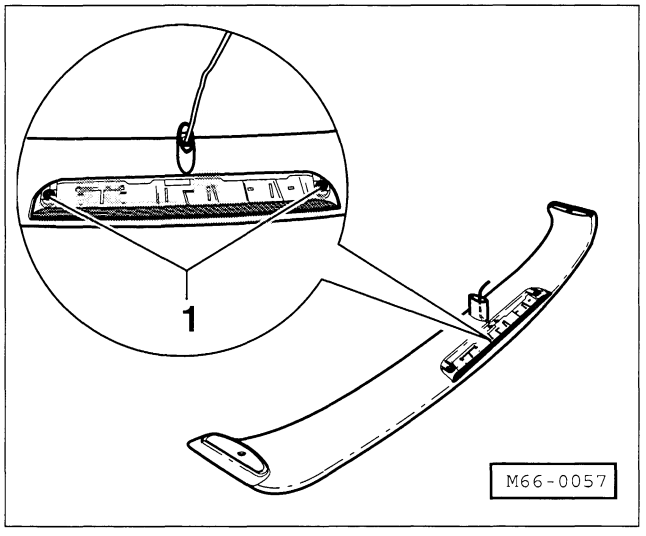
Rear spoiler stoplight, installing

NOTE —
Spoiler must be off vehicle to install stoplight.

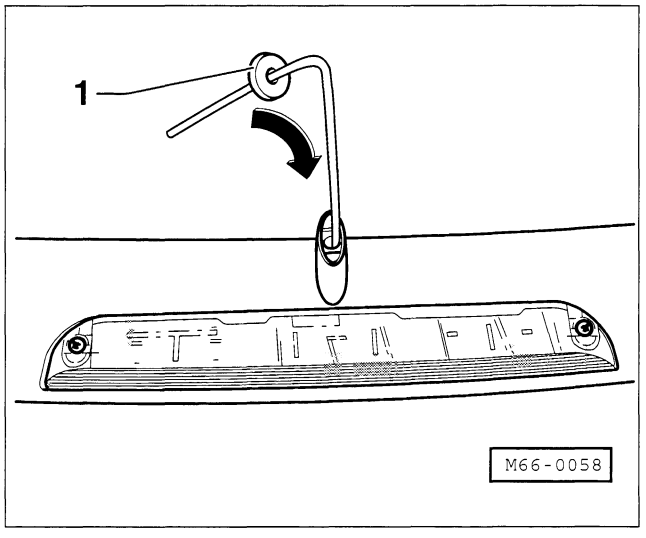
➢ Insert stoplight connection wire through stoplight support (**1**).

– Pull harness though spoiler support base (**2**).

NOTE —
Make sure that stoplight is close to support and adjust slack in harness as necessary.



➢ Install stoplight to spoiler by screwing (**1**) stoplight into spoiler support base.



➢ Install wire harness into grommet (**1**).

– Pull grommet toward spoiler support base (**arrow**).

– Test operation of rear stoplight before installing rear spoiler on vehicle.

NOTE —
Once spoiler is installed on vehicle, it is not possible to remove the rear spoiler stoplight.

69 Seatbelts, Airbags

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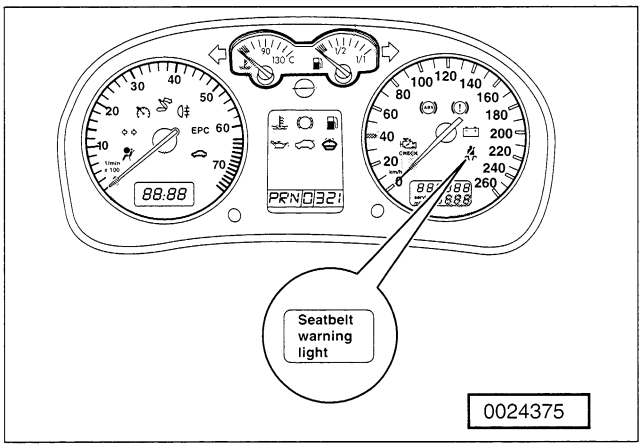
AIRBAGS 69-13
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GENERAL

This repair group covers emergency tensioning (pyrotechnic) seatbelt assemblies and airbag system components. This repair group does not cover airbag system or pyrotechnic seatbelt fault diagnosis or repair. Service and repair to these systems requires special test equipment, knowledge and training and should only be carried out by an authorized Volkswagen Dealer. Before starting repairs involving these systems, always read and observe all warnings, cautions and notes.

WARNING —

Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using a VAG 1551/1552 or equivalent scan tool.



SEATBELTS

The vehicles covered by this manual use an inertia reel-type lap/shoulder belt combination to restrain the front seat passengers. In addition, these belts are self-tensioning through the use of an electric or pyrotechnic device. Deployment of the tensioner is by means of either a mechanical trigger or in conjunction with the airbag system (electric). Rear seat passengers are protected by an inertia reel-type lap/shoulder belt combination. A warning light in the instrument cluster illuminates when the ignition is first switched on as a reminder to buckle up. It stays illuminated for approximately 6 seconds and then goes out.

Special precautions for pyrotechnic seatbelt equipped vehicles

Emergency tensioning front seatbelt systems can enhance passenger safety in the event of a collision provided that the seatbelts are used. Special service precautions must be followed to prevent possible serious bodily injury to the repair technician and others involved in the handling and storage of pyrotechnic seatbelt components and to insure proper operation in the event of a collision.

WARNING —

- *Before working on pyrotechnic seatbelt components linked to airbag systems,* ***disconnect the battery first.***
- *Pyrotechnic seatbelts are activated by an explosive device. Handled improperly or without adequate safeguards and training, the system can be very dangerous. Special precautions must be observed when working on or near the seatbelts.*
- *Seatbelts are vehicle safety systems. To guard against personal injury or system failure, only trained Volkswagen service Technicians should test, disassemble or service the pyrotechnic seatbelt systems.*
- *Install new seatbelt unit as soon as the unit is removed from the packaging. Reinstall in packaging if work will not be completed immediately.*
- *Do not leave any pyrotechnic seatbelt unit unattended. If work is interrupted, store seatbelt unit in a secure location where it cannot be disturbed.*
- *The storage and transportation of airbag units must be in accordance with all applicable Federal, State and Local rules and regulations.*
- *Observe all cautions, warnings and notes before starting repairs involving airbag systems.*
- *Belt tensioners that have been deployed can be disposed of as normal scrap.*
- *Do not use tools with a hammer-type action to disassemble the belt tensioner.*
- *The pyrotechnic seatbelt propellant has no expiration date, and it has an unlimited, maintenance-free life.*
- *The belt tensioner unit must not be exposed to grease, cleaning solutions or similar substances.*
- *Belt tensioner units must not be exposed to temperatures above 100°C (212°F), even for short periods.*
- *Belt tensioner components may not be opened or repaired; always use new parts.*
- *Belt tensioner units which have been dropped on the must not be installed into a vehicle.*
- *Belt tensioner units that show evidence of mechanical or physical damaged (dents, cracks) must be replaced.*
- *Pyrotechnic seatbelt units which have not been deployed should be marked and returned to the manufacturer for disposal using original seatbelt shipping container.*

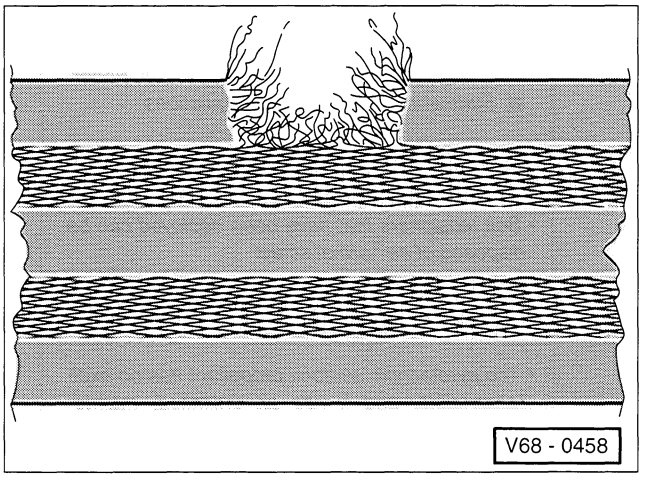
Seatbelts, inspecting

Any time a vehicle is involved in an accident, all of the seatbelts should be checked for damage and proper operation.

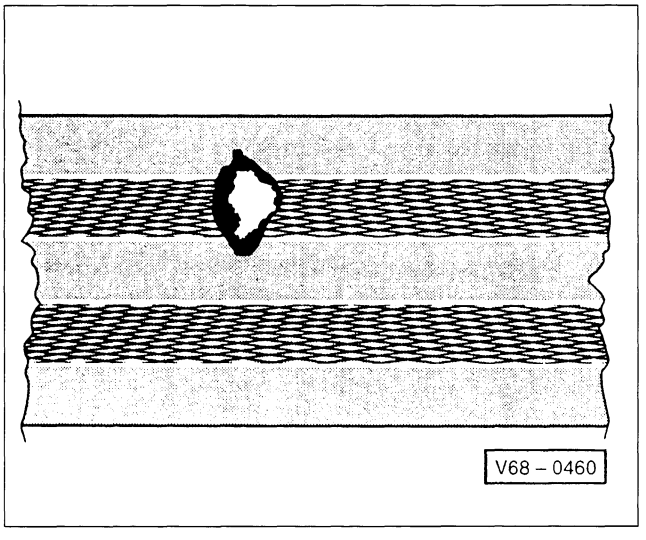
> ***WARNING —***
> *After every accident the seatbelt system must be inspected systematically. If damage is found when inspecting the check points, the customer must be advised regarding the necessity of replacing the seatbelts.*

Webbing (belt material), checking

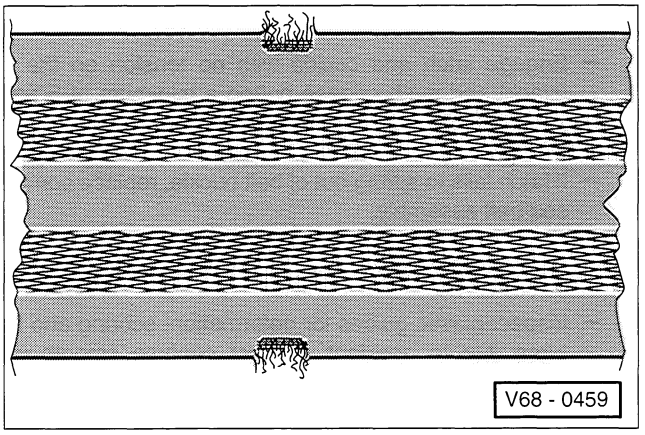
- Pull belt completely out.
- Inspect webbing for dirt and soiling; wash as needed using a mild soap solution.
- Inspect for damage



➢ Seatbelt webbing showing example of cuts, chafing and tears. If vehicle was in an accident replace complete seatbelt assembly with buckle. If vehicle was not in an accident and damage is from other sources, it is ok to replace only the belt.



➢ Seatbelt webbing showing example of burns from cigarettes etc. It is permissible to replace only the belt in this case.



Seatbelt webbing showing example of torn edges. If vehicle was in an accident replace complete seatbelt assembly with buckle. If vehicle was not in an accident and damage is from other sources, it is permissible to replace only the belt.

Inertia reel, checking

- Pull belt out of reel with a firm and sudden jerk. Seatbelt should lock immediately.
- Road test from 20 km/h (13 mph) by applying brakes suddenly to simulate an emergency stop. Seatbelt should lock immediately.
- If belt does not lock, check mounting position and correct as necessary.
- If belt does not lock and mounting is in order, replace complete seatbelt assembly.

> ***WARNING —***
> *For safety reasons, the road test should be done on a traffic-free stretch of road or parking lot to ensure safety to the vehicle and driver as well as other vehicles and pedestrians.*

Belt buckle latch, checking

- Inspect belt latch and buckle for cracks and breaks.
- If there is any indication of cracking or breakage, replace complete seatbelt assembly
- Inspect belt latch and buckle for proper operation by inserting latch into buckle a minimum of 5 times. Latch should engage buckle firmly and securely with an audible clicking sound and should not pull apart.
- If latch and buckle do not engage smoothly or firmly, or come apart when pulled, replace complete seatbelt assembly.

Belt buckle release, checking

– Engage latch and buckle with no tension on the belt (slack) and push release button a minimum of 5 times. Latch must spring out of belt buckle on its own.

– If latch fails to spring out of belt buckle, replace complete seatbelt assembly.

Belt guides and latch tongue, checking

– Inspect plastic guides for deformation, scoring and fractures due to accident. Do not confuse smooth wear marks which are normal due to frequent use.

– If deformation, scoring or fractures are present, replace complete seatbelt assembly.

Seatbelt mounting components and anchorage points, checking

– Check latch and bracket for deformation or stretching.

– Check function of height adjuster.

– Check anchorage points on B-pillar, seat and floor for distortion, damage and proper torque.

– If distortion or damage is present, repair or replace components as required. Torque fasteners to specification.

Automatic retractor mechanism, checking

– Check retractor mechanism for smooth operation when seatbelt is pulled out and smooth operation when belt is reeled in.

– Ensure that seatbelts equipped with child seat feature operate properly when seatbelt is pulled completely out.

– Ensure that seatbelt is not twisted.

– If retractor mechanism does not operate properly, replace seatbelt retractor.

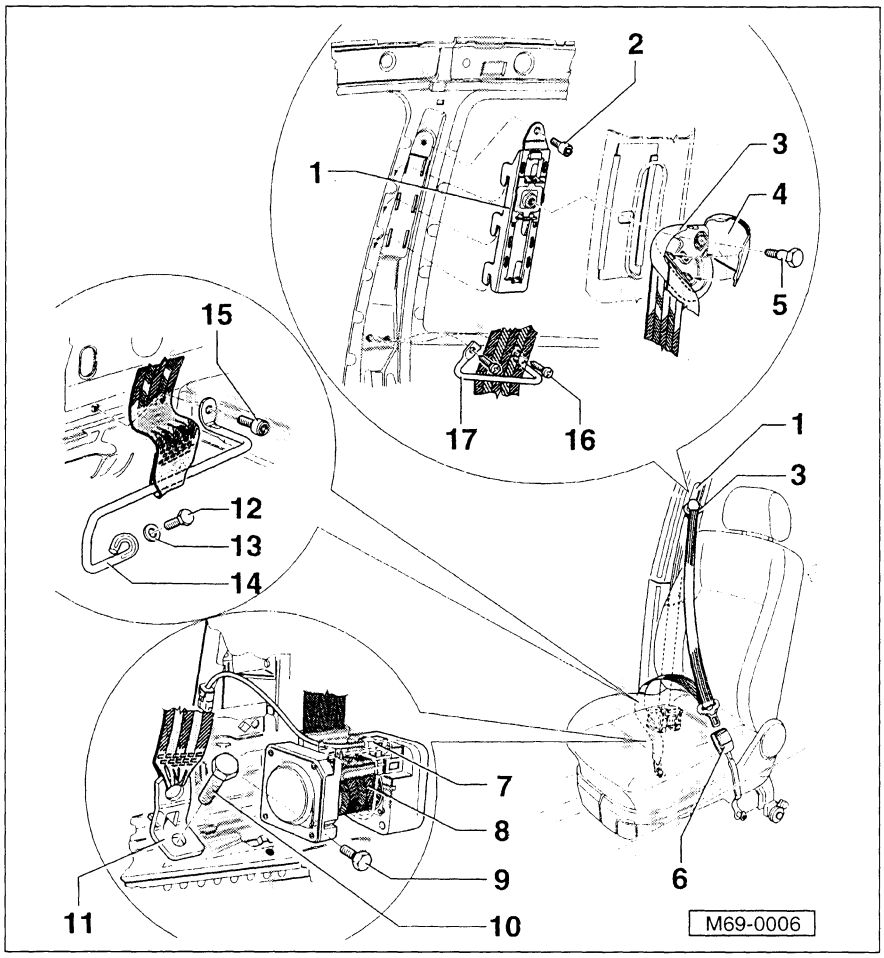
– If front pyrotechnic seatbelts do not retract, they have been deployed and are no longer usable. They must be replaced.

WARNING —

• Observe all cautions, warnings and notes before starting repairs involving airbag systems.

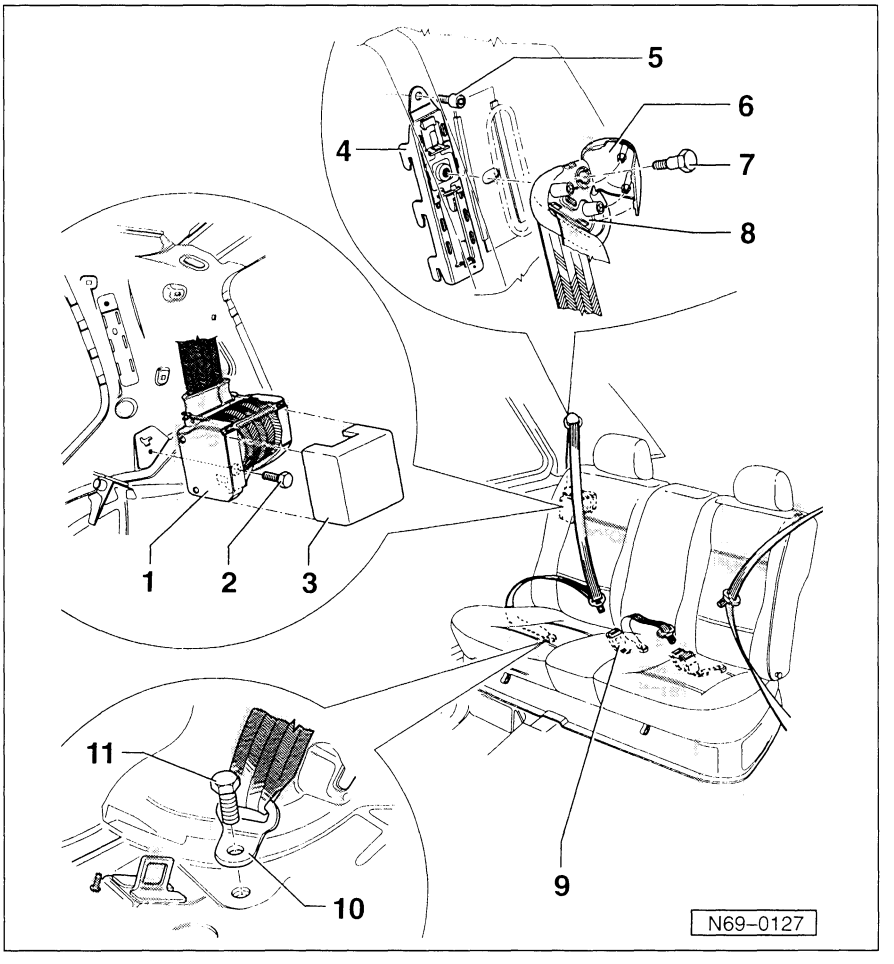
• Before starting any body disassembly, straightening or other body repair work, the belt tensioning units must be removed.

Front seatbelt assembly



1. **Belt height adjuster**
   - To remove height adjustment mechanism, first remove trim on top of B-pillar
2. **Screw**
   - Tighten to 23 Nm (17 ft-lb)
3. **Belt relay/guide**
4. **Belt relay/guide cover**
5. **Bolt**
   - Tighten to 40 Nm (30 ft-lb)
6. **Front belt buckle (latch)**
7. **Connector**
   - For electrically deployed belt tensioner only
8. **Seatbelt with belt tensioner**
   - Two different seatbelt tensioners are installed depending on vehicle production date
   - Mechanically activated with pyrotechnic tensioner for vehicles without side airbags
   - Electrically deployed via airbag system for vehicles with side airbags
   - After an accident in which one or both belt tensioners have been deployed (triggered), both seatbelts must be replaced (the belts will no longer retract)
   - Retaining tabs determine position of belt reel in mount
   - To remove, first remove lower B-panel trim and sill panel trim, see **70 Trim–Interior**
   - The disposal of old components that have not been deployed (triggered) is done by the manufacturer
9. **Bolt**
   - Tighten to 40 Nm (30 ft-lb)
   - Loosen bolt to prevent belt tensioner from deploying during repairs (mechanical tensioner only)
   - Tighten bolt to return tensioner to operational condition after repairs (mechanical tensioner only)
10. **Bolt**
    - Only on 4-door models
    - Tighten to 40 Nm (30 ft-lb)
11. **Lower belt mount**
    - Tighten to 1.5 Nm (13 in-lb)
12. **Bolt**
    - Only on 2-door models
    - Tighten to 40 Nm (30 ft-lb)
13. **Washer**
    - Only on 2-door models
14. **Guide bracket**
    - Only on 2-door models
15. **Bolt**
    - Only on 2-door models
    - Tighten to 23 Nm (17 ft-lb)
16. **Screw**
17. **Belt guide**
    - Secured with two screws

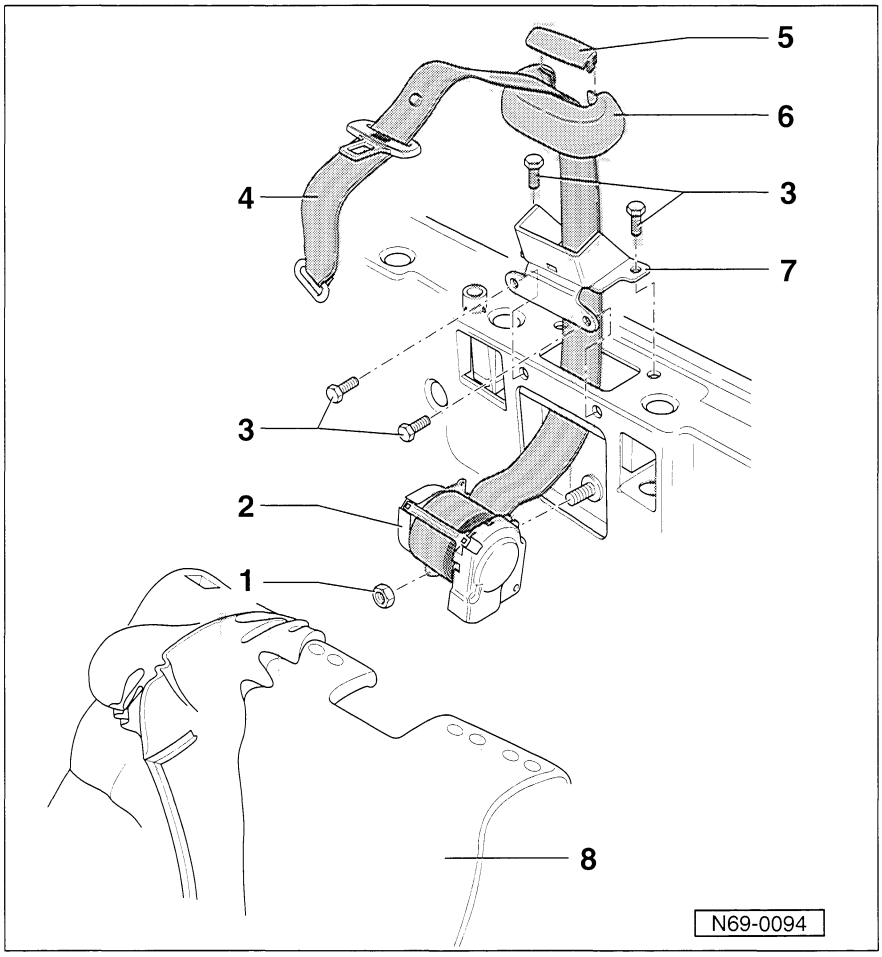
Rear seatbelt assembly

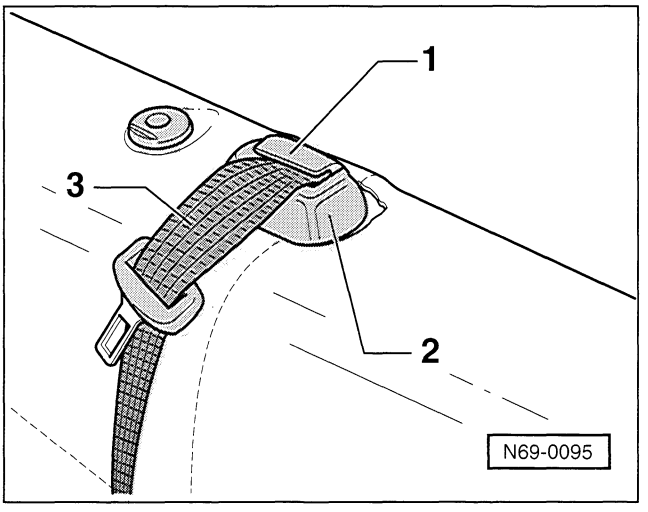


1. **Belt inertia reel**
   - Retaining tabs determine position of belt reel in mount
   - Removing:
     Pull up rear seat bottom and fold forward
     Release rear seat back rest and fold forward
     Remove support for luggage compartment cover, see **70 Trim –Interior**
     Unclip luggage compartment trim in area of belt inertia reel
     Remove belt inertia reel (item 1), belt relay (item 8), and lower anchorage (item 10)
2. **Bolt**
   - Tighten to 40 Nm (30 ft-lb)
3. **Sound deadener**
   - On belt inertia reel
4. **Belt height adjuster**
   - Remove C-pillar trim to access, see **70 Trim–Interior**
5. **Socket head screw**
   - Tighten to 23 Nm (17 ft-lb)
6. **Cover cap for belt guide**
7. **Bolt**
   - Tighten to 40 Nm (30 ft-lb)
8. **Belt guide**
9. **Belt latch**
10. **Lower anchorage**
11. **Bolt**
    - Tighten to 40 Nm (30 ft-lb

Rear center seatbelt assembly

1. **Nut**
   - Tighten to 40 Nm (30 ft-lb)
2. **Belt inertia reel**
   - Removing, see **Rear center seatbelt guide, removing**
3. **Mounting bolts**
   - Qty. 4
   - Tighten to 23 Nm (17 ft-lb)
4. **Seatbelt**
5. **Cover**
   - Remove first when removing seatbelt
   - Removing, see **Rear center belt reel, removing**
6. **Belt guide**
7. **Belt mount**
8. **Rear seat backrest**



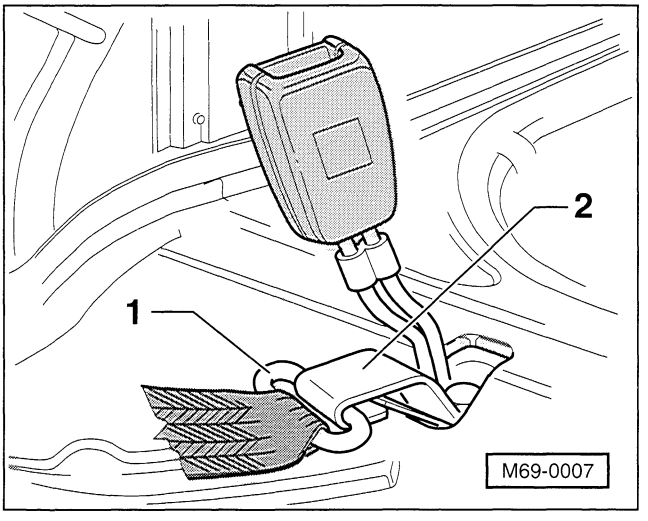


Rear center seatbelt guide, removing

➤ Pry off cap (**1**) and belt guide (**2**) carefully with screwdriver.

Rear center belt reel, removing

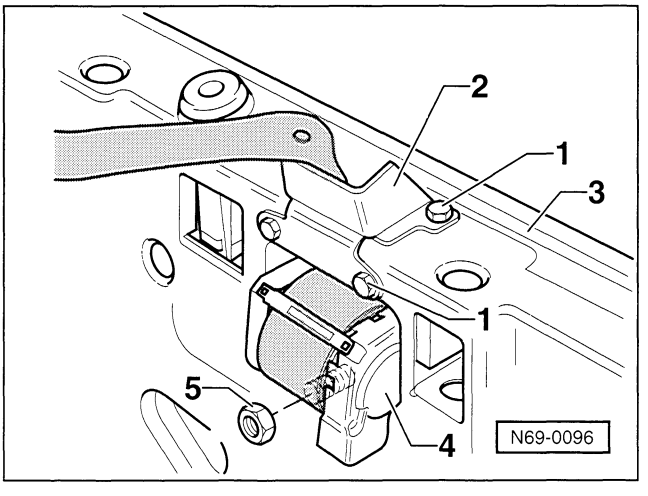
– Remove cap and belt guide as shown above.



➤ Unhook seatbelt bracket from lower mount.

– Remove head restraint guides, see **72 Seats**.

– Release seat back rest cover and padding, see **72 Seats**.



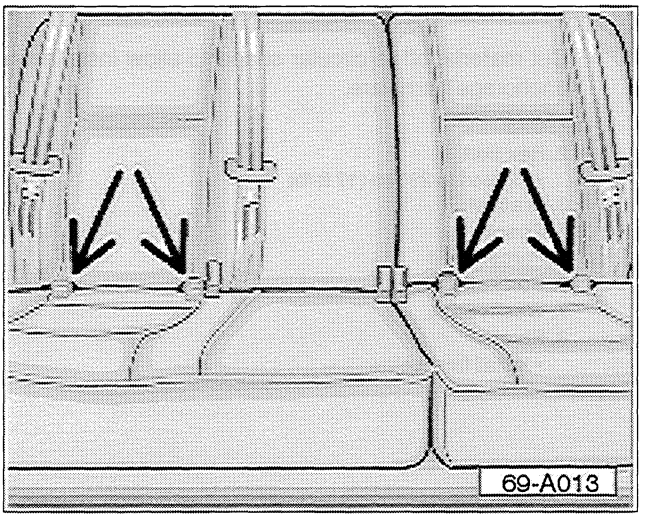
➤ Remove belt reel mounting bolts (**1**) and remove seatbelt mount (**2**) from backrest frame (**3**).

– Remove hex nut (**5**) and unhook inertia reel (**4**) from backrest frame.

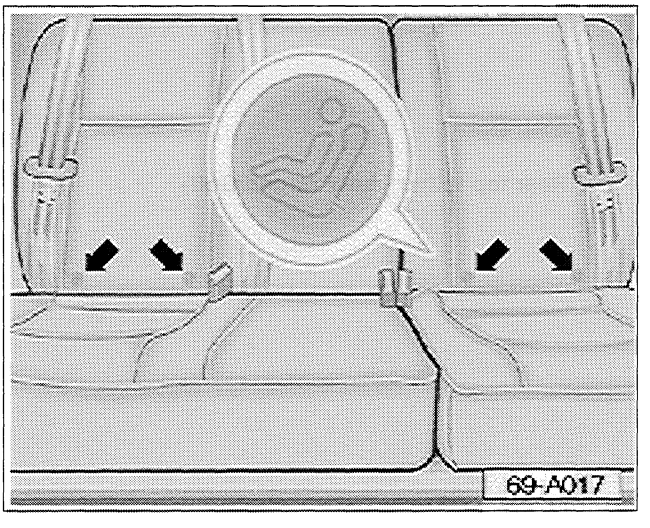
– Guide seatbelt with belt tongue downward from backrest frame.

– Belt reel must be held upright to unreel seatbelt.

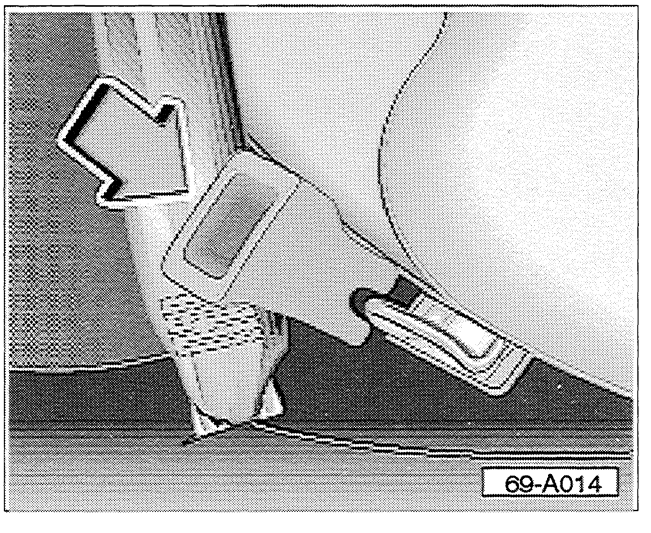
Child restraint LATCH guidance fixture, installing



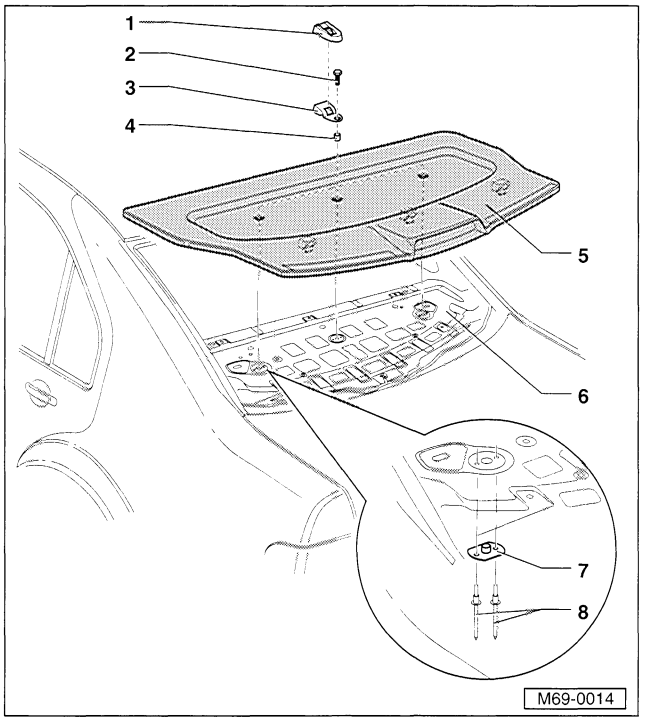
- Locate four anchorage bars between rear seat back and cushion (**arrows**).



- From **January 2001** production, vehicles are equipped with buttons (at **arrows**) to identify rear anchor points.



- Install LATCH guidance fixture (**arrow**) by snapping over anchorage bars. Part number on LATCH guidance fixture must face down when installed.



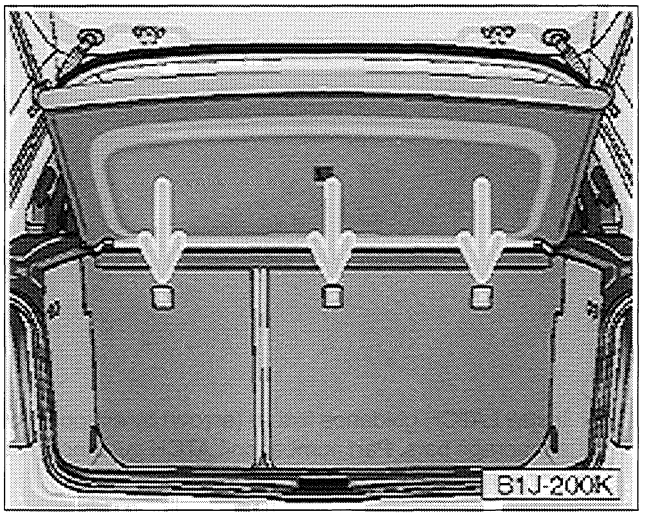
Rear top LATCH tether (Jetta sedan)

To install, locate pre-drilled anchorage holes in parcel shelf

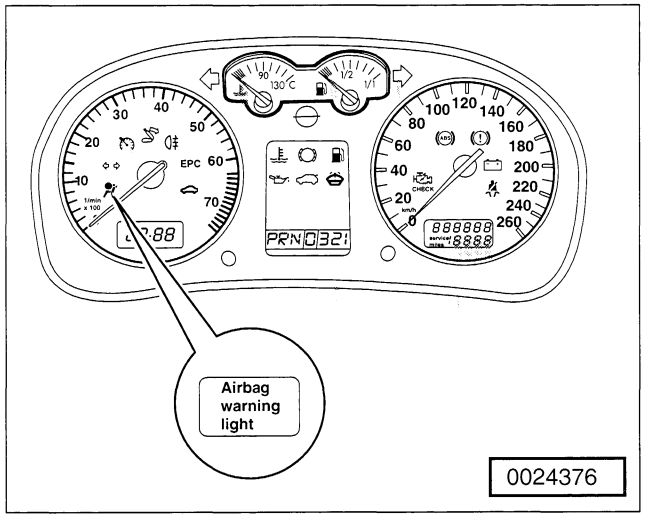
– Cut material off in circular shape to allow installation of anchorage hardware.

1. Cap
2. Hex bolt
- Tighten to 23 Nm (17 ft-lb)

3. Bracket
4. Spacer
5. Parcel shelf
6. Body sheet metal
7. Washer nut
8. Rivets
- Install from below



Rear top tether (Jetta wagon/Golf)



AIRBAGS

Diagnostics, component testing and repair of the airbag system should only be carried out by properly trained Volkswagen technicians using specialized test equipment.

When the ignition key is turned on, the airbag warning light will illuminate for approximately 5 seconds. The illuminated light indicates the self-test of the air bag electronic control module, and all of the related electronic components. If all monitored systems are operating normally, the light will go out. If the warning light does not go out after approximately 5 seconds, or if it comes on at any time while driving, the system has detected a fault and will not operate. In this case, the vehicle should be inspected by an authorized Volkswagen Dealer.

If the vehicle has been involved in an accident where the airbag was deployed, Volkswagen specifies that the following components must be replaced:

- All airbag units that have been deployed
- Passenger side airbag support
- Airbag control module and sensors
- Airbag spiral spring/slip ring
- Deployed front seatbelt tensioners

In addition, the following must also be replaced if necessary:

- All damaged components including, but not limited to, seat frames, seat covers and rear seatbelts

In the event of an accident where the airbags have not been deployed, observe the airbag system warning light. If the airbag system warning light does not indicate a fault, it is not necessary to replace any airbag components.

Airbag equipped vehicles have a fuel crash shut-off. This is intended to reduce the risk of vehicle fire following a crash by switching off the fuel pump via the fuel pump relay.

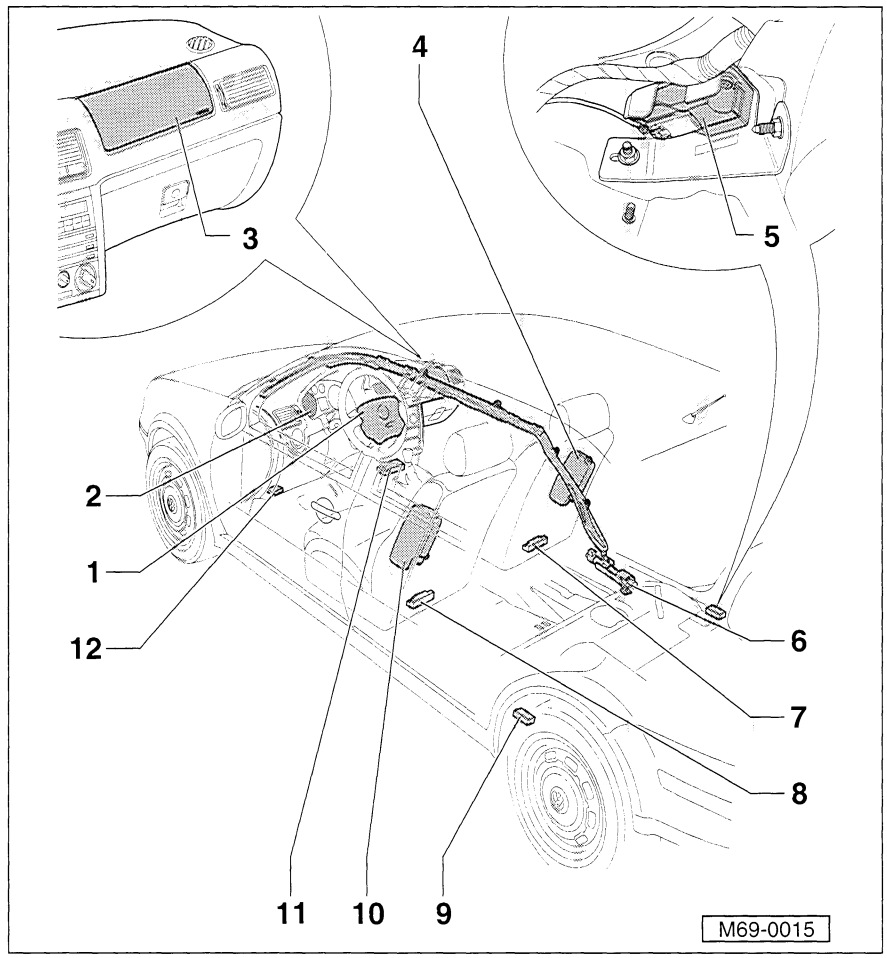
Special precautions for airbag equipped vehicles

Special service precautions must be followed to prevent possible serious bodily injury to the repair technician and others involved in the handling and storage of airbag components and to insure proper operation in the event of a collision.

WARNING —

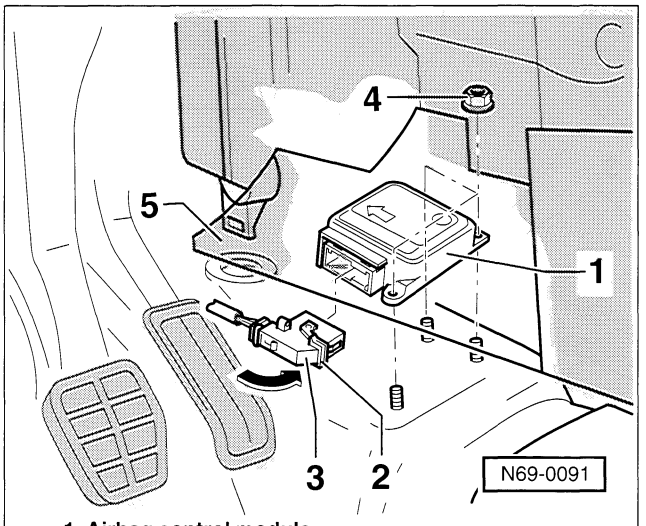
- *Before working on any airbag, steering wheel or steering column component, always **disconnect the battery first.***
- *No waiting time is required after disconnecting the battery. Airbag systems can be worked on immediately.*
- *Airbags are inflated by an explosive device. Handled improperly or without adequate safeguards and training, the system can be very dangerous. Special precautions must be observed prior to any work at or near the steering wheel and steering column including the pedal assembly.*
- *The airbag is a vehicle safety system. To guard against personal injury or airbag system failure, only factory trained Volkswagen service technicians should test, disassemble or service the airbag system.*
- *Airbag units that have been dropped onto a hard surface must not be installed. Always replace any airbag system component that has been mechanically or physically damaged (example: dented or cracked).*
- *Make sure that no one is in the passenger compartment when connecting the battery Ground (GND) strap.*
- *A technician must be electrostatically discharged before picking up or touching any airbag unit. This is accomplished by touching a suitable metal ground such as a water or heating pipe or metal frame. If in the vehicle, this is accomplished by touching a suitable chassis ground such as a door latch or striker.*
- *Install new airbag unit as soon as the unit is removed from the packaging. Reinstall in packaging if work will not be completed immediately.*
- *Do not leave any undeployed airbag unit unattended. If work is interrupted, store airbag unit in a secure location where it cannot be disturbed.*
- *Undeployed airbag units that have been replaced must only be stored and shipped in packaging designed specifically for the purpose, such as packaging found with the replacement unit.*
- *Undeployed airbag units that have been replaced must be properly identified as such.*
- *The storage and transportation of airbag units must be in accordance with all applicable Federal, State and Local rules and regulations.*
- *Airbag units that have been removed during the course of repairs must be stored with the padded side facing up and in a secure location where it cannot be disturbed.*
- *Observe all cautions, warnings and notes before starting repairs involving airbag systems.*

Airbag system, overview



1. **Airbag unit, driver's side**
   - With airbag igniter (N95)
2. **Airbag malfunction indicator lamp (K75)**
   - Location: in instrument cluster
3. **Airbag unit, front passenger**
   - With airbag igniter (N131)
4. **Side airbag unit, front passenger**
   - With airbag igniter (N200)
   - Location: in right front seat backrest frame
5. **Impact sensor, rear passenger side**
   - Location: bolted to body under rear wheelhouse trim
6. **Side curtain protection**
   - Driver side Jetta sedan model shown
   - Located in driver and passenger side roof pillars
7. **Impact sensor, side airbag, front passenger (G180)**
   - Location: bolted to right front floor crossmember under passenger seat
8. **Impact sensor, side airbag, driver (G179)**
   - Location: bolted to left front floor crossmember under driver seat
9. **Impact sensor, rear driver side**
   - Location: bolted to body under rear wheelhouse trim
10. **Side airbag unit, driver side**
    - With airbag igniter (N199)
    - Location: in left front seat backrest frame
11. **Airbag control module (J234)**
    - Location: on tunnel under center console
12. **Data link connector**
    - Location: left lower side of instrument panel
    - If replacing any airbag unit or airbag control module, consult your authorized Volkswagen Dealer's Parts Department for the proper registration procedure

WARNING —
Before working on any airbag component always ***disconnect the battery first.***



1. Airbag control module
- Must be electronically coded before installing

2. Locking bar
- Swing in opposite direction of arrow to release harness connector

3. Harness connector

4. Nuts
- Tighten to 9 Nm (80 in-lb)

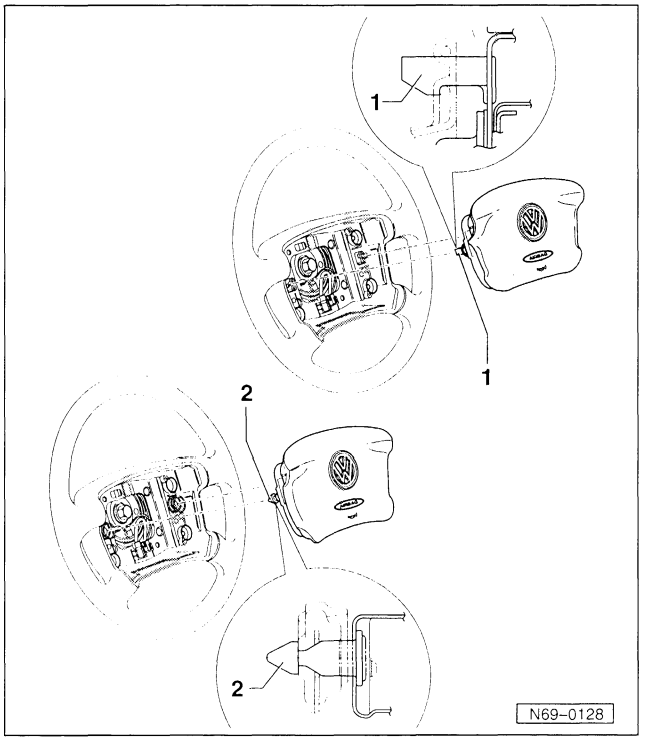
5. Footwell trim

Airbag control module

The airbag control module is mounted to the floor on the tunnel near the base of the bulkhead. To access the control module, remove the footwell trim, see **70 Trim–Interior**. Be sure to disconnect battery ground (GND) strap from battery negative (–) terminal before removing control module. See the **Cautions** at the beginning of this repair group regarding battery disconnection.

> ***WARNING —***
> - *Observe all cautions, warnings and notes before starting repairs involving airbag systems.*
> - *Disconnect battery Ground (GND) strap before disconnecting or removing the airbag control module.*

Most service and repair to the airbag system requires the use of a scan tool such as the Volkswagen VAG 1551/1552 or equivalent. Access for diagnosis, including coding of replacement control modules is via the Data Link Connector (DLC) which is below the driver's side of the dashboard. Replacement airbag control modules are shipped uncoded and will not function when installed. Because of the specialized nature of these repairs, servicing should be referred to an authorized Volkswagen Dealer or qualified independent repair shop. Proper airbag control module coding is derived from the airbag control module part number as reported by the scan tooi. For a listing of airbag control module codings, refer to the **Scan Tool** section at the back of this manual. Always verify vehicle equipment when installing and coding a new airbag control module.



Airbag unit in 4-spoke steering wheel, distinguishing features

Four spoke steering wheels and airbags are supplied by two different manufacturers, Petri and TRW.

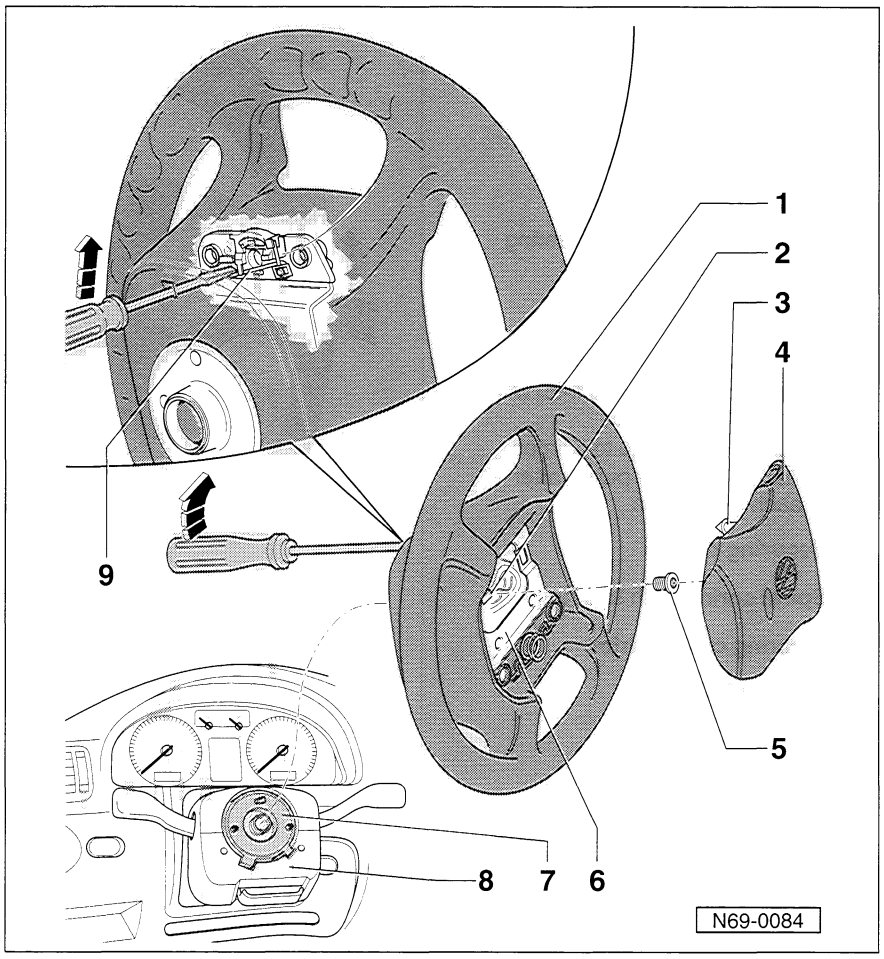
1. Petri airbag, mounting stud
- Rectangular, see inset

2. TRW airbag, mounting stud
- Stepped, see inset

> ***WARNING —***
> *Use only 4-spoke steering wheels, airbags and replacement parts supplied by the same manufacturer due to the different mounting studs of the various airbags.*

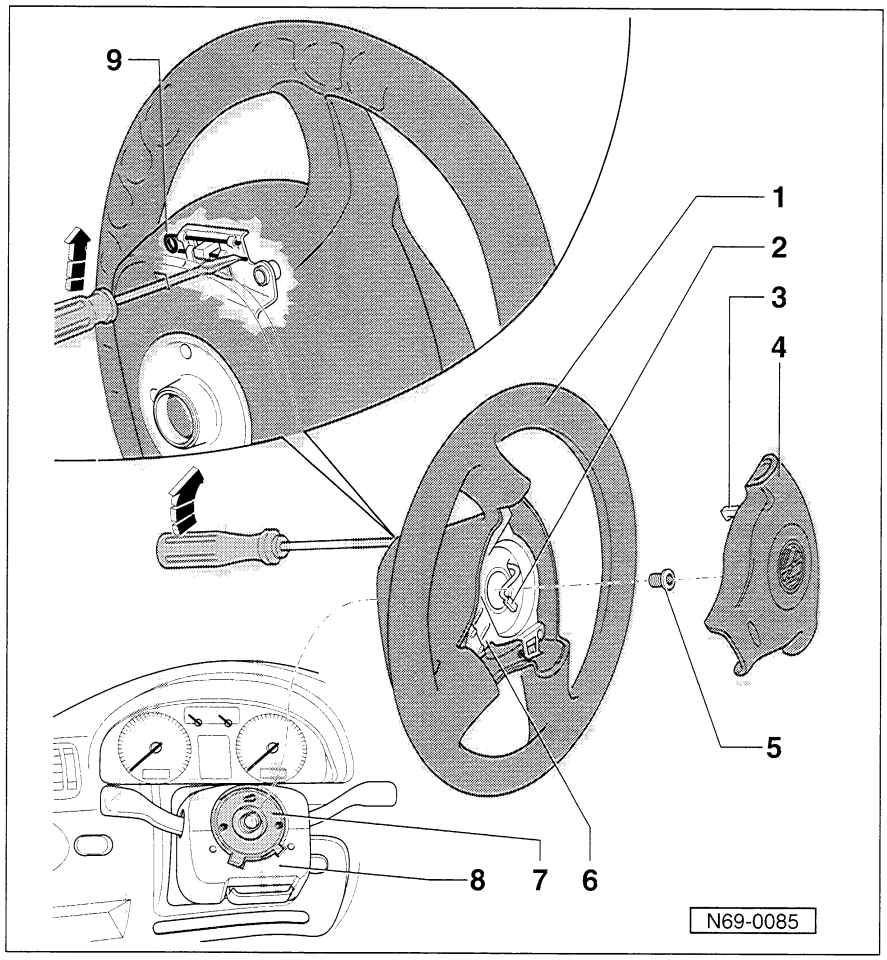
4-spoke steering wheel and airbag

1. **Steering wheel**
2. **Connector**
3. **Locking lug**
   - Release from rear of steering wheel
4. **Airbag unit**
   - Because of differing engaging mechanisms, only steering wheel and airbags units from the same supplier can be installed.
5. **Bolt, multi-point socket-head**
   - Tighten to 55 Nm (40 ft-lb) with locking compound
   - Can be reused up to 5 times
   - Mark with center punch after each installation
6. **Securing plate**
7. **Spiral spring with slip ring**
8. **Steering column trim**
9. **Spring clip**



3-spoke steering wheel and airbag

1. **Steering wheel**
2. **Connector**
3. **Locking lug**
   - Release from rear of steering wheel
4. **Airbag unit**
5. **Bolt, multi-point socket-head**
   - Tighten to 55 Nm (40 ft-lb) with locking compound
   - Can be reused up to 5 times
   - Mark with center punch after each installation
6. **Securing plate**
7. **Spiral spring with slip ring**
8. **Steering column trim**
9. **Spring clip**



Airbag unit in steering wheel, removing and installing

Removal of the steering wheel airbag unit is accomplished by inserting a tool into openings in the dashboard side of the steering wheel.

> ***WARNING —***
> *Observe all cautions, warnings and notes before starting repairs involving airbag systems.*

- Disconnect battery ground (GND) strap from battery negative (–) terminal. See the **Cautions** at the beginning of this repair group regarding battery disconnection.
- Release steering column adjustment lever.
- Turn steering wheel until a spoke is vertical. Extend steering column out fully toward driver.
- Secure steering column adjustment lever.
- Using a screwdriver approximately 175 mm (7 in.) long, insert approximately 45 mm (1¾ in.) from reverse side into hole on dashboard side of steering wheel hub.

  NOTE —
  If a screwdriver with a very short handle is used, it is possible to eliminate step 2 and leave the instrument cluster in place.

- Press screwdriver upward to press back spring clip and release locking lug of airbag unit.
- Turn steering wheel back ½ turn (180°) and release second locking lug on opposite side.
- Turn steering wheel to center position (wheels straight ahead).
- Disconnect harness connector from airbag unit.
- Place the removed airbag unit in a secure location with the padding side facing up.
- Begin installation by connecting harness connector for airbag unit.
- Position airbag unit on steering wheel and snap into place until retaining tabs are locked.

  NOTE —
  Airbag unit locking lugs must be heard and felt to snap into place.

- Switch ignition on.
- Connect battery ground strap.

WARNING —

- *Make sure the passenger compartment is not occupied before connecting the battery Ground (GND) strap.*
- *Observe all cautions, warnings and notes when completing repairs involving airbag systems.*

Airbag slip ring, removing and installing

WARNING —

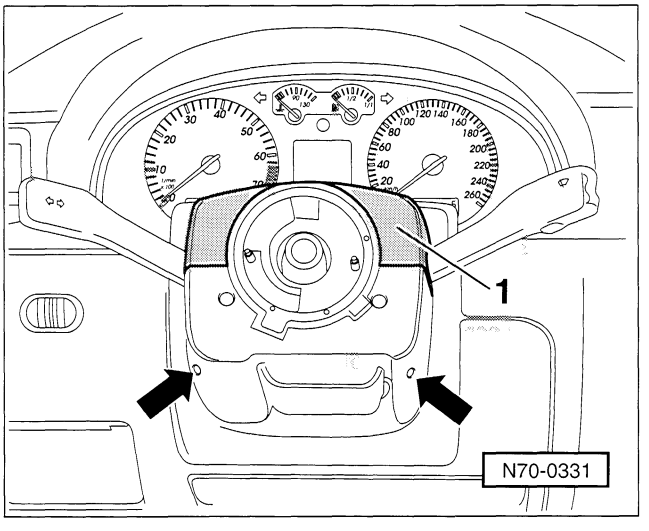
Observe all cautions, warnings and notes before starting repairs involving airbag systems.

– Turn the wheels to the straight ahead position.

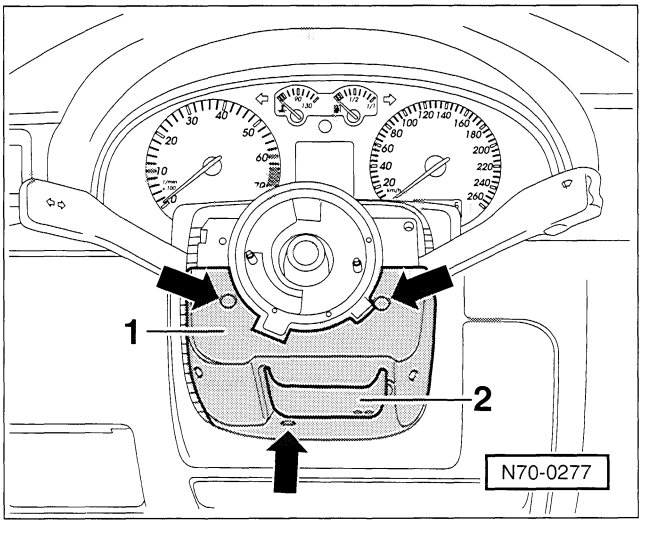
– Disconnect battery ground (GND) strap from battery negative (–) terminal. See the **Cautions** at the beginning of this repair group regarding battery disconnection.

– Remove airbag unit in steering wheel as described earlier.

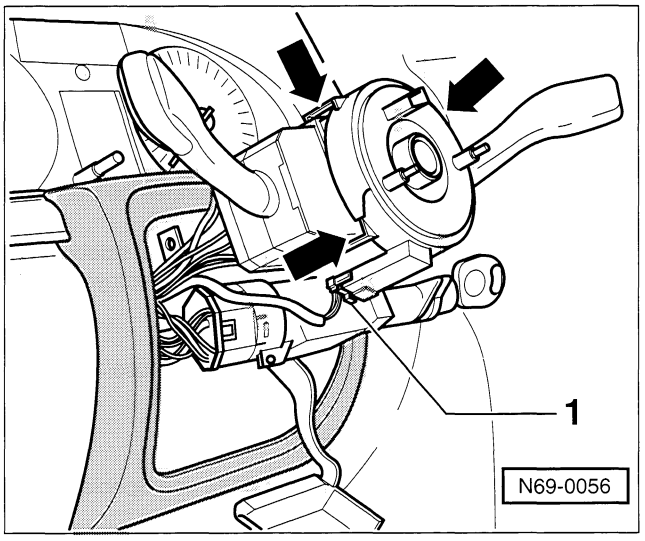
– Remove steering wheel.



➤ Remove screws (**arrows**) for steering column upper trim.



➤ Remove screws (**arrows**), release steering height adjustment lever (**2**), and pull off steering column lower trim (**1**).



➤ Remove spiral spring/slip ring by releasing lugs (**arrows**) and unplugging harness connector (**1**).

NOTE —
Steering wheel must be in center position (wheels pointed straight ahead) when harness connector and slip ring are removed and installed.

– Installation is the reverse of removal.

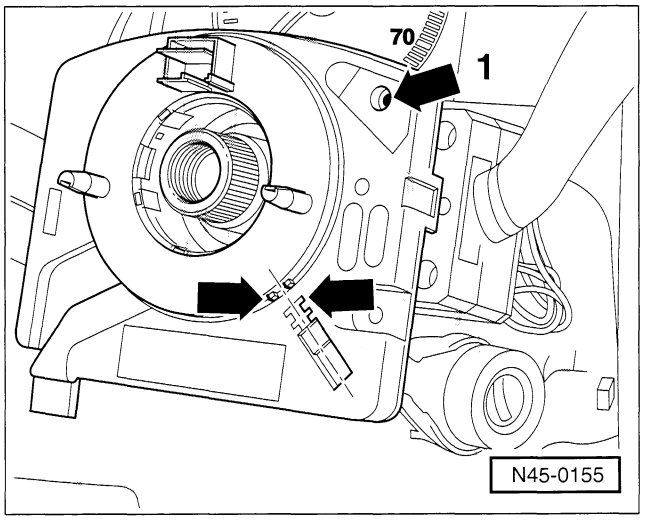
WARNING —
Observe all cautions, warnings and notes when completing repairs involving airbag systems.

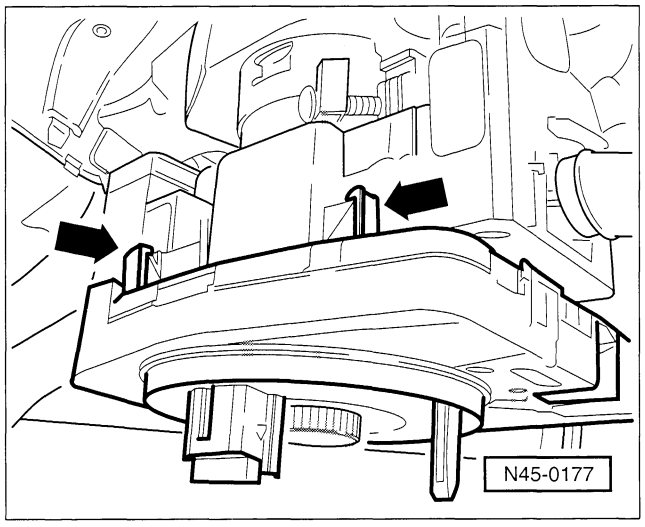
Vehicles with ESP (Electronic Stability Program)

Vehicles with ESP are additionally equipped with a steering angle sensor (G85). This sensor is installed in conjunction with coil connector and slip ring in a housing.

– Position front wheels in straight ahead position.

➤ Check to see that a yellow spot is visible through hole (**1**) and that the marking (**arrow**) aligns as shown.

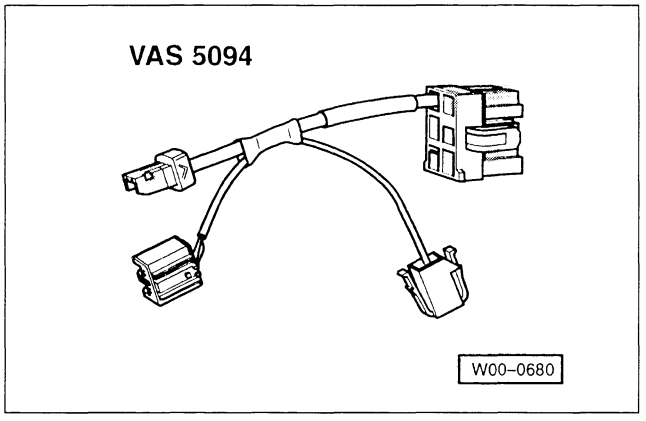


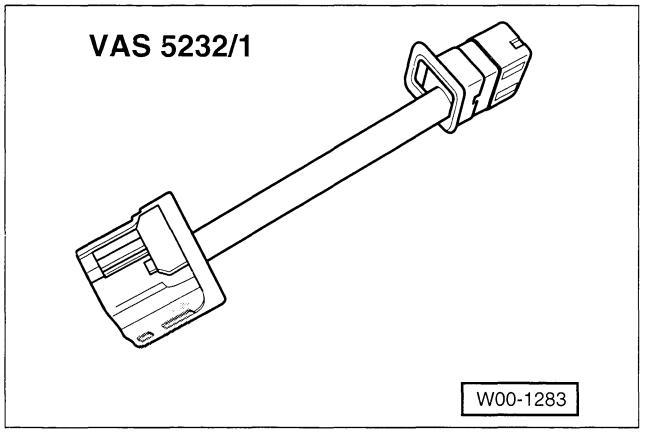


➤ Lift hooks (**arrows**) carefully and pull off steering angle sensor.

– Install in reverse order of removal noting the following:
- When installing steering wheel, steering angle sensor must be correctly seated and free of stress.
- Check for yellow spot and alignment of markings as described above after installing steering angle sensor housing.
- Remove securing cable tie if installing new steering angle sensor.

– Perform zero compensation using diagnostic scan tool VAG 1551/1552 or equivalent.





Side airbag unit safety harness

Both driver's and passenger's front seats are equipped with airbags mounted in the seat backrest frames. These airbags are designed to deploy under certain side impact conditions and are triggered by separate sensors mounted to the front floor crossmembers under the front seats.

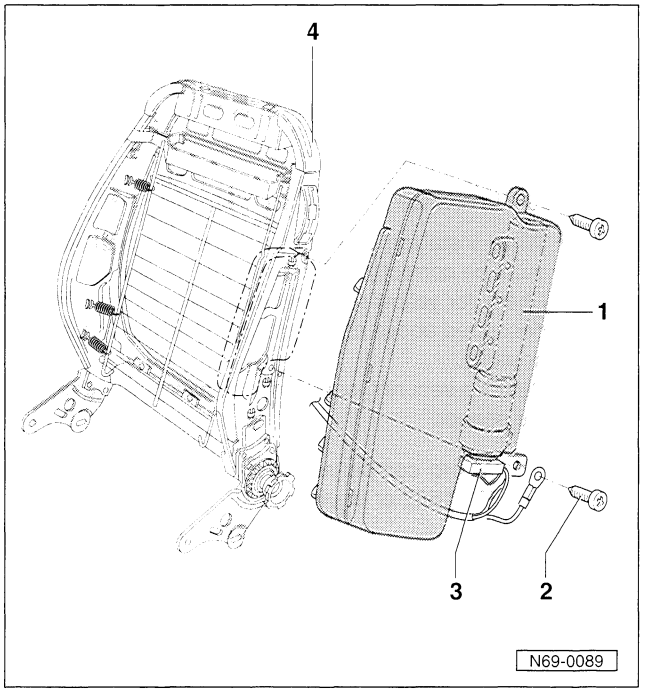
– Before removing the front seats, a special safety harness must be installed to prevent accidental deployment of the airbag units.

➢ For vehicles produced **through 07/00**, use Special tool VAS 5094.

➢ For vehicles produced **from 08/00**, use Special tool VAS 5232/1.

WARNING —

- *Observe all cautions, warnings and notes before starting and when completing repairs involving airbag system.*
- *Volkswagen of America specifically warns against the installation of aftermarket upholstery on any vehicle equipped with side airbags. The factory-installed upholstery is designed to separate in specific places at specific rates, and in specific directions. Installation of non-factory upholstery including, but not limited to, "beads" and "sheepskins", may cause seat mounted airbags to deploy when they are not supposed to; fail to deploy when they should; or to deploy in some manner other than designed. This is a safety hazard and could result in serious injury or death to occupants of the vehicle.*



Side airbag assembly

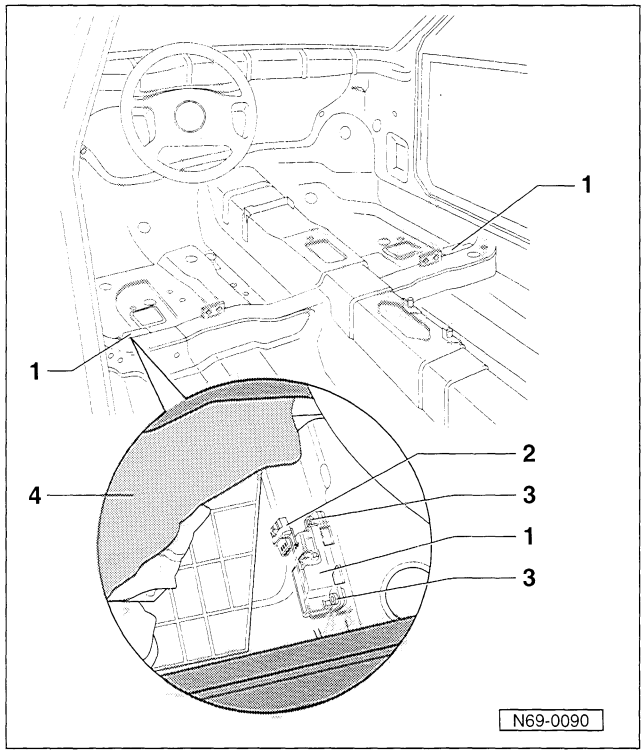
➢ Driver's side shown, passenger side similar

1. Side airbag unit

2. Bolt
- Tighten to 7 Nm (62 in-lb)

3. Harness connector
- When removing airbag, disconnect battery ground strap before disconnecting harness connector
- When installing airbag, connect harness connector, switch on ignition and then connect battery

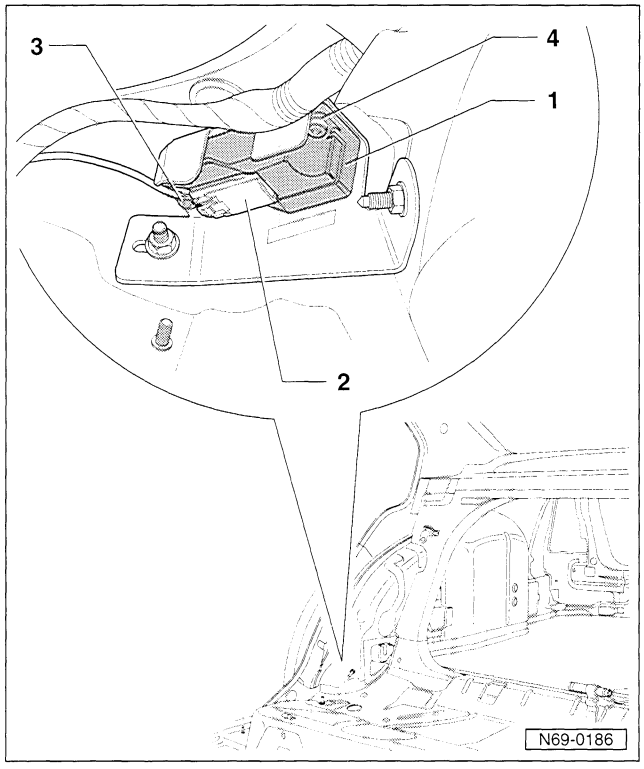
4. Seat backrest frame



Front impact sensor, side airbags, overview

Driver's side shown, passenger side similar

1. **Impact sensors, side airbag**
2. **Harness connector**
   - When removing sensor, disconnect battery ground strap before disconnecting harness connector
   - When installing sensor, connect harness connector, switch on ignition, close doors and then connect battery
3. **Bolt**
   - Tighten to 6 Nm (53 in-lb)
4. **Carpeting and sound absorber padding**



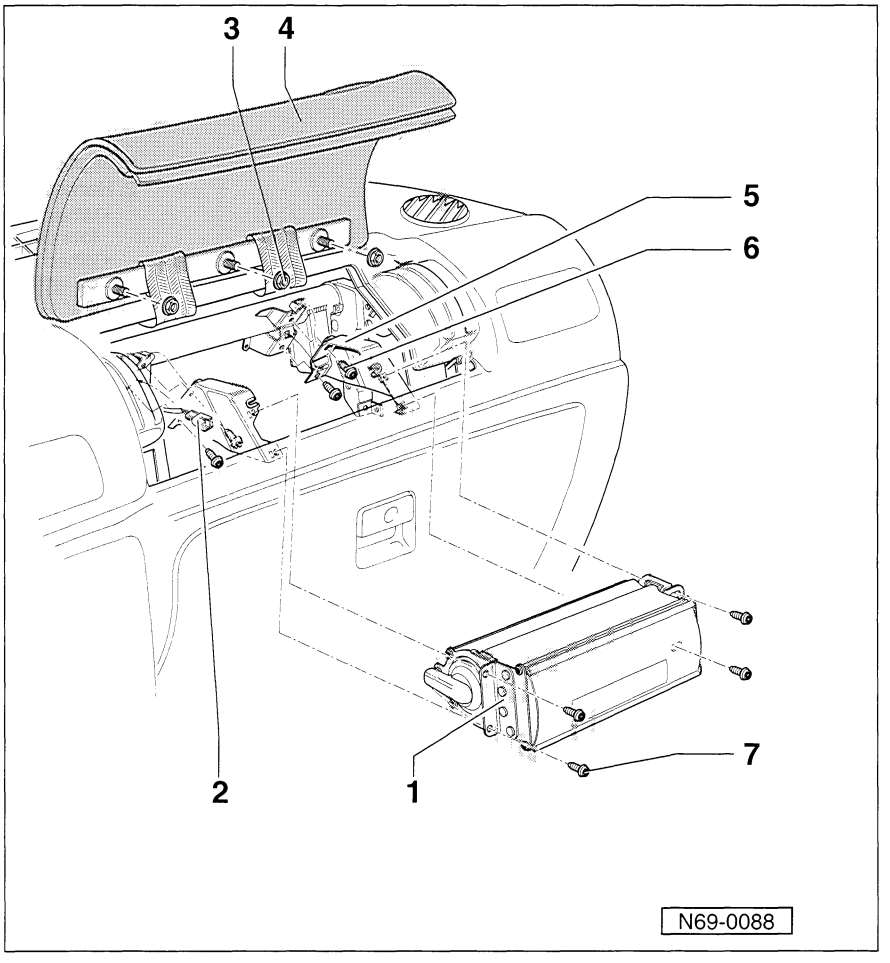
Rear impact sensor, side curtain airbags, overview

Passenger side shown, driver's side similar

1. **Impact sensor, side curtain airbag**
2. **Harness connector**
   - When removing sensor, disconnect battery ground strap before disconnecting harness connector
   - When installing sensor, connect harness connector, switch on ignition, close doors and then connect battery
3. **Bolt**
   - Tighten to 6 Nm (53 in-lb)
4. **Bolt**
   - Tighten to 6 Nm (53 in-lb)

Airbag unit, front passenger, assembly (with seams in dash for airbag)

1. **Airbag unit, front passenger (N131)**
2. **Airbag harness connector**
   - When removing airbag, disconnect battery ground strap before disconnecting harness connector
   - When installing airbag, connect harness connector, switch on ignition and then connect battery
3. **Nuts**
   - Tighten to 4 Nm (35 in-lb)
4. **Cover panel**
   - Carefully pry up from bottom edge to release
   - Swing up and out of the way
5. **Support**
   - Always replace if airbag has been deployed
6. **Bolts**
   - Tighten to 2.5 Nm (22 in-lb)
7. **Bolt**
   - Tighten to 2.5 Nm (22 in-lb)



Installing

WARNING —

- *Make sure the passenger compartment is not occupied before connecting the battery Ground (GND) strap.*
- *Observe all cautions, warnings and notes when completing repairs involving airbag systems.*

– Connect harness connector (**2**) to airbag.

– Install airbag on supports (**6**).

– Install cover (**5**), if previously removed.

– Press cover until flush with dash.

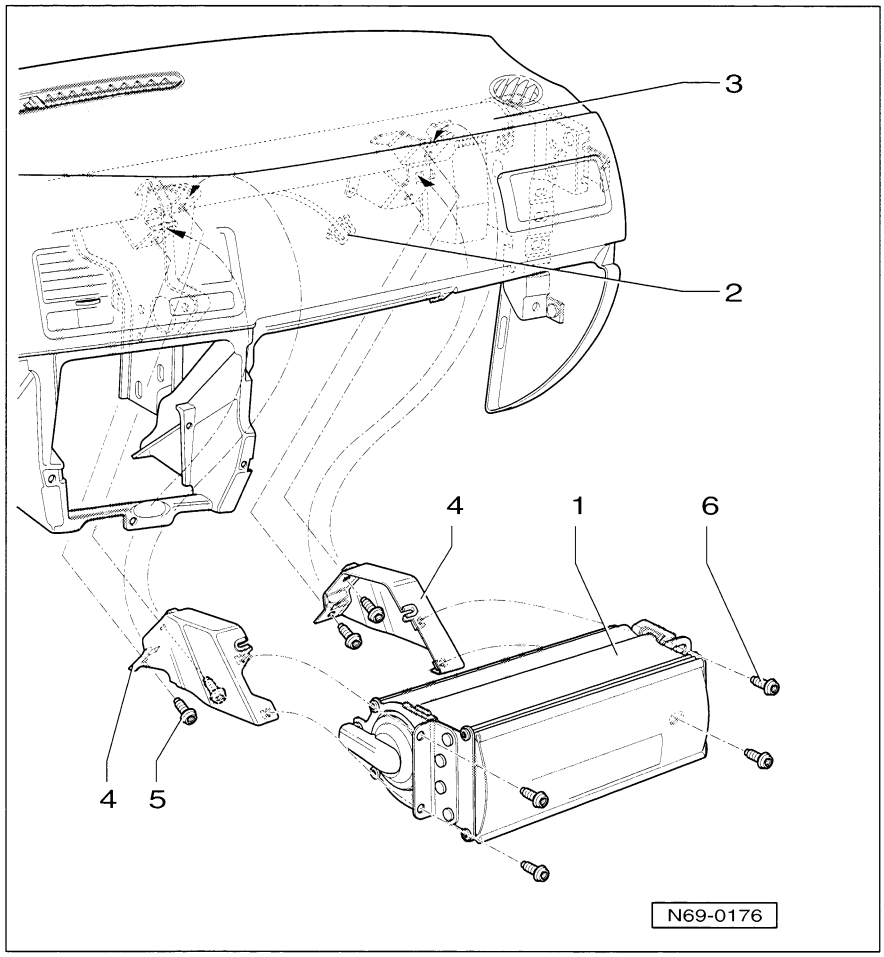
– Switch on ignition.

– Close doors.

– Connect battery ground strap.

Airbag unit, front passenger, assembly (without seams in dash for airbag)

1. **Airbag unit, front passenger (N131)**
2. **Airbag harness connector**
   - When removing airbag, disconnect battery ground strap before disconnecting harness connector
   - When installing airbag, connect harness connector, switch on ignition and then connect battery
3. **Center tube**
4. **Support**
   - Always replace if airbag has been deployed
5. **Torx-head screw**
   - Qty: 4
   - Tighten to 2.5 Nm (22 in-lb)
6. **Torx-head screw**
   - Qty: 4
   - Tighten to 2.5 Nm (22 in-lb)



Removing

- Disconnect battery ground (GND) strap from battery negative (–) terminal. See the **Warnings** at the beginning of this repair group regarding battery disconnection.
- Remove center console and glove box, see **70 Trim-Interior**.
- Remove four Torx-head screws (item **5**).
- Press airbag unit (**1**) along with supports (**4**) up and out of mounting elbow on central tube (**3**).
- Push airbag unit to side and move downward.
- Disconnect electrical harness connector (**2**) from airbag unit. Remove airbag unit.

WARNING —
Before disconnecting the side airbag connector for the seat, a technician must discharge him/herself electrostatically by briefly touching door striker or vehicle body.

Installing

- Install airbag in reverse order of removal.
- Switch on ignition.
- Close doors.
- Connect battery ground strap.

WARNING —
- *Make sure the passenger compartment is not occupied before connecting the battery Ground (GND) strap.*
- *Observe all cautions, warnings and notes when completing repairs involving airbag systems.*

70 Trim–Interior

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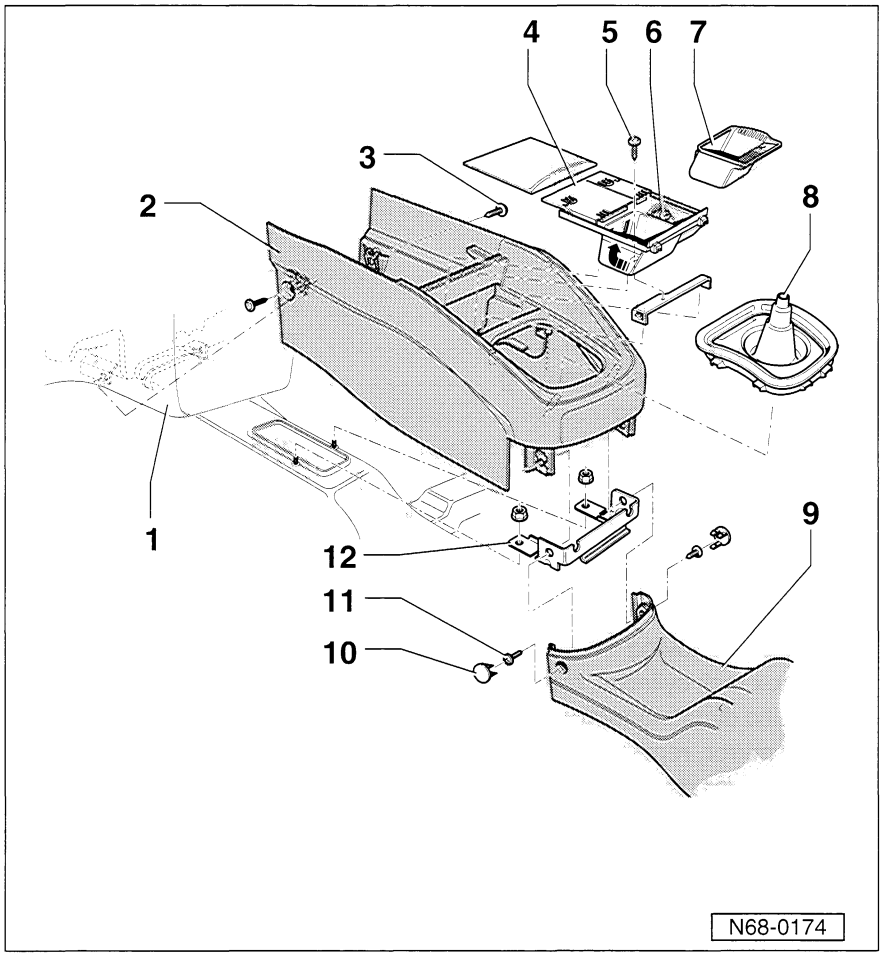
QUALITY REVIEW 70-42

GENERAL

This repair group covers interior equipment and trim panels, including center console and instrument panel removal. For interior lights and accessories see **96 Lights, Accessories–Interior**.

CENTER CONSOLE

Center console assembly



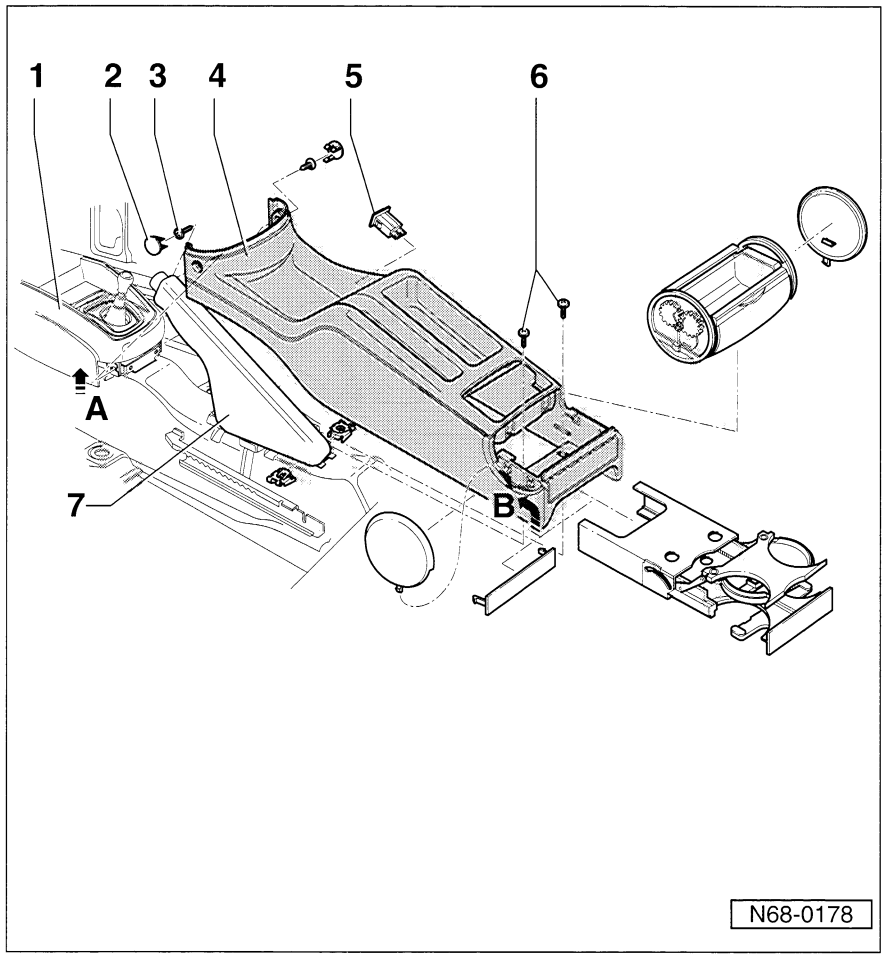
1. **Instrument panel**
2. **Center console**
   - It is not necessary to remove shifter trim plate on vehicles with automatic transmission before removing center console. Automatic shift lever knob will need to be removed, see **37 Automatic Transmission**
   - Removing:
     Unclip cover caps (item **10**) and remove screws (item **11**)
     Unclip shifter boot (item **8**) and pull up
     Pull out ashtray insert (item **7**) and remove screw (item **5**)
     Slide ashtray forward, close lid and pull out (**arrow**) until it is possible to disconnect cigarette lighter connector (item **6**)
     Remove screws (item **3**) and pull center console upward over shift lever to remove
3. **Screws**
   - Qty. 2
4. **Ashtray**
5. **Screw**
6. **Cigarette lighter**
7. **Ashtray insert**
8. **Shifter boot**
9. **Center console extension**
10. **Screw cover**
    - Qty. 2
11. **Screw**
    - Qty. 2
12. **Mounting bracket**

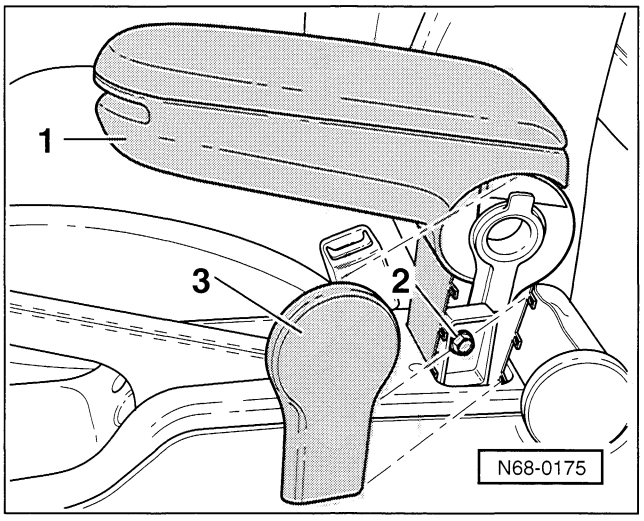
WARNING —

- *Disconnect battery ground (GND) strap from battery negative (–) terminal before working on any components of the electrical system.*
- *Be sure to have radio anti-theft code on hand before disconnecting battery.*
- *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased.*

Center console extension

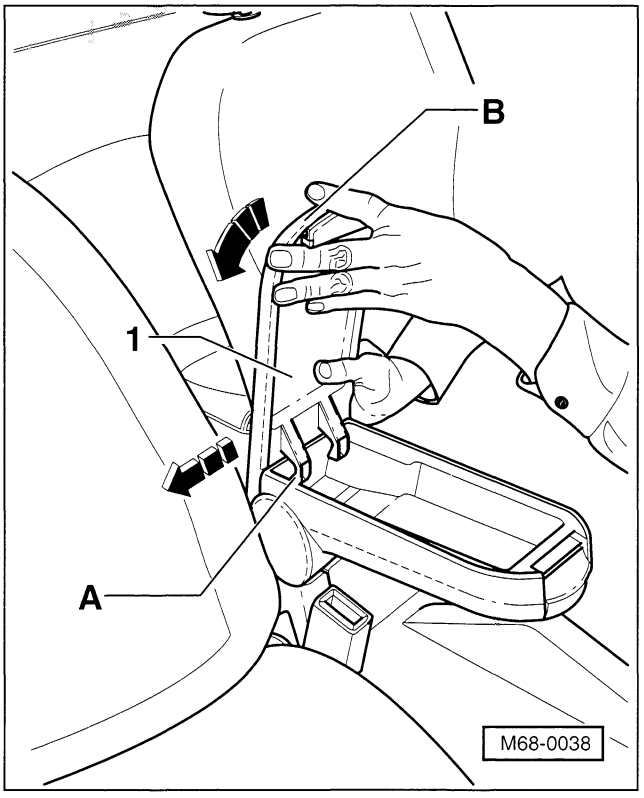
1. **Center console**
2. **Cover caps**
3. **Screws**
   - Qty. 2
4. **Center console extension**
   - It is not necessary to remove shifter trim plate on vehicles with automatic transmission before removing center console.
   - Removing:
     If equipped, remove center armrest, see **Front center armrest, removing**
     Remove rear ashtray, see **Rear ashtray, removing**
   - Center console extension, removing (continued):
     Remove rear cupholder, see **Rear cupholder, removing and installing**
     Pry off cover caps (item **2**)
     Remove screws (item **3**) and pull up parking brake
     Release extension from center console
     Pull up front of extension (**arrow A**), guide rear over center armrest support and pull connector off fuel fill flap switch (item **5**)
     Pull center console extension off forward over parking brake lever (item **7**)
5. **Fuel flap switch**
6. **Screws**
7. **Parking brake lever**





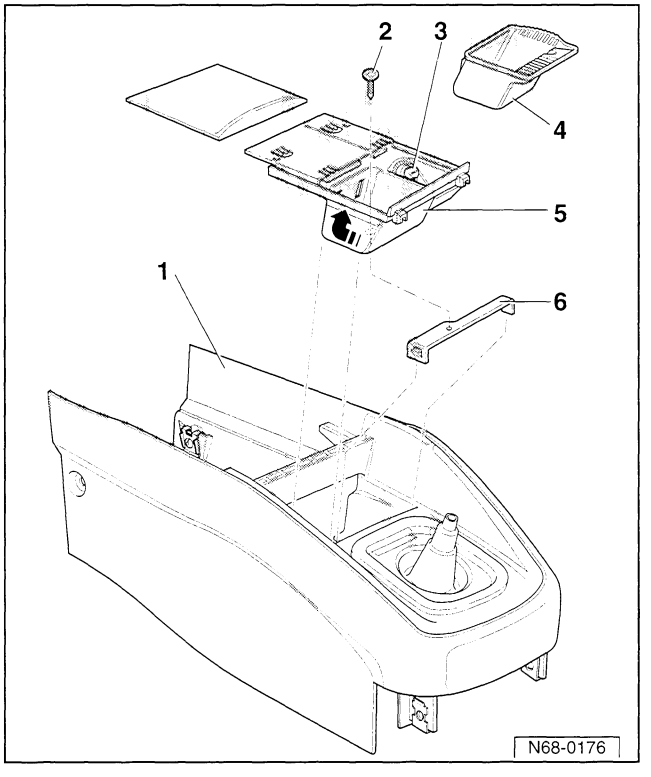
Front center armrest, removing

- Unclip trim (**3**) from center console (**1**).
- Remove bolt (**2**) and remove armrest.
- When installing tighten bolt to 18 Nm (13 ft-lb).



Armrest lid, removing

- Open armrest lid (**1**) and hold armrest lid firmly.
- Press armrest lid base (**A**) with right hand in direction of lower **arrow** and with left hand move armrest lid top end (**B**) in direction of upper **arrow** until lid has been released from armrest.



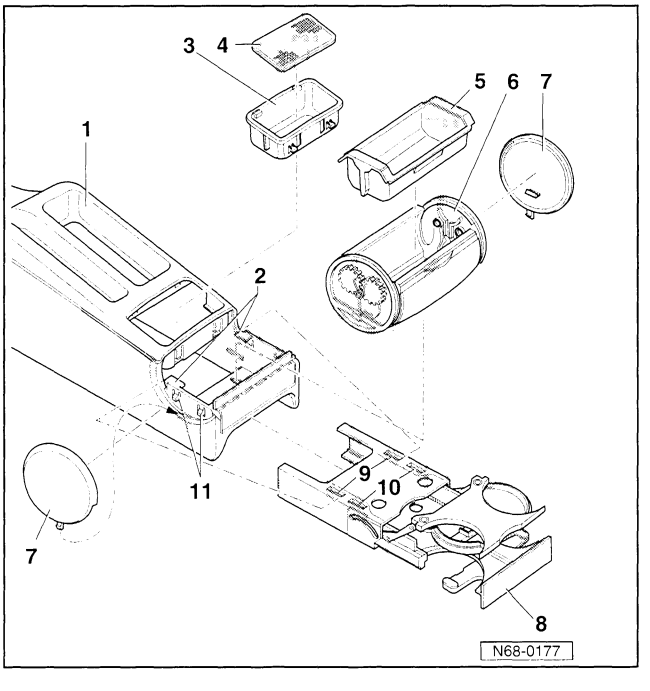
Front ashtray, removing

– Switch ignition off.

➤ Pull out ashtray insert (**4**) and remove bolt (**2**) from bracket (**6**).

– Slide ashtray (**5**) forward, close and pull out (**arrow**) far enough until cigarette lighter connector (**3**) can be disconnected.

– Pull out ashtray (**5**) from center console (**1**).

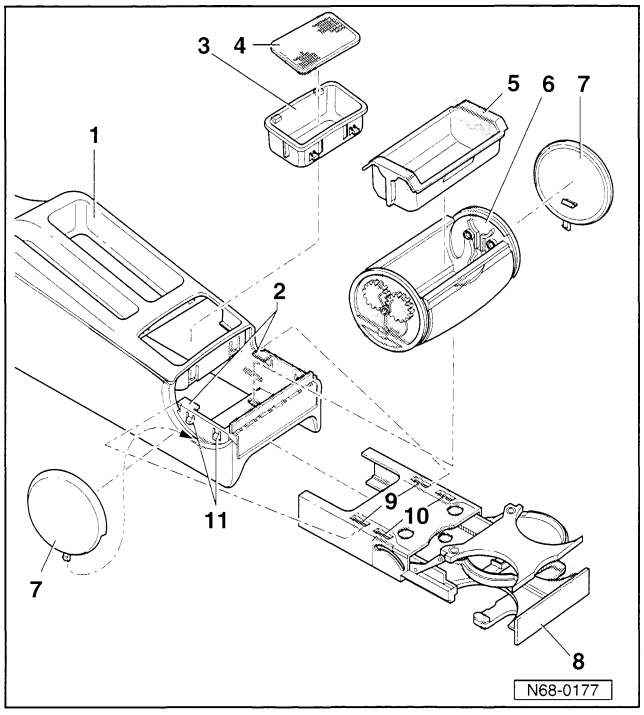


Rear ashtray, removing

➤ Storage compartment and lid (**3** and **4**) are not installed on vehicles with center armrest.

– Remove cover caps (**7**).

– Release ashtray at and right locking lugs (**11**).



Rear cupholder, removing and installing

– Remove rear ashtray.

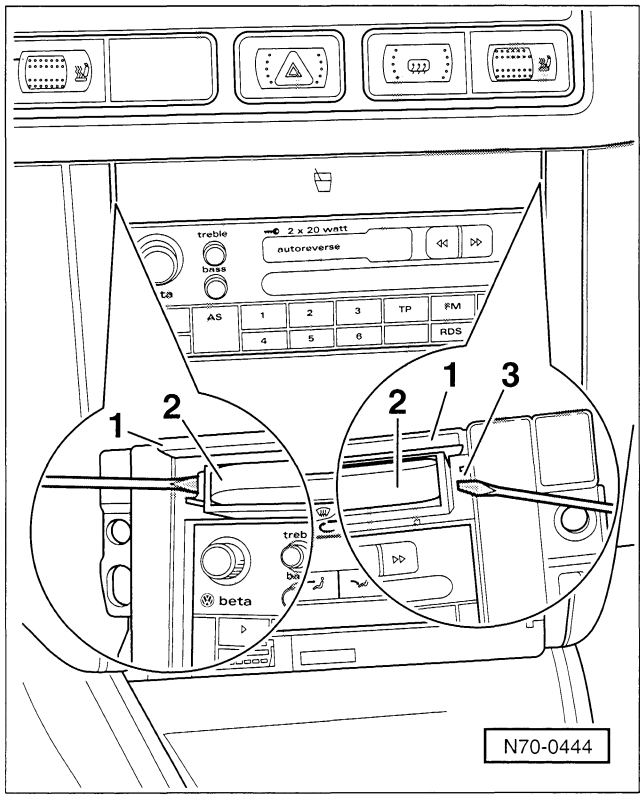
➢ Press down retaining hooks (**9**) and pull cupholder out from center console (**1**).

– To install, guide cupholder into center console until retaining hooks (**10**) meet retaining lugs (**2**).

– Bend up retaining hooks (**9**) slightly.

– Install ashtray (**6**).

INTERIOR EQUIPMENT

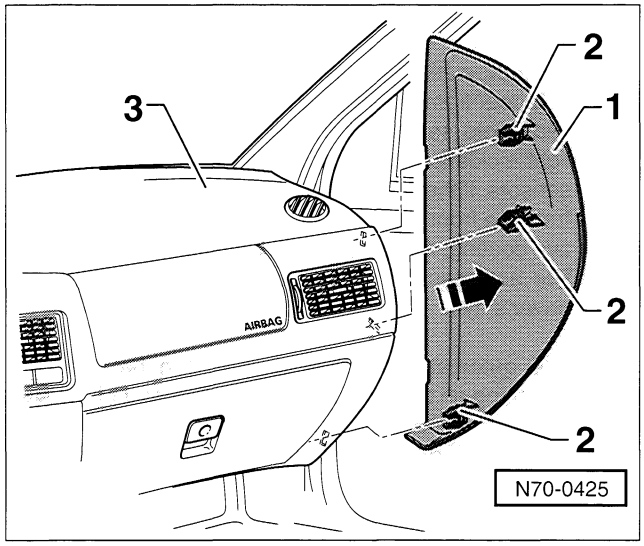


Front cup holder, removing

➢ Fold up trim panel (**1**) for front cup holder.

– Press retaining clips (**2** and **3**) at sides of cup holder assembly with flat tip screwdriver and unclip.

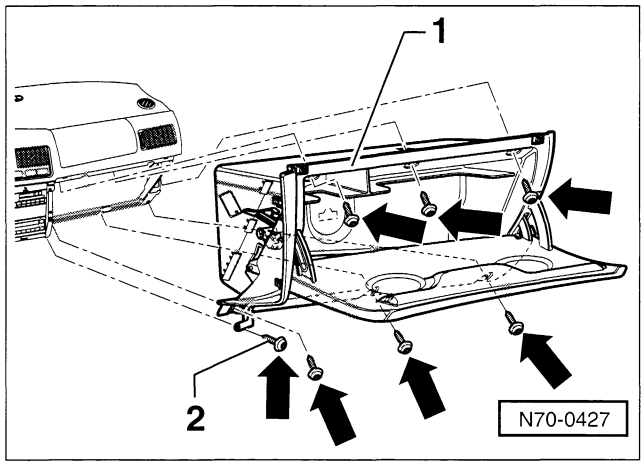
– Pull out cup holder.



Glovebox, removing

➤ Carefully pry off right side instrument panel cover (**1**) at mounting clips (**2**).

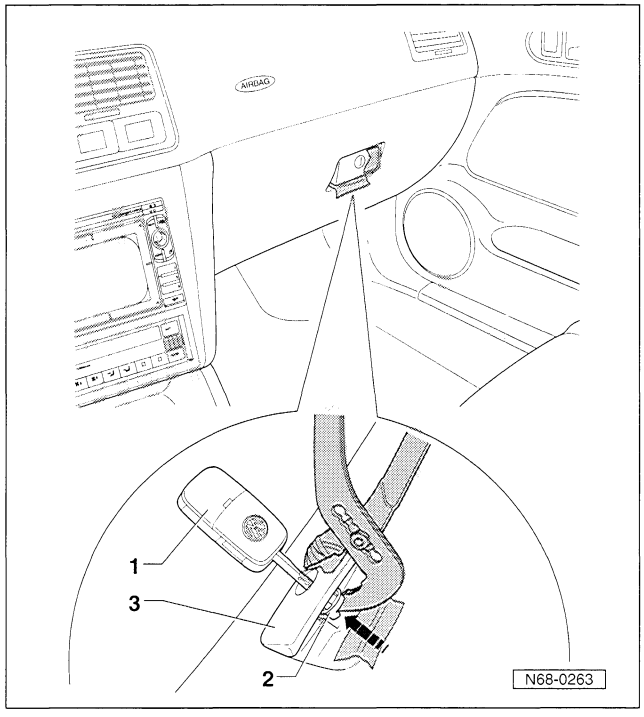
– Remove center console as described earlier.



➤ Remove retaining screws (**arrows**) and glovebox (**1**). Screw (**2**) is located underneath center console.

NOTE —
*Glovebox mounting screw (**2**) secures the glovebox to carrier and is located behind center console.*

– Disconnect harness connector for glove box light.



Glovebox lock cylinder, removing

– Protect glovebox release button and glovebox face from damage by covering with tape. Wrap tips of channel lock pliers with adhesive tape.

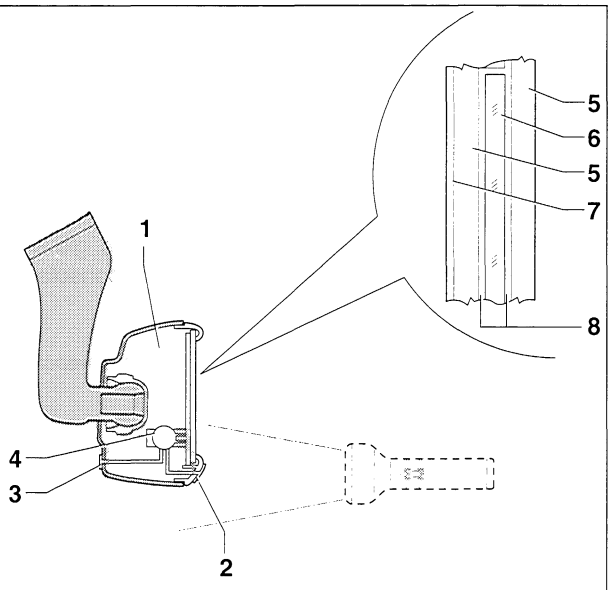
➤ Insert ignition key (**1**) into lock cylinder (**2**).

– Using pliers, push lock cylinder out of button (**3**) in direction of **arrow**.

– When installing, press lock cylinder into button opening until it engages audibly.

Automatic dimming interior mirror

The automatic interior mirror darkens when the driver is "blinded" from behind. It consists of a mirror element and two photo sensors. The electronic circuitry recognizes light incidence for the front and rear through the photo sensors. If the light incidence is greater from the rear than from the front the circuitry applies voltage to the conductive coating. An increase in voltage darkens the electrolyte and less of the light incidence is reflected to the driver's eye.



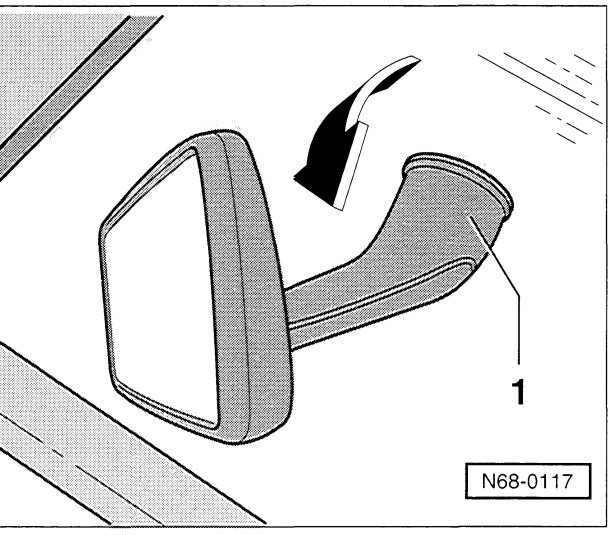
1. Mirror
2. Rear photo sensor
3. Front photo sensor
4. Electronic circuitry
5. Glass pane
6. Electrolyte coating
7. Silver reflective coating
8. Conductive coating

The automatic dimming function can be checked by switching on the ignition, covering the front photo sensor (**3**) and shining a flashlight at the rear photo sensor (item **2**). The mirror should darken if reverse gear is not engaged.

NOTE —

When selecting reverse gear the dimming function of the mirror is switched off enabling the mirror to be effectively used to back up the vehicle (i.e. from a dark garage).

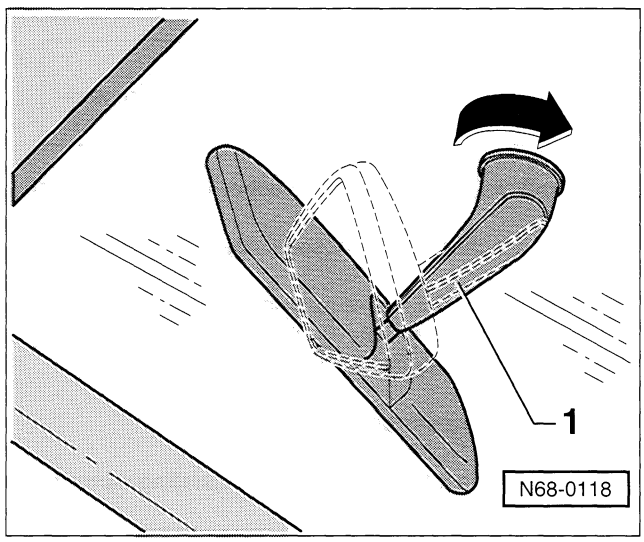
Interior mirror, removing and installing



Rotate mirror (**1**) downward (**arrow**) and counter-clockwise to release it from retaining plate. (spring clip in mirror base).

NOTE —

- *In cold weather, warm the windshield first by running the defroster on high for a few minutes.*
- *To aid in removal, rotate mirror counter-clockwise as you pull it down.*



➢ To install, place mirror (**1**) on mount and rotate clockwise (**arrow**) until locking spring clicks into place.

Interior mirror retaining plate, installing

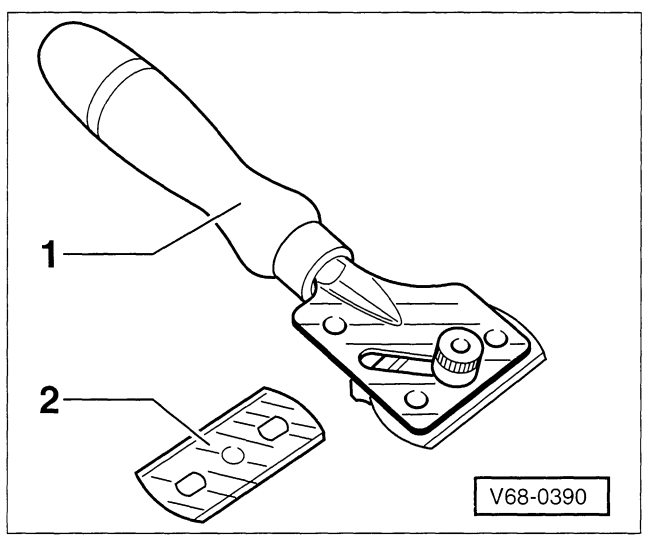
If the mirror retaining plate separates from the windshield it must be re-attached using Volkswagen glass-metal adhesive kit (part no. D 000 703 A1) or equivalent.

– Remove retaining plate from mirror base.

– Remove PUR adhesive from retaining plate with wire brush.

– Grind off three spacer protrusions on bonding surface using sandpaper (360/400 grit) on flat surface.

NOTE —
Keep sanded surface clean and free of grease.



➢ Scrape PUR adhesive material and primer from windshield down to ceramic layer using glass scraper (**1**) with blade (**2**).

WARNING —
Do not damage ceramic coating. Scratches will remain permanently visible.

– Clean bonding area with adhesive remover (VW part no. D 002 000 10) or cleaning solution (VW part no. D 009 401 04). Allow cleaner to dry at least 10 minutes.

NOTE —
Volkswagen part numbers are given for reference only. Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.

– Cut nylon mesh fabric to exactly the size of mirror retaining plate.

– Apply adhesive evenly and smoothly to retaining plate.

> ***WARNING —***
> *Wear hand protection (rubber gloves) when working with adhesive.*

– Apply nylon mesh fabric to adhesive on retaining plate.

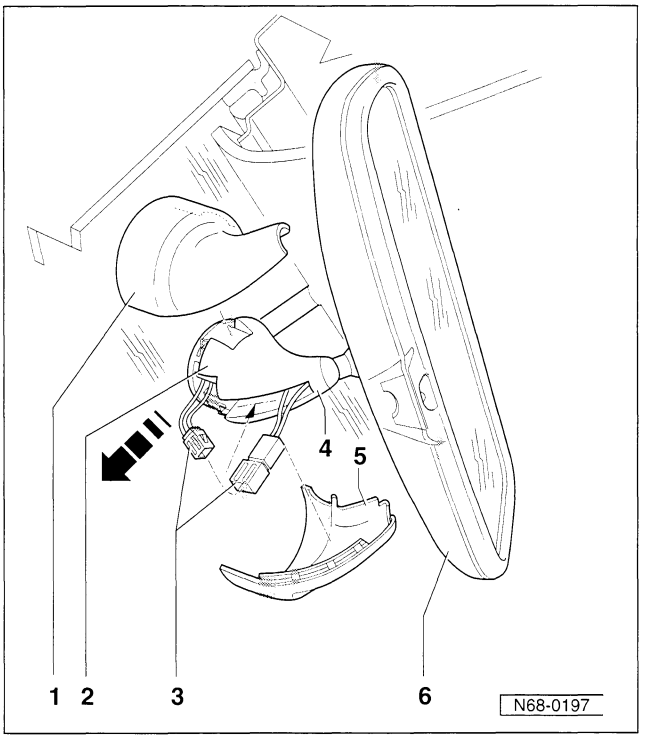
– Apply adhesive to exposed surface of nylon mesh.

– Within 30 seconds of applying adhesive to nylon mesh, press retaining plate firmly (do not use force) against windshield. Hold in place for 15 seconds.

– Remove excess adhesive with a cloth.

– Wait at least 15 minutes before installing mirror onto retaining plate.

Interior mirror with rain sensor, removing and installing



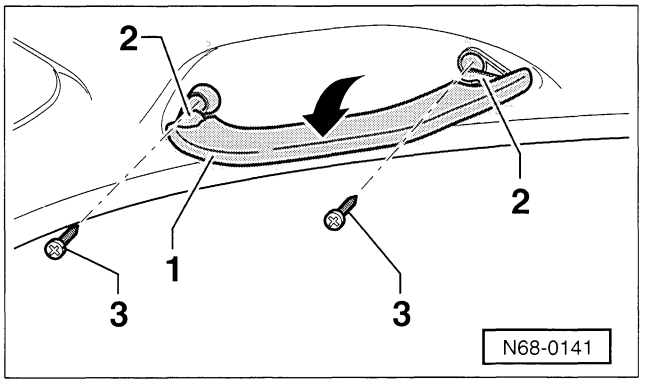
◀ Pry left and right side trim covers (**1** and **5**) on neck of mirror apart.

– Pull out wiring harness connector (**3**) and disconnect.

– Pull mirror base (**4**) and mirror (**6**) down off windshield in direction of **arrow**.

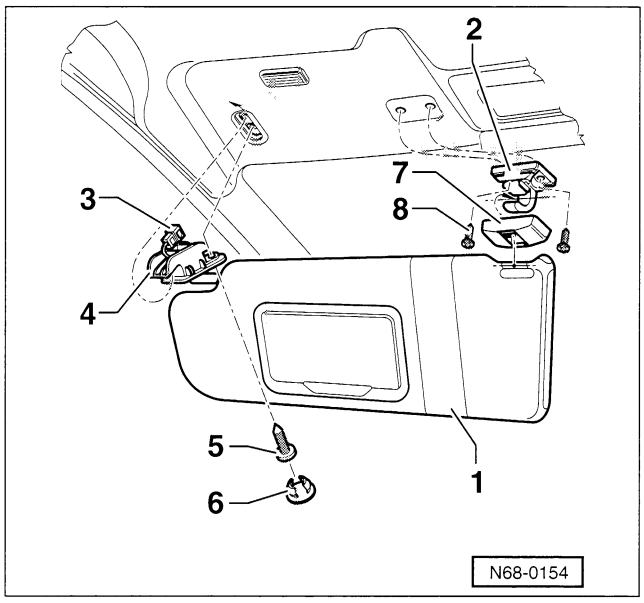
– Install in reverse order of removal.

Roof handle, removing



◀ Fold handle (**1**) down.

– Pry covers up (**2**) with screwdriver. Remove mounting screws (**3**) and handle.



Sun visors, removing

➤ Release sun visor from inner mount (**2**).

– Pry off outer mount cover cap and remove screw.

– Swing sun visor outer mount (**4**) down from roof and separate harness connector (**3**)

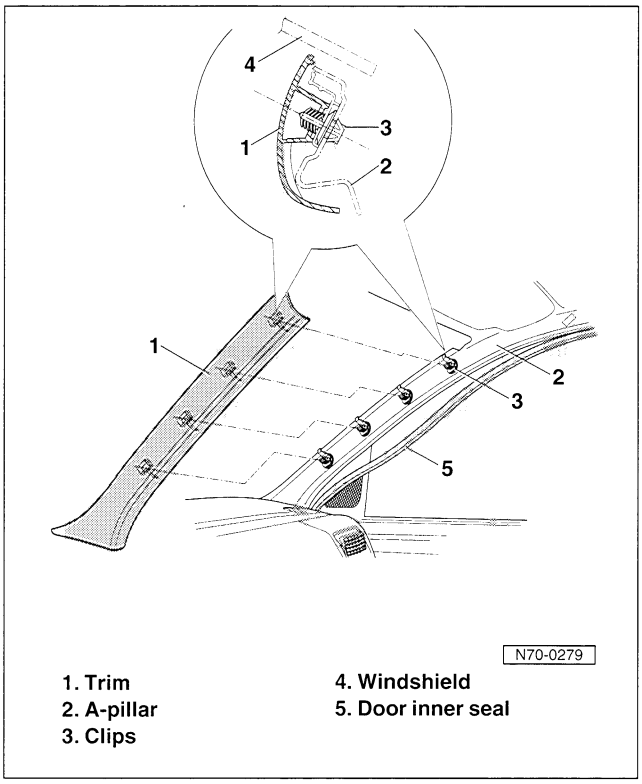
– Pry off inner mount cover cap and remove screw and mount.

NOTE —
The center sun visor (above interior mirror) can be removed by folding it down and removing the self-tapping mounting screws from roof frame.

PASSENGER COMPARTMENT TRIM

Details of the passenger compartment interior trim panels are shown below. Unless otherwise noted, installation is the reverse of removal.

NOTE —
It is advisable to use a special non-marring trim removal tool (plastic bone) to pry various trim panels out without damaging paint or other adjacent panels.



1. Trim
2. A-pillar
3. Clips
4. Windshield
5. Door inner seal

A-pillar upper trim, removing

Vehicles without side curtain airbags

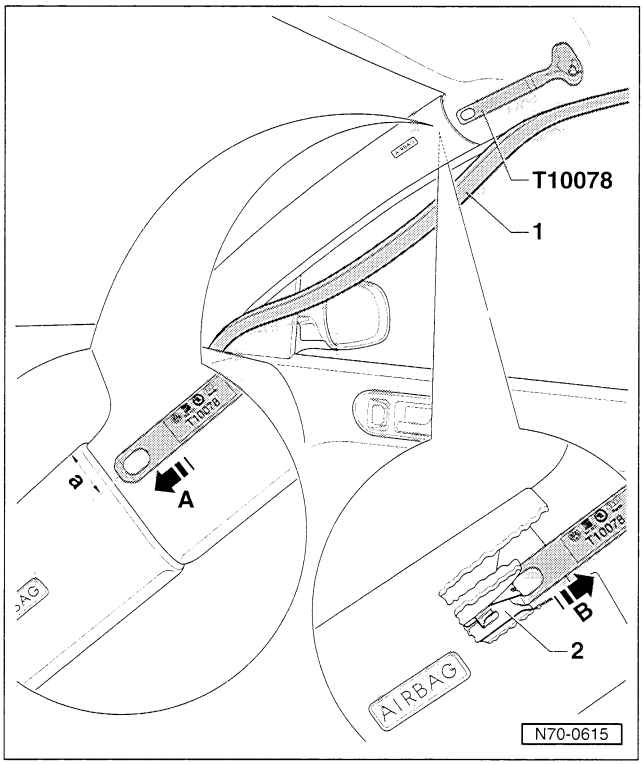
➤ Pull door inner seal off A-pillar.

– Starting at top, unclip trim from A-pillar. Lift up to remove.

NOTE —
Vehicles with side curtain airbags, see below.

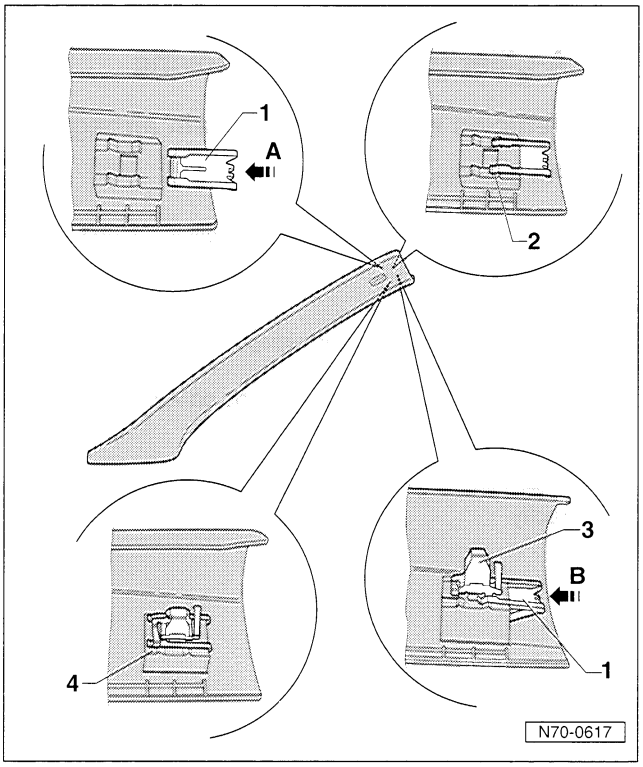
– Before installing trim, check clips on A-pillar and replace as necessary.

– After installing trim, make sure door seal is seated correctly.



A-pillar upper trim, removing
Vehicles with side curtain airbags

- Pull inner door seal (**1**) off A-pillar.
- Position release tool T10078 at transition of inside roof lining and trim panel of A-pillar.
- The distance (distance **a**) from the windshield to middle of tool must be approximately 22 mm (0.866 in.).
- Pull release tool back (**arrow B**) which will remove lower part of steel clip (**2**).
- Unclip trim (**1**) starting at top from A-pillar and remove.



A-pillar upper trim, installing
Vehicles with side curtain airbags

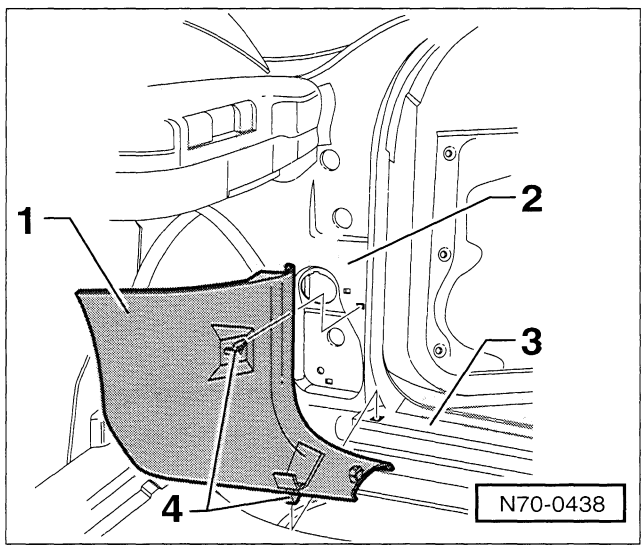
Steel safety clips (**1** and **3**) MUST be replaced every time A-pillar trim panel is removed on a vehicle with side curtain protection.

NOTE —
Steel clips and upper A-pillar trim parts can no longer be ordered separately from Volkswagen parts department.

- Push steel clip (**1**) in direction of arrow **A** to first detent (**2**) of A-pillar trim panel.
- Insert steel clip (**3**) into the mount.
- Push steel clip (**1**) in direction of arrow **B** into second detent (**4**).

A-pillar lower trim, removing

– Remove hood release lever (as applicable for driver's side). See **55 Hoods and Lids**.



➤ Unclip top of trim (**1**) first, then unclip from sill (**3**). Trim is secured to body with two panel clips (**4**).

NOTE —
It may be necessary to remove side panel of dashboard and glovebox to access top part of A-pillar lower trim.

B-pillar upper trim, removing (through 04/2001)

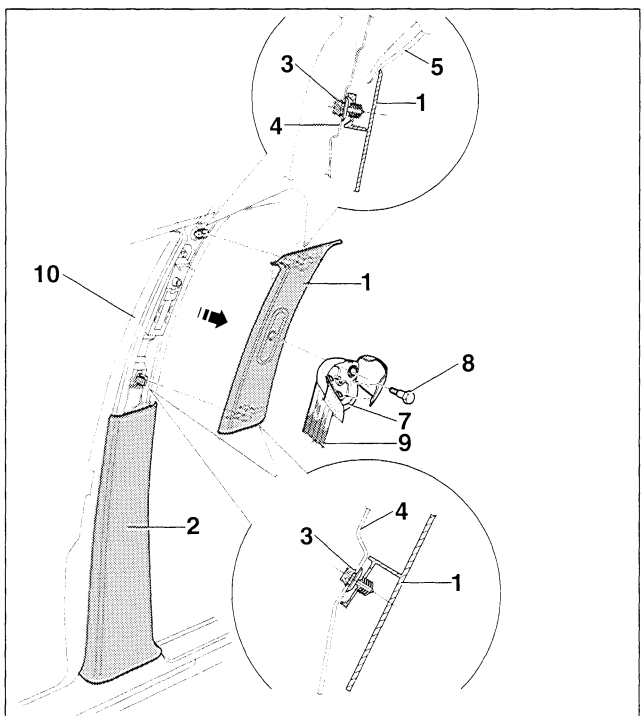
– Pull inner door seal off B-pillar.

– Pry off seatbelt relay cover, remove retaining bolt and seatbelt relay.

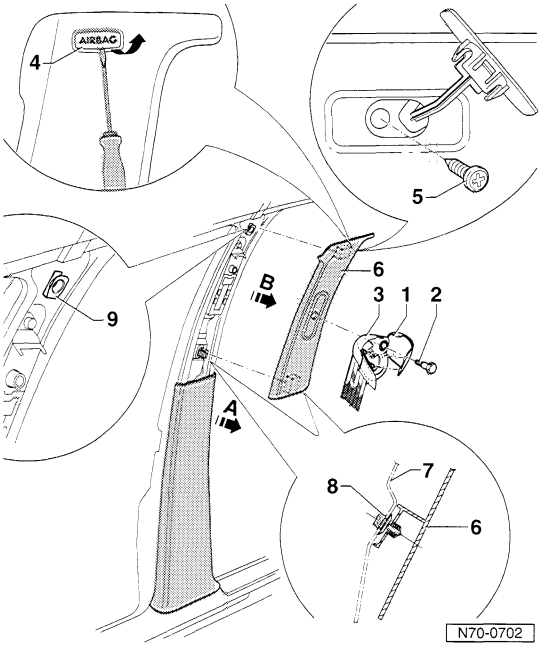
– Release lower B-pillar trim at top.

➤ Pry B-pillar trim off at sides and then in center.

– Before installing upper B-pillar trim check condition of retaining clips and replace as necessary.



1. B-pillar upper trim
2. B-pillar lower trim
3. Securing clips
4. Sill
5. Molded headliner
6. Cover cap
7. Belt relay
8. Bolt (40 Nm (30 ft-lb))
9. Seatbelt
10. B-pillar



1. Cover cap
2. Bolt (40 Nm (30 ft-lb))
3. Belt relay
4. Airbag emblem
5. Screw
6. B-pillar upper trim
7. B-pillar
8. Securing clip
9. Steel clip

B-pillar upper trim, removing (from 05/2001)

➤ Pry of cover cap (**1**).

– Remove bolt (**2**) and belt relay (**3**).

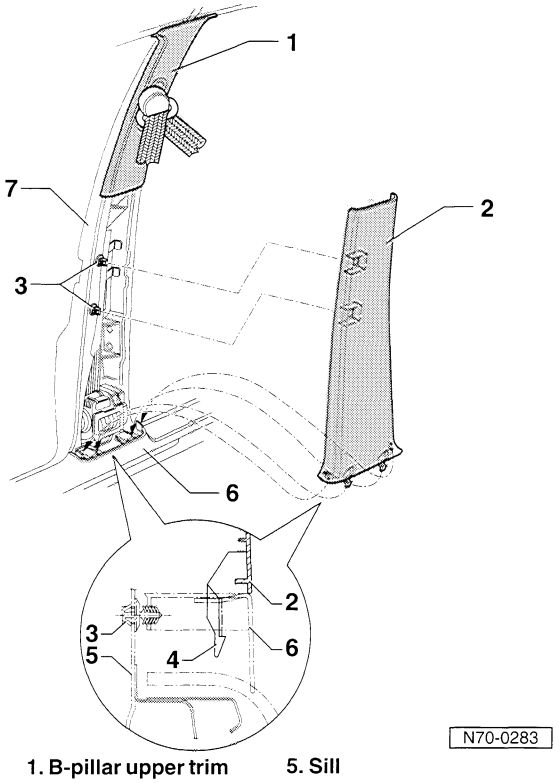
– With a small screwdriver unclip the airbag emblem (**4**).

– Remove screw (**5**).

– Release upper area from lower trim panel (**arrow A**).

– Release B-pillar upper trim (**6**) from B-pillar (**7**) first at sides and then in the middle.

NOTE —
The steel clip cannot be removed without damaging the clip.



1. B-pillar upper trim
2. B-pillar lower trim
3. Securing clips
4. Locking hook
5. Sill
6. Sill panel trim
7. B-pillar

B-pillar lower trim, removing

– Pry lower B-pillar trim off at sides and then in center.

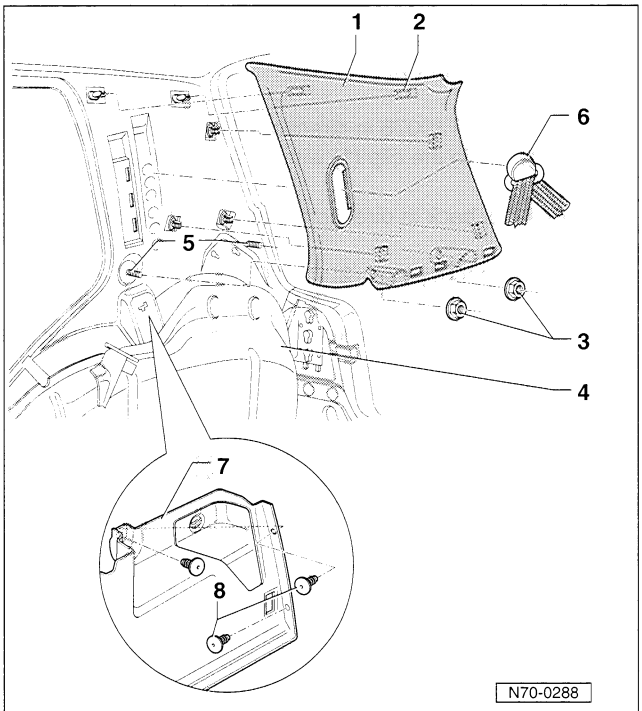
➤ Pull lower B-pillar trim upwards to release locking hooks from sill panel trim.

– Before installing lower B-pillar trim check condition of retaining clips and replace as necessary.

NOTE —
The steel clip cannot be removed without damaging the clip.

C-pillar trim (Golf), removing

Vehicles without side airbags



1. C-pillar trim
2. Securing clips (5)
3. Speed nuts (2)
4. Wheel housing
5. Studs (2)
6. Belt relay
7. Lower trim
8. Plugs

– Remove seatbelt relay by prying off trim cover and removing mounting bolt.

– Remove luggage compartment cover support as described later.

➤ Unclip plugs (**8**) from C-pillar.

– Remove lower trim (**7**) from over C-pillar.

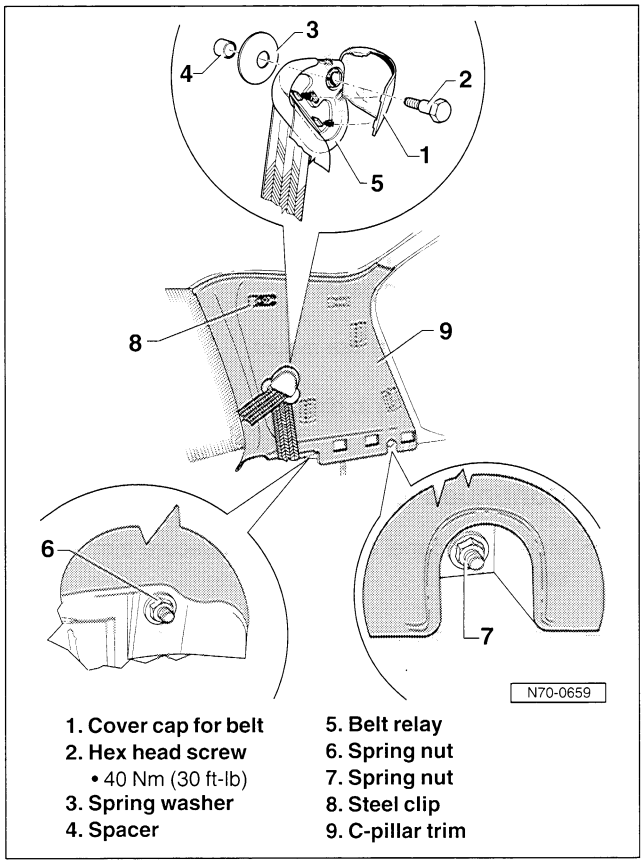
– Remove speed nuts (**3**) from studs.

NOTE —
Speed nuts are located near wheel housing flange and are covered by C-pillar trim.

– Remove seal around trim panel at door opening.

– Unclip trim from C-pillar.

Vehicles with side airbags



1. Cover cap for belt
2. Hex head screw
   • 40 Nm (30 ft-lb)
3. Spring washer
4. Spacer
5. Belt relay
6. Spring nut
7. Spring nut
8. Steel clip
9. C-pillar trim

– Remove support for luggage compartment cover.

– Remove close-out molding.

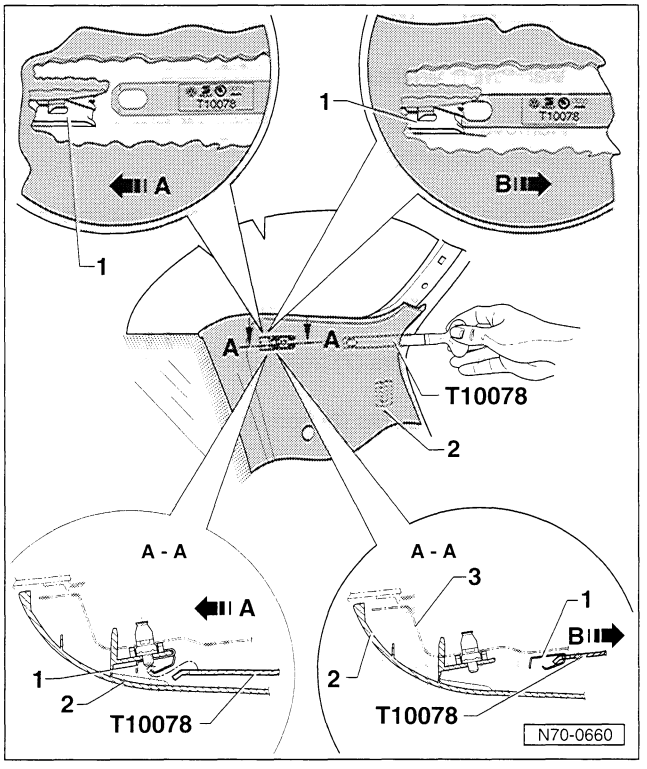
➤ Unclip cover cap (**1**) remove hex head screw (**2**).

– Remove belt relay (**5**), spring washer (**3**) and spacer (**4**).

– Remove spring nuts (**6**) and (**7**).

– Remove the trim (**9**) in area of rear lid.

– Continue as described below using special tool T10078 to release trim panel from C-pillar.



continued for vehicles with side airbags

Use release tool T10078 at transition of inside trim panel (**2**) of C-pillar (**3**).

– Push tool T10078 in direction of dashed **arrow A**, until it engages in the clip (**1**) with an audible click.

– Pull tool back in direction of **arrow B** to remove clip.

– Remove trim panel (**2**) from C-pillar (**3**).

– Remove steel clips from body with channel lock pliers and discard.

NOTE —

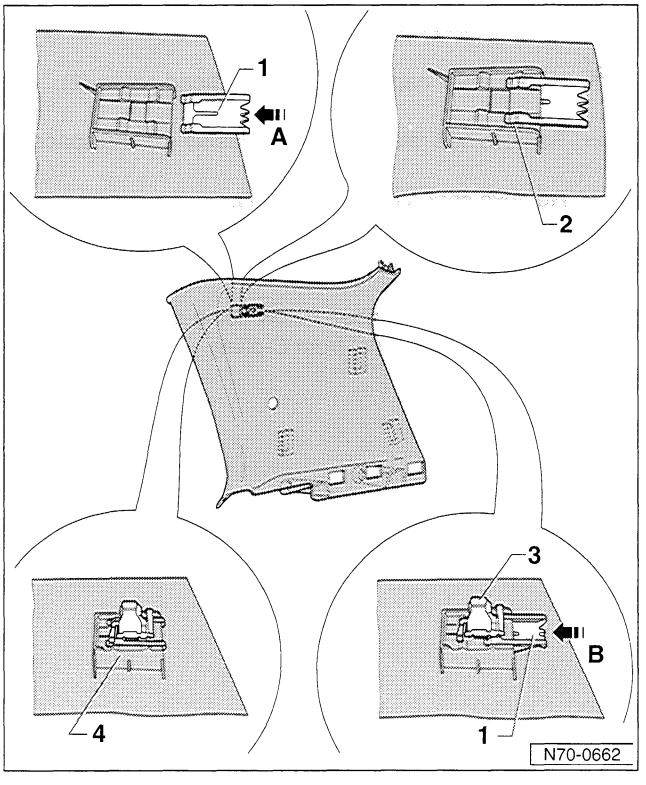
The steel clip cannot be removed without damaging the clip. Steel clips must be replaced after each removal.

C-pillar trim (Golf), installing

Vehicles with side airbags

NOTE —

- *For safety reasons, steel clips and upper C-pillar trim must be replaced every time trim panel of C-pillar is removed on a vehicle with side curtain airbags.*
- *Steel clips and upper C-pillar trim parts can no longer be ordered separately for vehicles with side curtain protection parts catalog.*



Push steel clip (**1**) in direction of **arrow A** to first detent (**2**) of C-pillar trim panel.

– Insert steel clip (**3**) into mount.

– Push steel clip (**1**) in direction of **arrow B** to second detent (**4**).

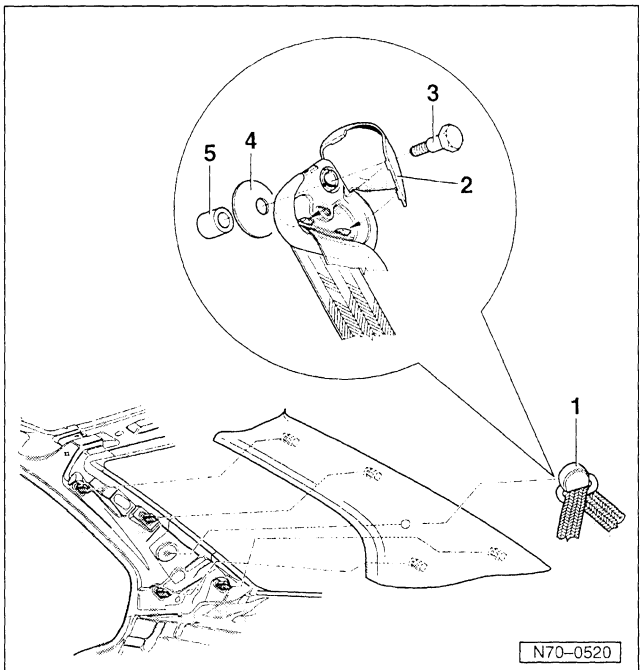
Continued for all vehicles

– Mount trim panel to C-pillar and secure trim with lower spring nuts.

– Install seat belt relay in reverse of removal.

Tightening torque

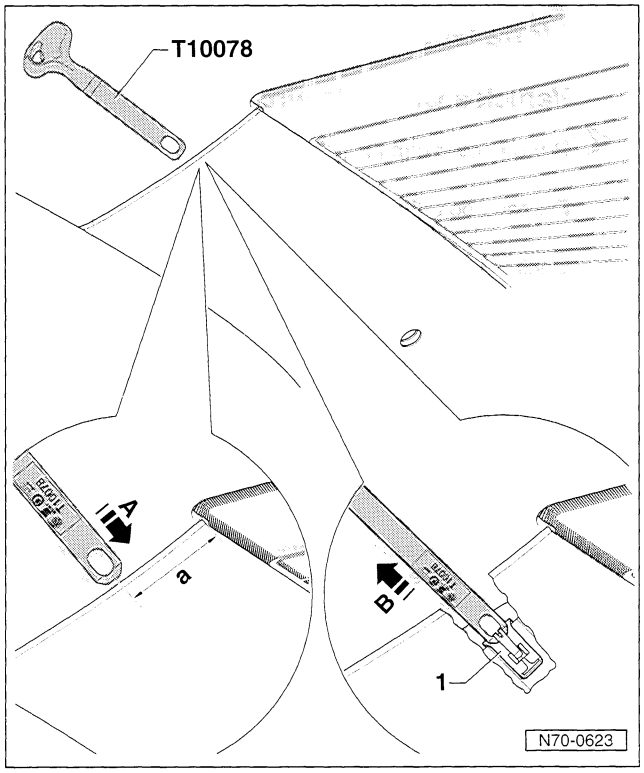
- Seat belt relay to C-pillar . . . . . 40 Nm (30 ft-lb)



1. Belt relay
2. Belt relay cover
3. Bolt
   - 40 Nm (30 ft-lb)
4. Washer
5. Spacer

C-pillar trim (Jetta), removing

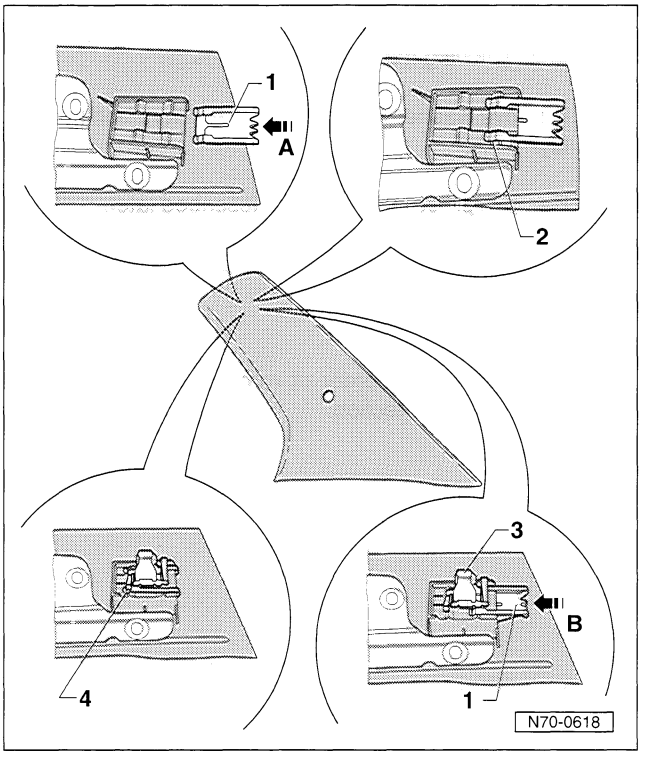
- Remove seatbelt relay by prying off belt relay cover (**2**) and removing mounting bolt (**3**).
- Remove washer (**4**) and spacer (**5**) from behind belt relay.
- Remove parcel shelf trim as described later.
- Remove seal around trim panel at door opening.
- Unclip trim from C-pillar.
- Install in reverse order of removal for vehicles without side curtain protection.



Vehicles with side airbags

- Position release tool T10078 at transition of inside roof lining and trim panel of C-pillar.
- The distance from windshield to middle of tool must be about 66 mm dimension (**a**).
- Slide release tool T10078 between inside roof lining and trim panel of C-pillar until it engages (**arrow A**).
- Pull tool back (**arrow B**), to remove lower part of steel clip (**2**).
- Unclip trim panel from C-pillar.
- Remove steel clips from body with channel lock pliers and discard.

NOTE —
The steel clip cannot be removed without damaging the clip. Steel clips must be replaced after each removal.



C-pillar trim (Jetta), installing

Vehicles with side airbags

NOTE —

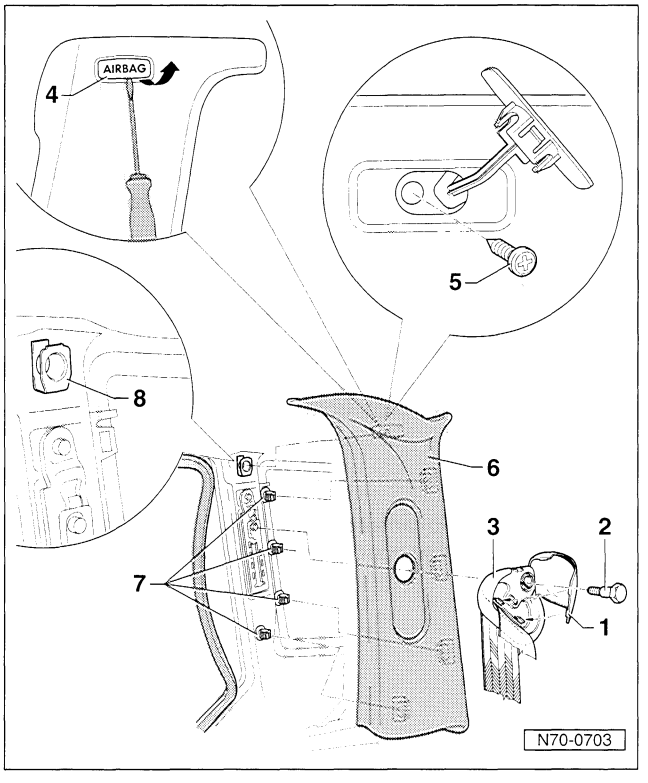
- *For safety reasons, steel clips and upper C-pillar trim must be replaced every time trim panel of C-pillar is removed on a vehicle with side curtain airbags.*
- *Steel clips and upper C-pillar trim parts can no longer be ordered separately for vehicles with side curtain protection parts catalog.*

➢ Push steel clip (**1**) in direction of **arrow A** to first detent (**2**) of C-pillar trim panel.

– Insert steel clip (**3**) into mount.

– Push steel clip (**1**) in direction of **arrow B** to second detent (**4**).

– Mount trim panel to C-pillar and install door seal.



C-pillar trim, removing (Jetta wagon from 05/2001)

Vehicles with side airbags

➢ Pry off cover cap (**1**).

– Remove bolt (**2**) and take off relay (**3**).

– Unclip airbag emblem (**4**) using a small screwdriver.

– Remove bolt (**5**).

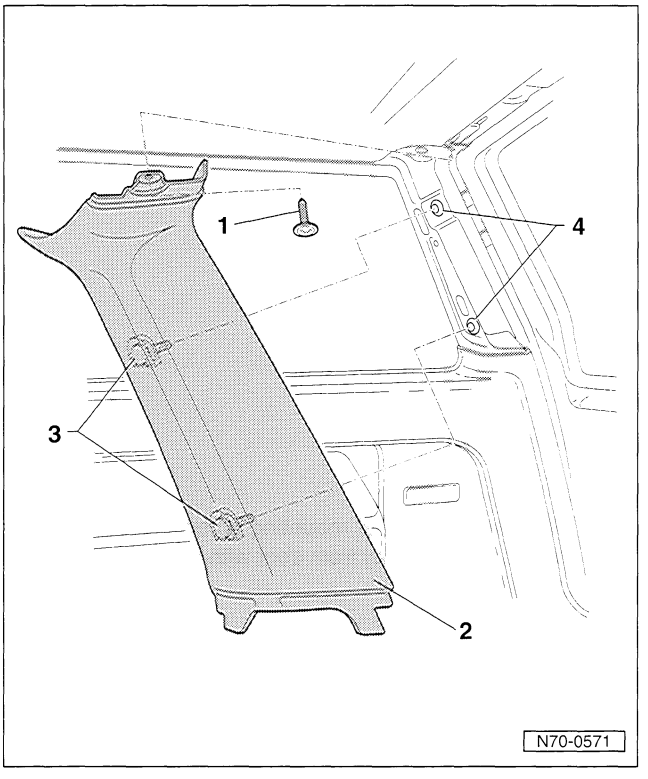
– Unclip trim (**6**) from C-pillar.

– Install in reverse order of removal.

NOTE —

- *For safety reasons, the steel clips must be replaced each time the C-pillar trim panel is removed and installed again.*
- *Steel clips and C-pillar trim parts can no longer be ordered separately for vehicles with side curtain protection from Volkswagen parts department.*

D-pillar upper trim (Jetta wagon), removing



- Unclip close-out molding at rear of headliner.
- Remove bolt (**1**).
- Unclip trim (**2**) and pull out and up away with steel clips (**3**) from mounting sleeve (**4**).

NOTE —

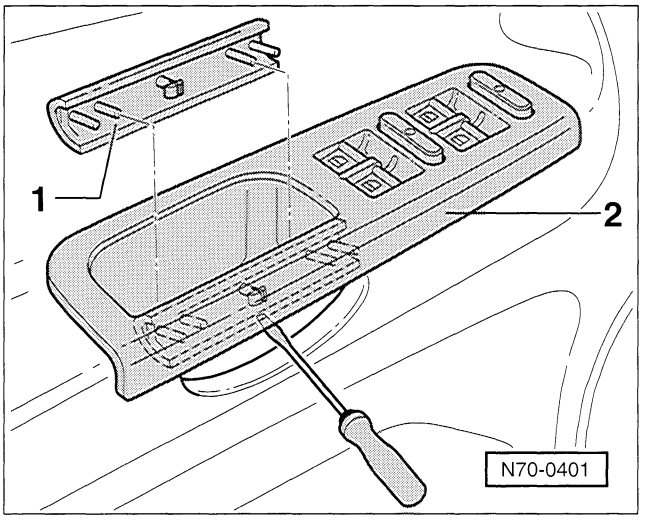
- *Before installing trim (**2**) check clips (**3**) and mounting sleeves (**4**) for and replace if necessary.*
- *Steel clips and upper D-pillar trim parts can no longer be ordered separately from the Volkswagen parts department.*

Driver's door panel, removing and installing

NOTE —

Removing and installing driver's door panel for vehicles with manual windows is the same as the removing and installing passenger side door panel as described later.

- Disconnect battery ground (GND) strap from battery negative (–) terminal. See the **Cautions** at the beginning of this repair group regarding battery disconnection.



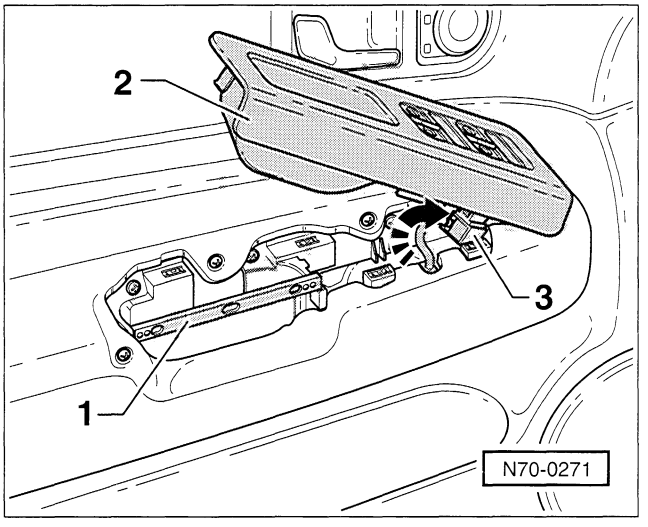
NOTE —

Be sure to have the anti-theft radio code on hand before disconnecting the battery.

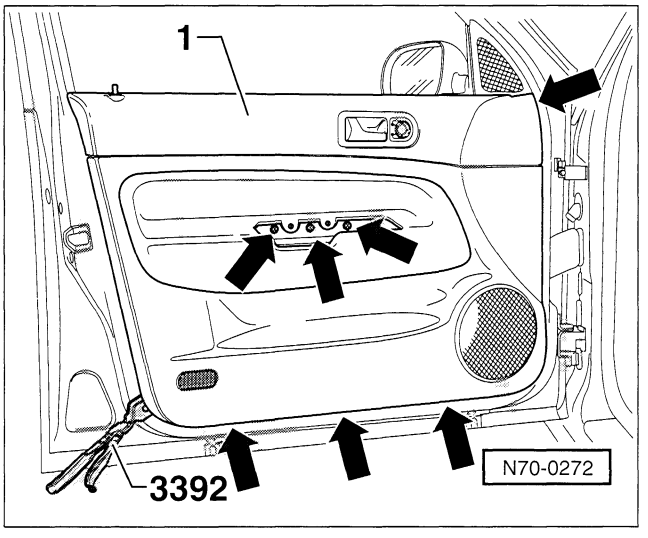
- Use a screwdriver with a thin blade to carefully pry inner trim piece (**1**) out of electric window control panel (**2**) toward door.
- Unclip window control panel from door panel and lift upwards.

NOTE —

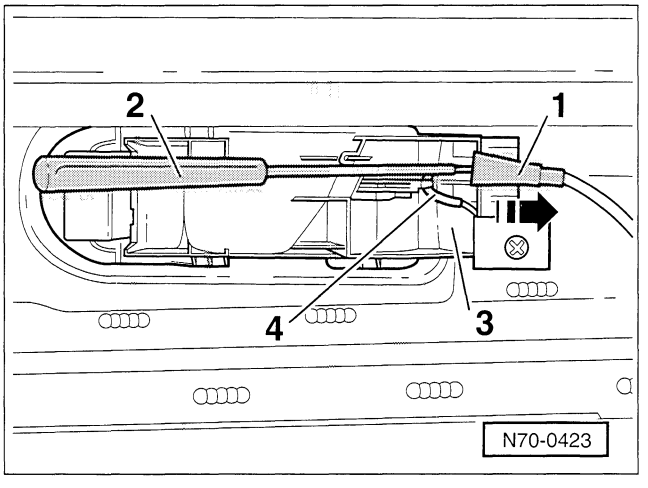
Do not grasp in grip depression (where inner trim was) when pulling off grip recess as a strut is secured to door trim underneath.



➢ Unclip window control panel (**2**) at rear, lift upward and release locking lug (**3**) by pressing in direction of **arrow**.

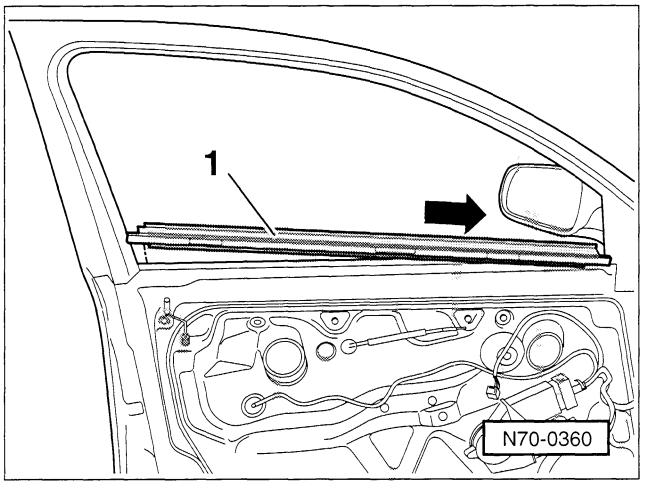


➢ Remove door panel mounting screws (**arrows**) and pry door panel (**1**) away from door with VW special tool 3392, or equivalent.



➢ Unclip cable guide (**1**) with screwdriver (**2**), remove bracket (**3**) in direction of **arrow** and unhook cable hook (**4**).

– Disconnect harness connectors from door panel switches.



➢ Install door panel in reverse order of removal, noting the following:

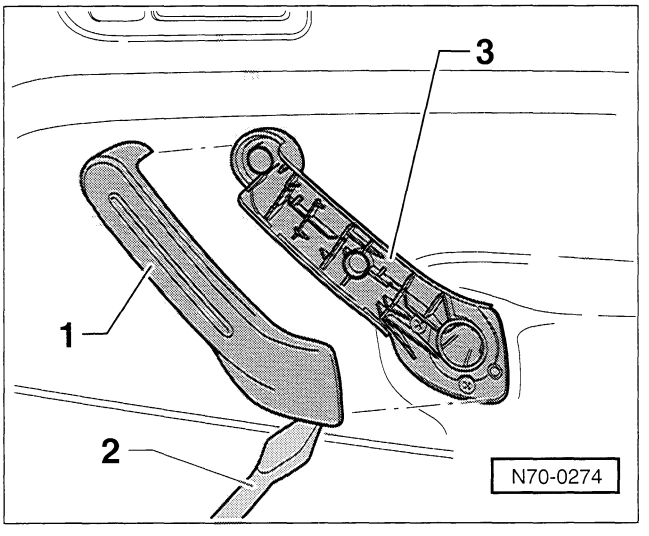
- Remove window slot seal (**1**) from door panel and insert (in direction of **arrow**) into window slot before installing door panel.
- Check door trim clips before installing door panel and replace if necessary.
- After connecting battery, check vehicle equipment (radio, clock, electric windows).
- If ECM is subjected to low voltage with ignition on, DTC memory and readiness code must be checked using VAG scan tool 1551/5051, or equivalent.

Passenger door panel, removing and installing

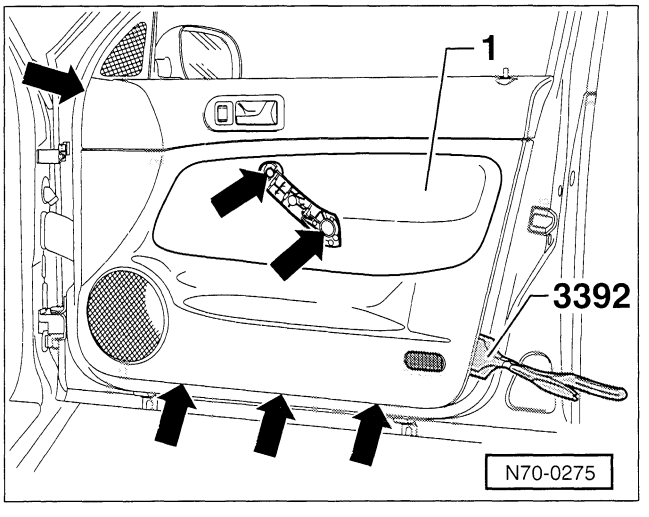
NOTE —
Removing and installing driver's door panel for vehicles with manual windows is the same as removing and installing passenger side door panel as described below.

– Disconnect battery ground (GND) strap from battery negative (–) terminal. See the **Cautions** at the beginning of this repair group regarding battery disconnection.

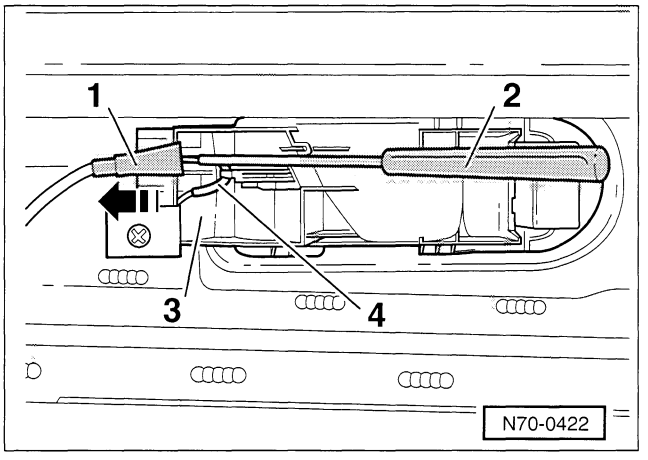
NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.



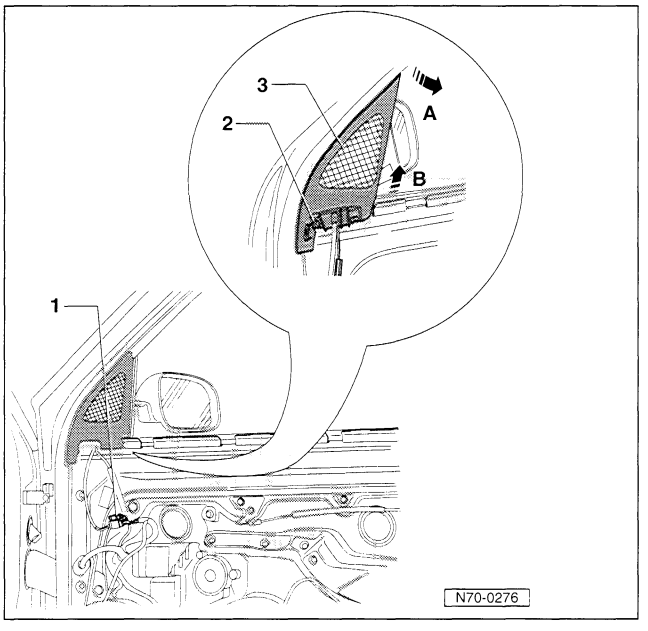
➢ Pry out door grab handle trim (**1**) with screwdriver (**2**).



➢ Remove door panel mounting screws (**arrows**) and unclip panel (**1**) from door using Volkswagen special tool 3392 or equivalent. Lift door panel upwards and out of window slot.

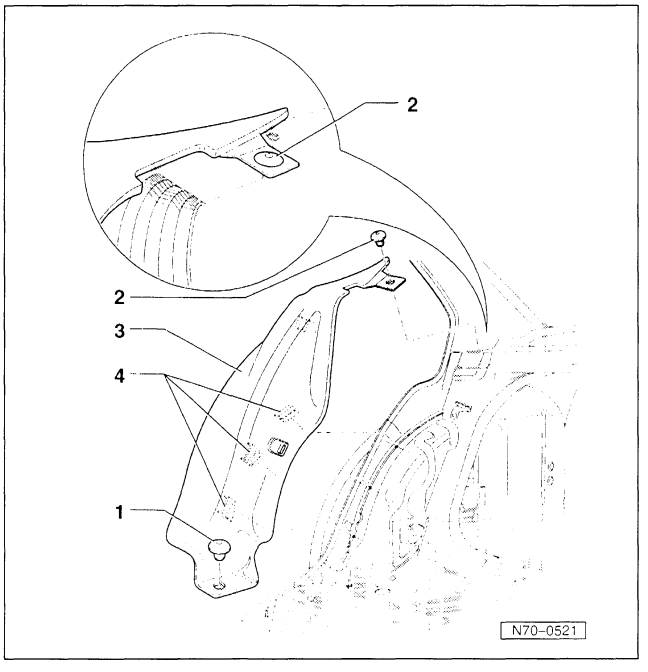


- Unclip cable guide (**1**) with screwdriver (**2**), remove bracket (**3**) in direction of **arrow** and unhook cable hook (**4**).
- Disconnect harness connectors from door panel switches.
- Installation is the reverse of removal, noting the following:
  - Pull window slot seal off door panel and insert into window slot before installing panel as shown earlier.
  - Check door trim clips before installing door panel and replace if necessary.
  - After connecting battery, check vehicle equipment (radio, clock, electric windows).



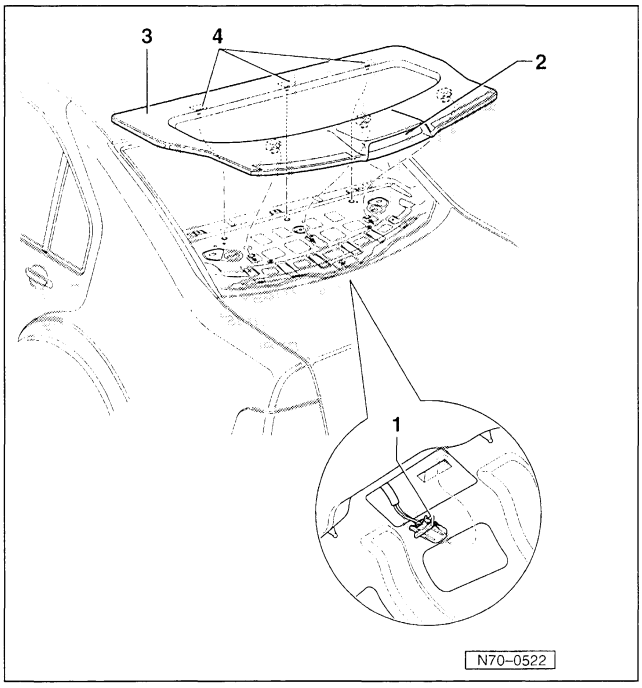
Front door window triangular trim (with speaker), removing

- Remove door panel as described above.
- Separate speaker harness connector in door.
- Remove mounting screw (**1**) and pull off trim in direction of **arrows A** and **B**.
- Pull speaker off at top and separate from door.



Inner wheel housing trim, removing

- Remove parcel shelf trim (Jetta only).
- Fold seat cushion and backrest forward.
- Unscrew press button (**1**) at bottom of inner wheel housing trim.
- For Jetta sedan only, remove plug (**2**) at top of wheel housing trim using Volkswagen 3392 removal pliers or equivalent.
- Unclip trim panel from retaining clips and remove.



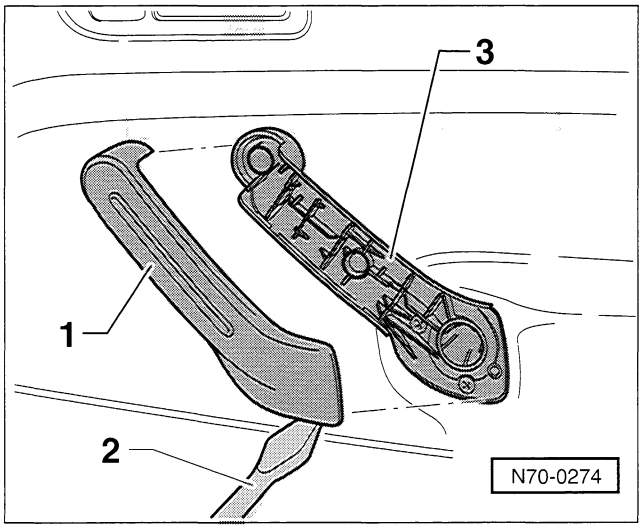
Parcel shelf trim (Jetta), removing

– Fold rear seat backrest forward.

➤ Separate harness connector (**1**) for center mounted brake light (**2**).

– Unclip and remove parcel shelf (**3**).

– Check trim clips (**4**) before installing and replace if necessary.

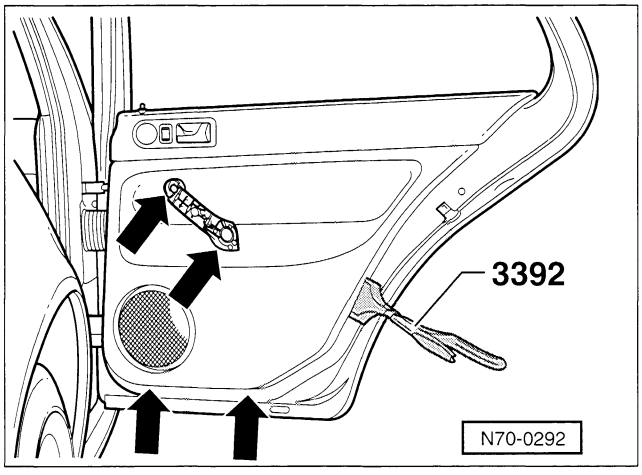


Rear door panel, removing and installing

– Disconnect battery ground (GND) strap from battery negative (–) terminal. See **Cautions** at the beginning of this repair group regarding battery disconnection.

NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.

➤ Pry out door grab handle trim (**1**) with screwdriver (**2**).

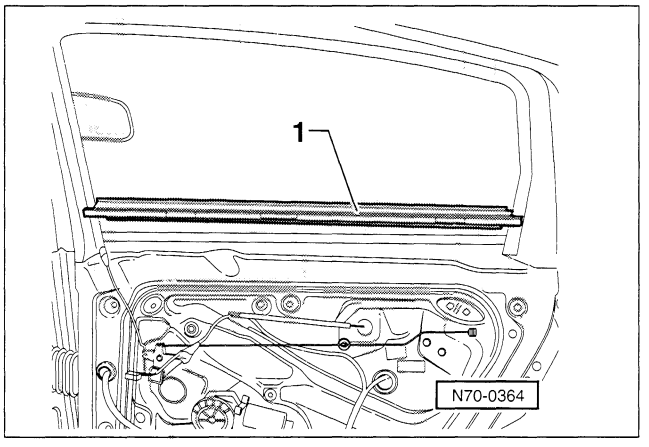


➤ Remove door panel mounting screws (**arrows**) and unclip panel at sides with Volkswagen 3392 assembly pliers, or equivalent.

– Lift door trim upward off window slot.

– Unclip cable guide from door latch with screwdriver, pull cable out from retainer and unhook cable hook.

– Disconnect harness connectors from door panel switches.



Installation is reverse of removal, noting the following:

- Pull window slot seal (**1**) off door panel and insert into window slot before installing panel.
- Check door trim clips before installing door panel and replace if necessary.
- After connecting battery, check vehicle equipment (radio, clock, electric windows).

NOTE —

If ECM is subjected to low voltage with ignition on, DTC memory and readiness code must be checked using VAG scan tool 1551/5051, or equivalent.

Rear side trim (2-door Golf), removing

– Remove rear seat and backrest, see **72 Seats**.

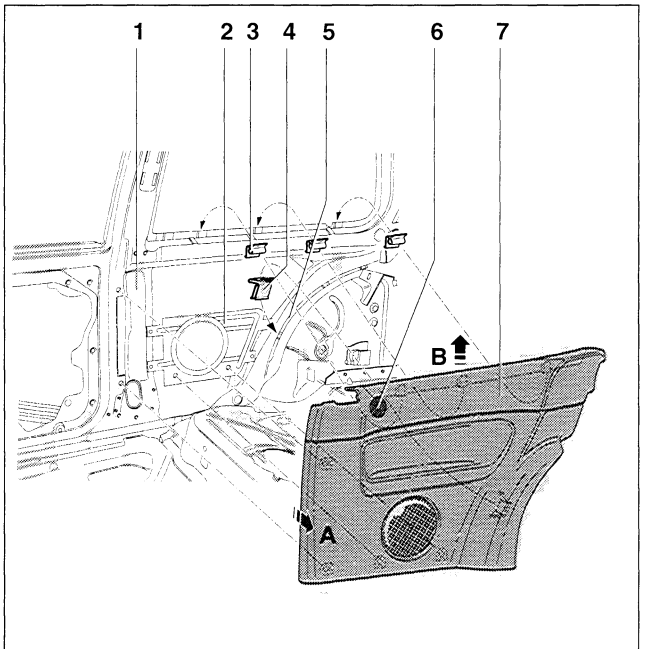
Unclip side panel trim from B-pillar and speaker bracket.

– Pull up side panel slightly and separate harness connector for speaker (if applicable).

– Pull panel away at **arrow A** and lift up (**arrow B**).

– Installation is reverse of removal, noting the following:

- Check door trim clips before installing door panel and replace if necessary.
- Clip for body flange (**4**) secures the side panel trim to the wheel housing body flange.

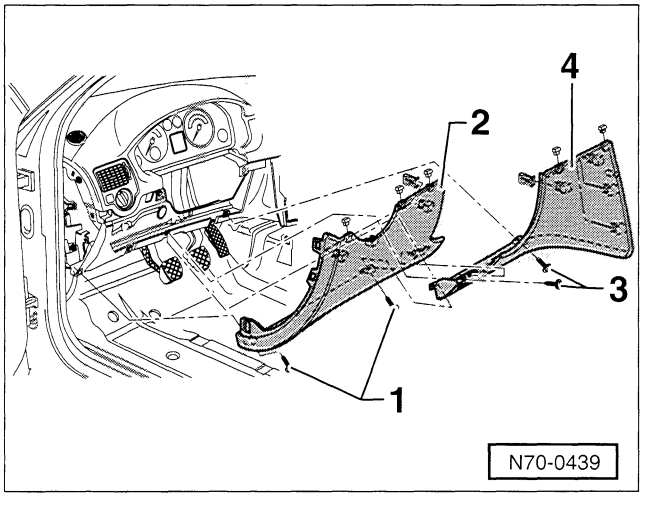


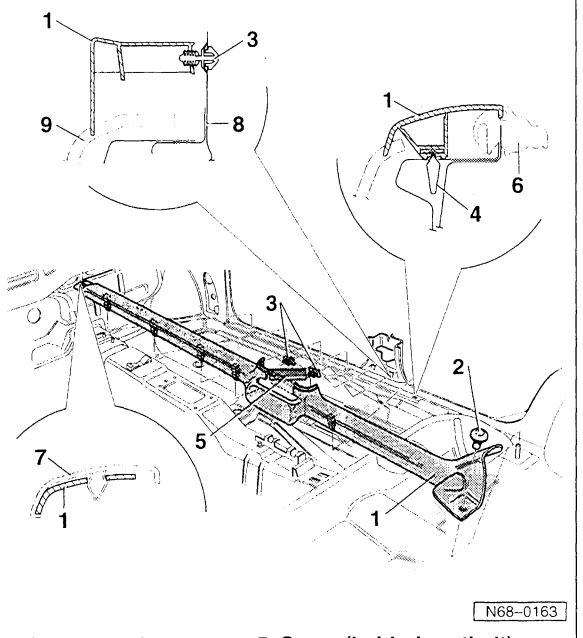
1. B-pillar
2. Speaker bracket
3. Clip (3)
4. Clip for body flange
5. Body flange
6. Speaker
7. Side panel trim

Steering column lower trim, removing

Remove lower mounting screws (**1**) for trim panel (**2**) directly underneath steering column and unclip top of trim.

– Remove mounting screws (**3**) for trim panel (**4**) to the right of steering column and unclip panel from top.





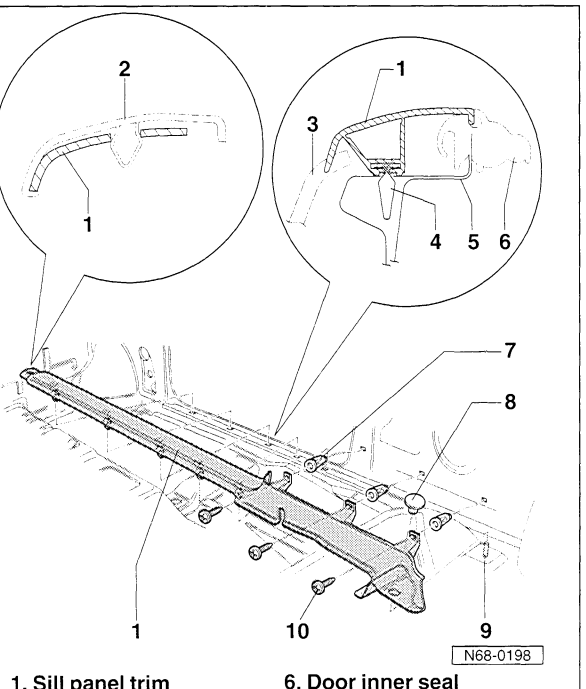
1. Sill panel trim
2. Press button
3. Securing clips
4. Clips (5)
5. Cover (behind seatbelt)
6. Door inner seal
7. A-pillar trim
8. Sill
9. Carpet

Sill panel trim (4-door), removing

– Fold rear seat bottom and backrest forward.

– Remove A-pillar, B-pillar, and inner wheel housing trim as described earlier.

➤ Unclip sill panel on left and right sides of B-pillar by pulling upward. Remove sill panel by pulling toward center of car.



1. Sill panel trim
2. A-pillar lower trim
3. Carpet
4. Clips (5)
5. Sill
6. Door inner seal
7. Spreader nut (3)
8. Press button
9. Threaded stud
10. Screw (3)

Sill panel trim (2-door), removing

– Remove rear seat cushion and backrest, see **72 Seats**.

– Remove rear side trim as described earlier.

➤ Remove press button at rear of sill panel trim.

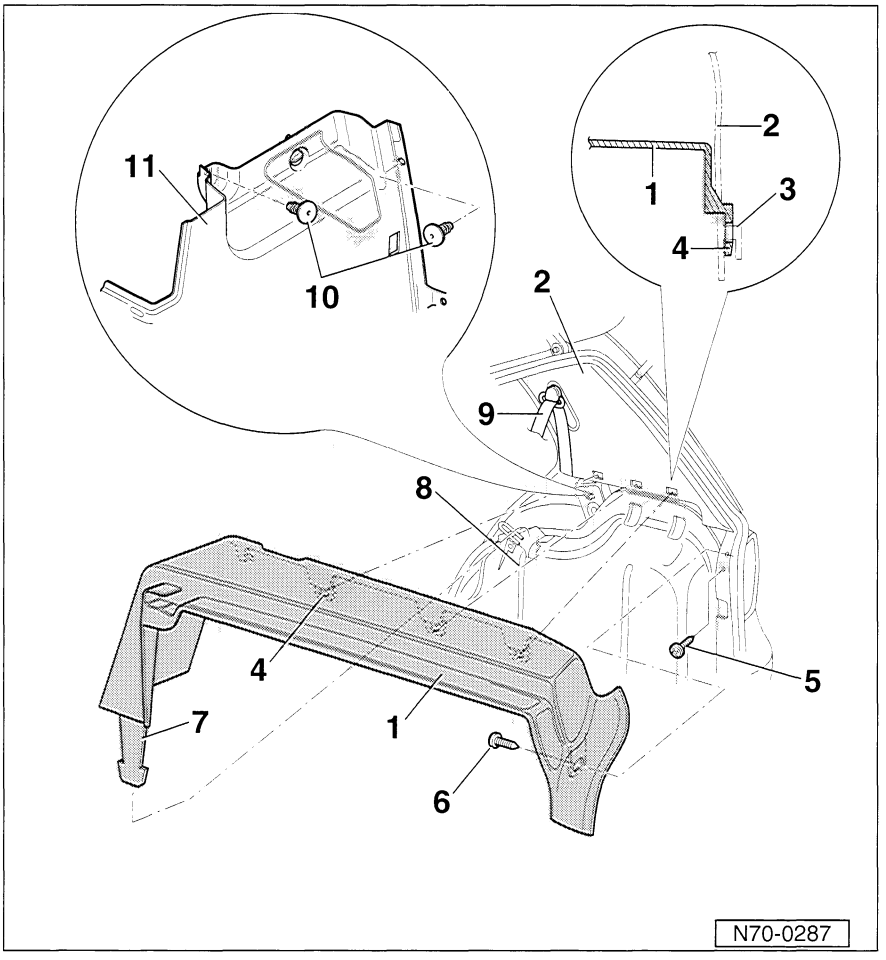
– Remove sill panel mounting screws.

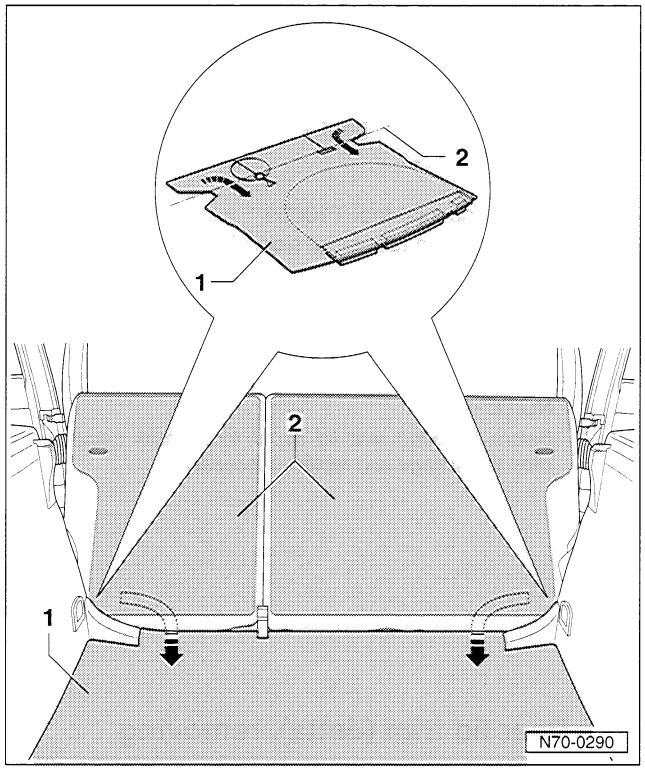
– Starting at the front, unclip sill panel from lower A-pillar and remove.

LUGGAGE COMPARTMENT TRIM

Luggage compartment cover support (Golf)

1. **Support**
   - Removing:
     Remove screw (**5**)
     Unclip lock carrier trim from C-pillar and pull out clips (**10**)
     Remove screw (**6**)
     Unclip support (**1**) upwards, starting at rear
     Pull support (**1**) out of wheel housing (**8**), including locking pin (**7**)
2. **C-pillar trim**
3. **Locking lug on C-pillar trim**
4. **Locking hook on support**
5. **Screw**
6. **Screw**
7. **Locking pin**
8. **Wheel housing**
9. **Seat belt**
10. **Clips**
11. **Luggage compartment trim**





Luggage compartment floor covering (Golf), removing

– Fold rear seat cushion and backrest forward.

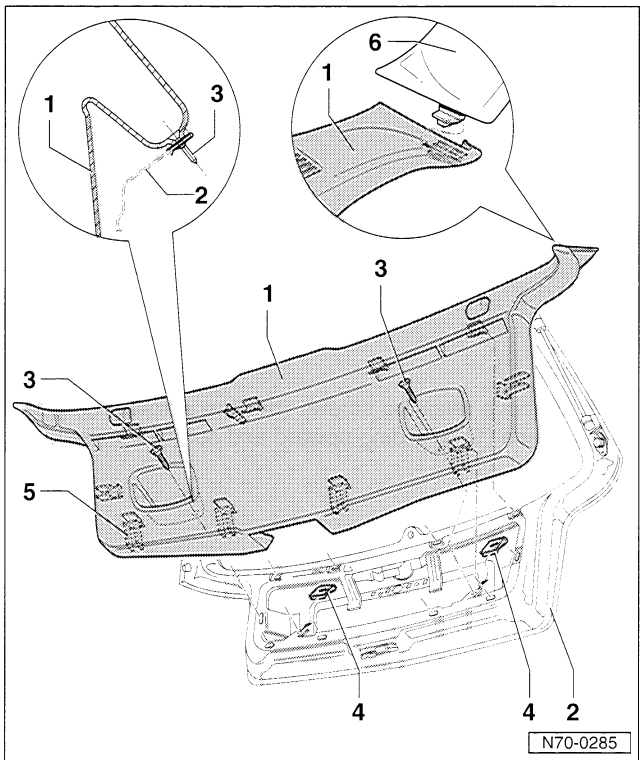
➤ Pull luggage compartment floor covering (**1**) out toward rear (**arrows**) with rear seat backrest (**2**) folded forward.

Rear lid lower trim (Golf), removing

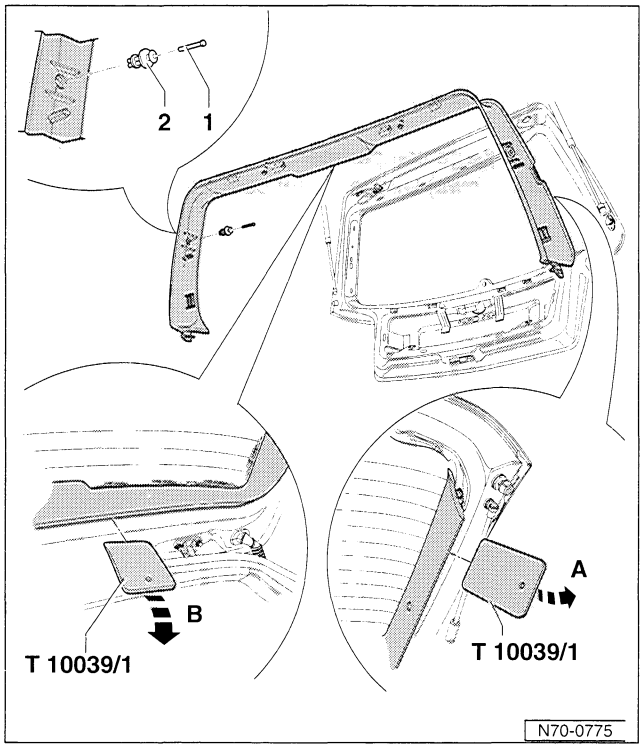
– Remove two mounting screws from bottom of rear lid lower trim.

– Remove side straps for parcel tray from upper trim.

➤ Unclip trim from rear lid and from upper trim at sides.



1. Lower trim panel
2. Rear lid
3. Screws (2)
4. Panel nuts (2)
5. Clips (10)
6. Upper trim



Rear lid upper trim (Golf), removing

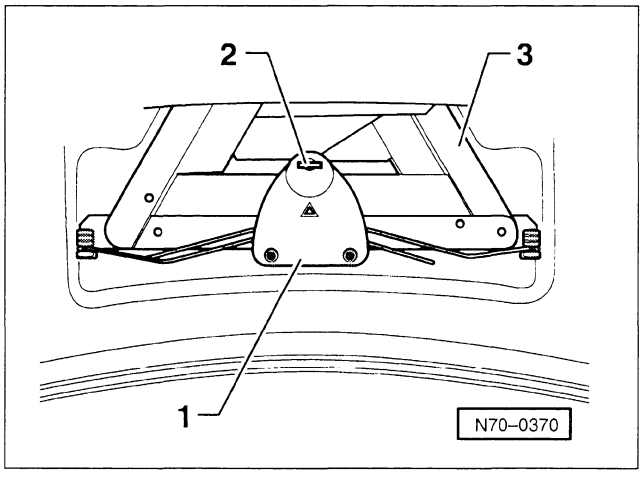
– Remove rear lid lower trim as described above.

➢ Remove left and right side spreader pins (**1**) from rear shelf bracket (**2**).

– Use VW special tool T10039/1 wedge, or similar, to pry trim away from rear lid at sides (**arrow A**).

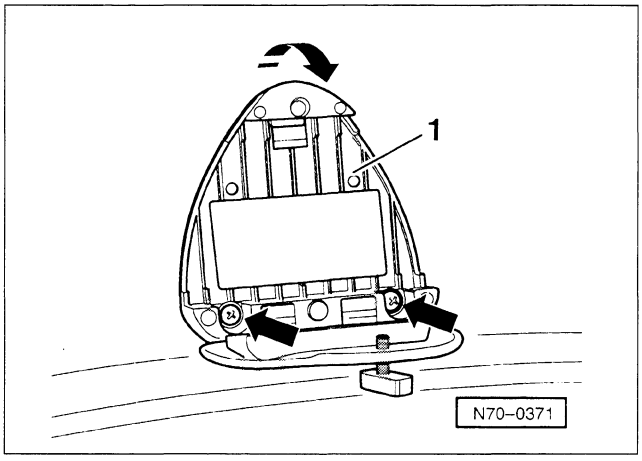
– Use VW special tool T10039 lever, or similar, to pry trim at upper edge (**arrow B**).

NOTE —
Before installing rear lid upper trim, check securing clips for damage and replace if necessary.

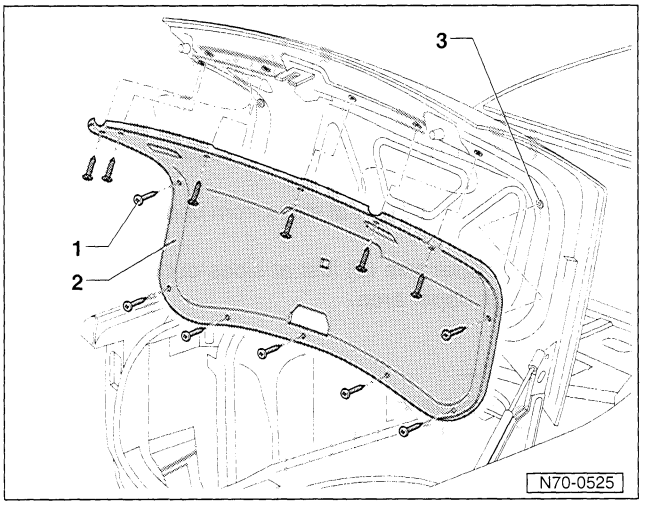


Rear lid trim (Jetta), removing

– Open rear lid and remove emergency warning triangles (**3**) from rear lid trim, if applicable, by opening locking device (**2**) and folding open retainer (**1**) that holds triangles in place.

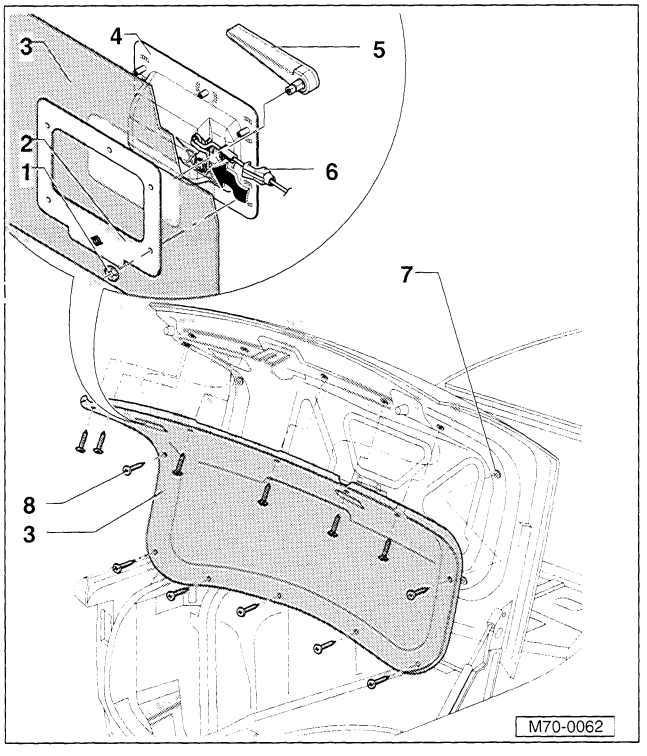


➢ Remove retaining screws (**bottom arrows**) and locking device (**1**) by sliding upward and out (**top arrow**).



➤ Remove retaining screws (**1**) for rear lid trim (**2**) and release trim in area of handle molding and remove.

– Installation is the reverse of removal. Check condition of spreader nuts in rear lid and replace as necessary.



Vehicles with trunk escape handle (from 06/01 production)

➤ On vehicles with trunk escape handles, release clip (**6**) and disconnect bowden cable (**arrow**).

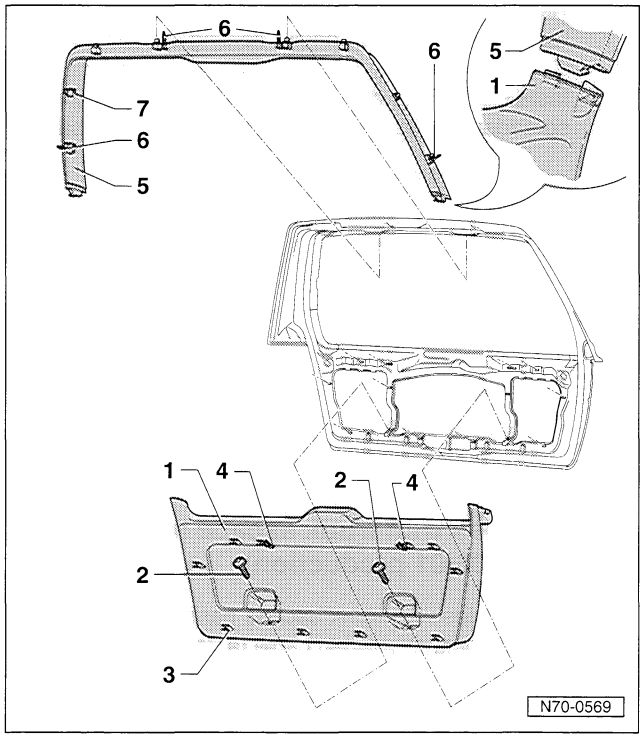
– Remove trim panel as described above.

– To continue with removal of trunk escape handle, carefully pry off clamping washers (**1**) and handle retaining frame (**2**) from backside of trim panel.

– Remove handle support (**4**) from rear lid trim.

– Release escape handle (**5**) from handle support (**4**).

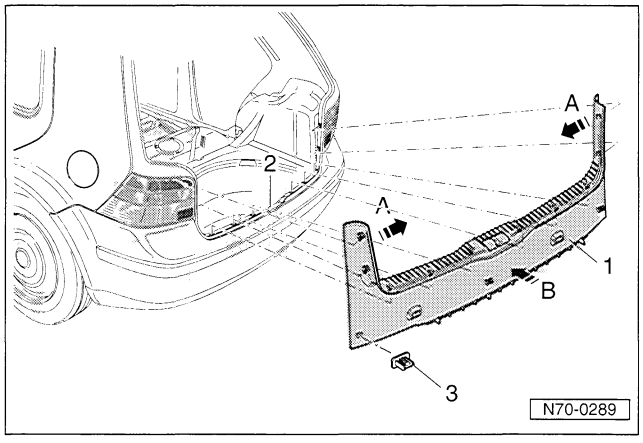
– Installation is the reverse of removal. Check condition of spreader nuts in rear lid and replace as necessary.



Rear lid trim (Jetta wagon), removing

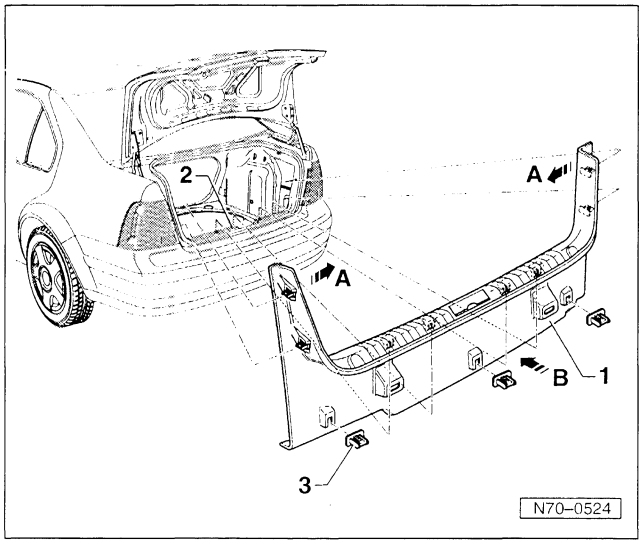
- Remove mounting screws (**2**) from inside rear lid handles.
- Unclip lower trim (**1**) from lid at bottom.
- Unclip lower trim (**1**) at sides from upper trim (**5**).
- Unclip upper trim (**5**) first at sides out of clips (**7**). Then unclip at upper area.

NOTE —
*Before installing, check clips (**3**) and (**7**) for damage and replace if necessary.*



Rear lock carrier trim (Golf), removing

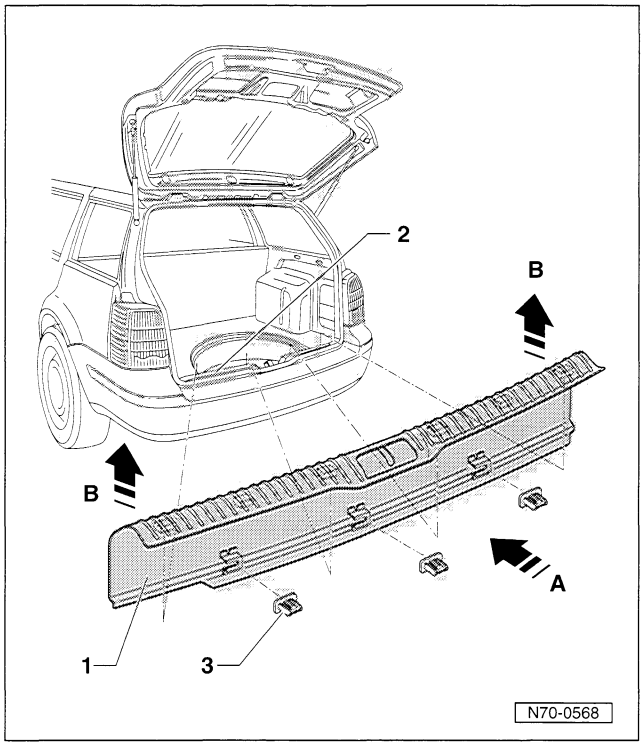
- Open rear hatch and release rear lock carrier trim (**1**) from cross panel (**2**) at top first (**arrows A**) and then at bottom (**arrow B**).
- Pull lock carrier trim upward off cross panel.



Rear lock carrier trim (Jetta), removing

- Open trunk and release rear lock carrier trim (**1**) from lock carrier (**2**) at top first (**arrows A**) and then at bottom (**arrow B**).
- Pull lock carrier trim upward off lock carrier.

Rear lock carrier trim (Jetta wagon), removing



➢ Open trunk and release rear lock carrier trim

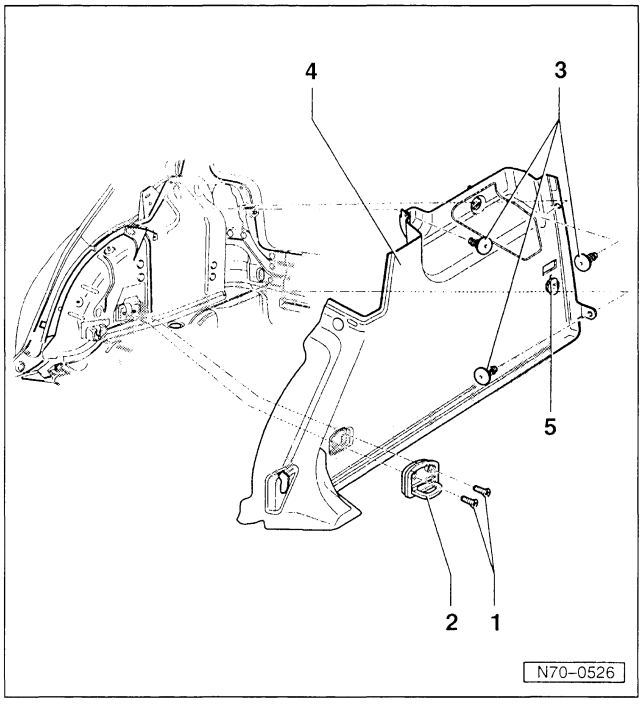
– Release lower section of lock carrier cover (**1**) from cross panel (**2**) in direction of arrow **A**.

– Pull lock carrier -1- off cross panel -2- -arrow B-.

– Install in reverse order of removal.

NOTE —
*Check clips (**3**) before assembling and replace as necessary.*

Right-side luggage compartment trim (Golf), removing



– Remove right rear seat backrest, see **72 Seats**.

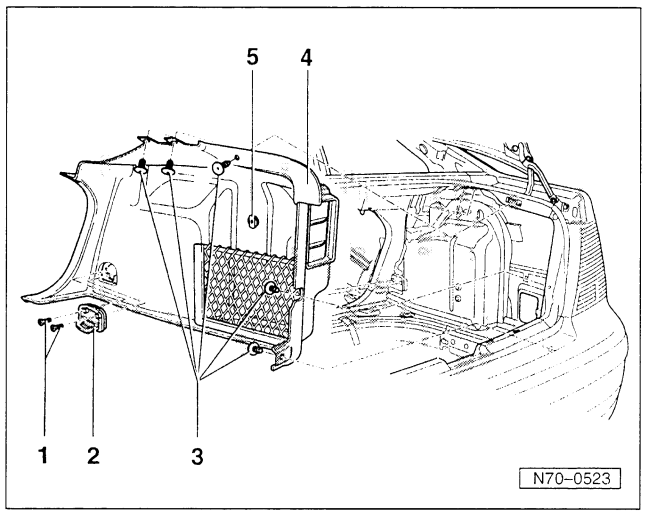
– Remove inner wheel housing trim as described earlier.

– Remove rear lock carrier trim as described above.

– Remove tie down hook mounting screws and tie down hooks.

➢ Pull out three trim panel retaining plugs. Remove mounting screws (**1**), tie down hook (**2**), pull out three plugs (**3**), remove panel and disconnect harness connector for 12V accessory socket (**5**).

– Remove trim panel and disconnect harness connector for 12 V accessory socket.



Right-side luggage compartment trim (Jetta), removing

– Remove rear seat backrest, see **72 Seats**.

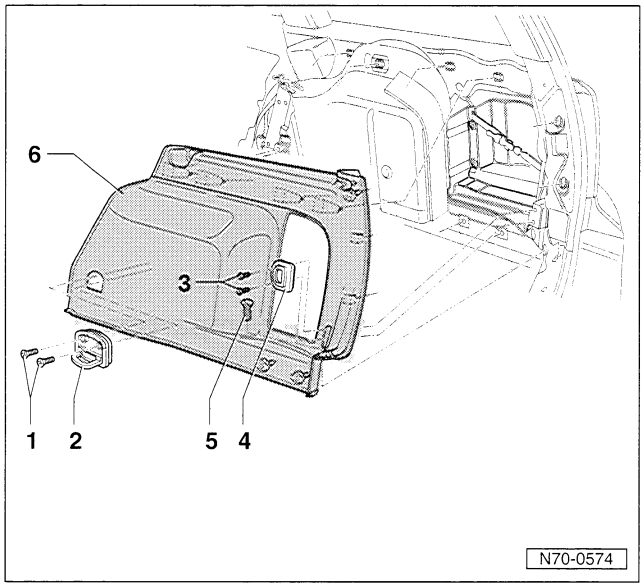
– Remove inner wheel housing trim as described earlier.

– Remove rear lock carrier trim as described above.

➢ Remove tie down hook mounting screws (**1**) and tie down hooks (**2**).

– Pull out three trim panel retaining plugs (**3**).

– Remove trim panel and disconnect harness connector for 12 V accessory socket (**5**).



Right-side luggage compartment trim (Jetta wagon), removing

– Lift right-hand seat cushion up forwards.

– Remove right-hand seat backrest.

– Remove wheel housing trim.

– Remove rear lock carrier cover.

➢ Unscrew bolts (**1**) and take off tie-down hook (**2**).

– Unscrew bolts (**3**) and take off tie-down mount (**4**).

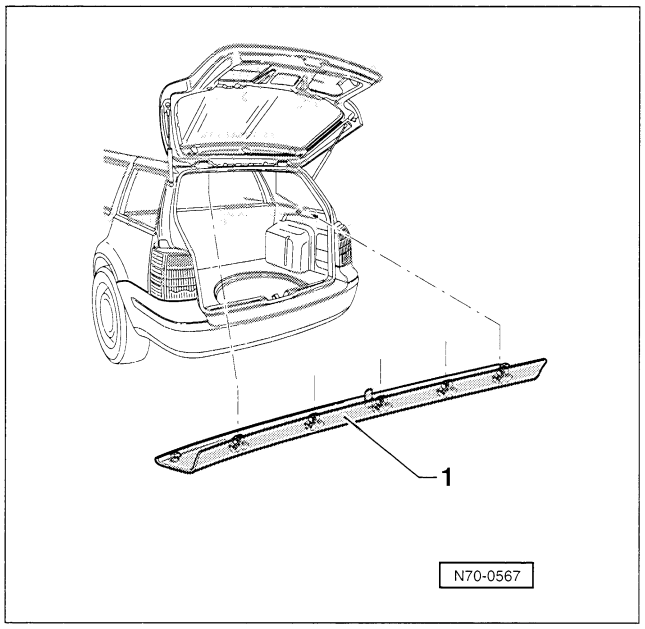
– Remove bolt (**5**).

– Release luggage compartment trim (**6**) and separate connections for lighting and 12 V socket if installed.

– Install in reverse order of removal.

NOTE —

- *Before installing check clips and replace as necessary.*
- *The luggage compartment trim panel on the left-hand side contains a 12V socket and luggage compartment light. When removing the trim panel be sure to disconnect battery ground (-) strap.*



Roof end strip (Golf, Jetta wagon), removing

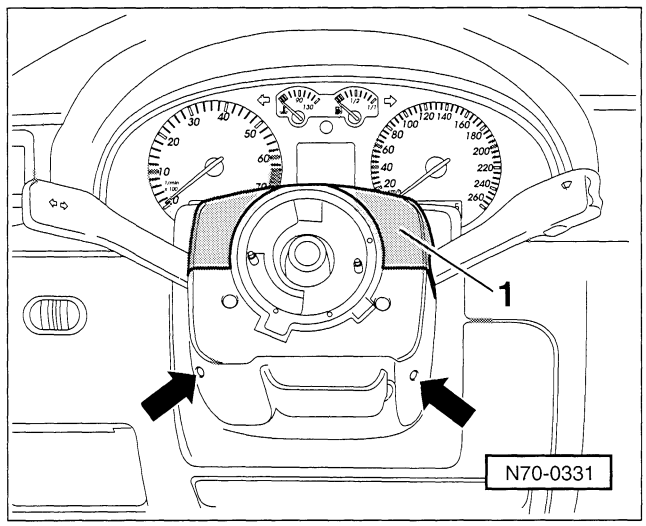
➢ Open tailgate and remove roof end strip (**1**) downward out of mounts in roof cross member.

INSTRUMENT PANEL

Instrument panel, removing and installing

WARNING —

- *Disconnect the battery Ground strap (GND) from negative (–) battery terminal before working on the electrical system.*
- *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using a VAG 1551/5051 or equivalent scan tool.*



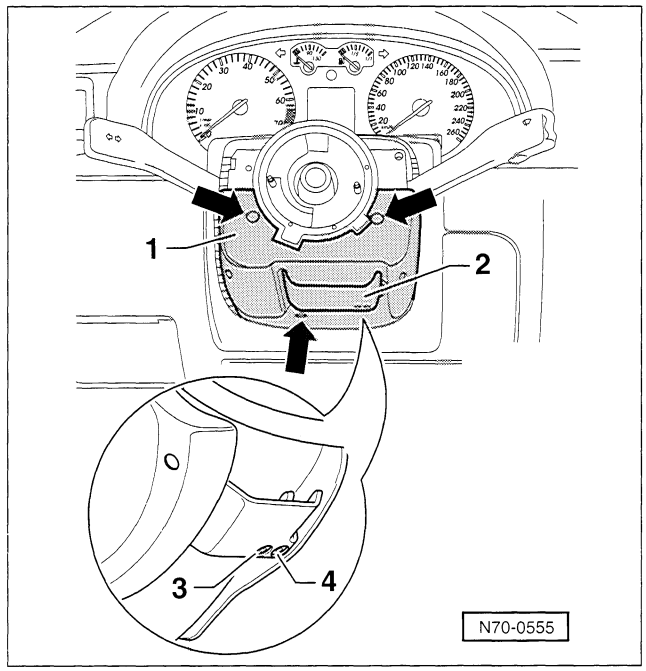
NOTE —

- *Be sure to have the anti-theft radio code on hand before disconnecting the battery.*
- *Removal of the instrument panel requires removing the radio. Volkswagen special tool 3316 is necessary for removing the factory radio.*

– Remove steering wheel and driver's airbag unit as described in **48 Steering** and **69 Seatbelts, Airbags**.

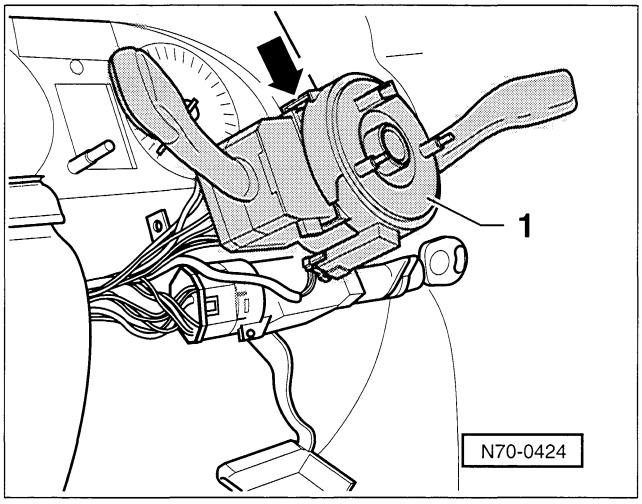
– Remove center console as described earlier.

➢ Remove screws (**arrows**) holding upper steering column switch trim (**1**) in place and remove trim.

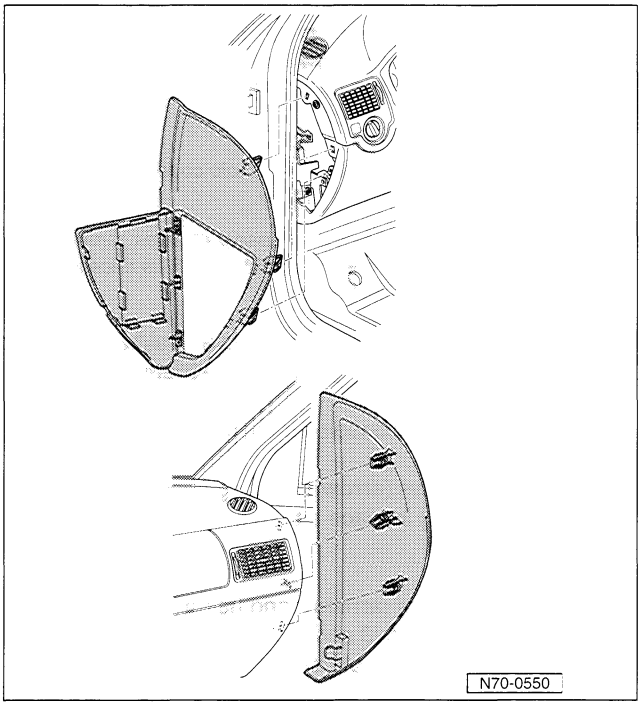


➢ Remove screws (**arrows**) and height adjustment handle mounting screws (**3** and **4**) and handle (**2**). Remove lower steering column switch trim (**1**).

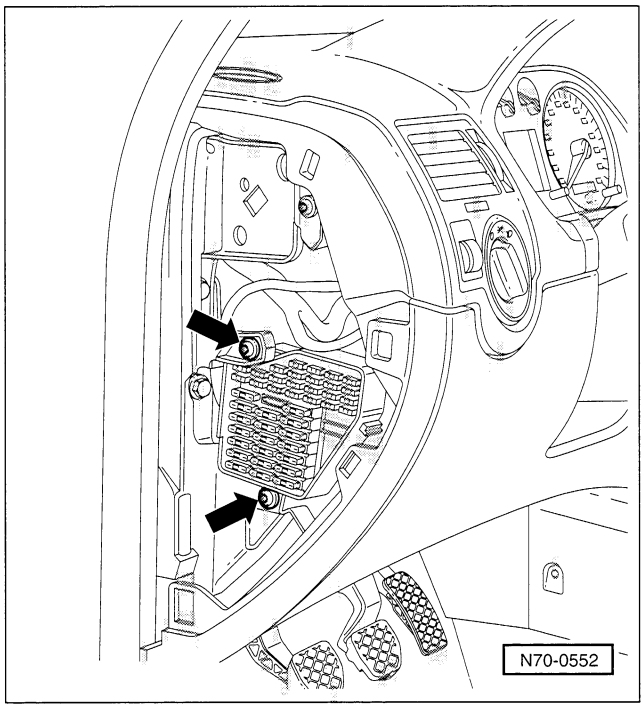
– Remove steering column height adjustment handle and release (pull down) height adjustment lever. Remove lower steering column switch trim.



- Remove bolt (**arrow**) behind steering column switch assembly.
- Disconnect harness connectors from steering column switch assembly.
- Remove steering column switch assembly (**1**).

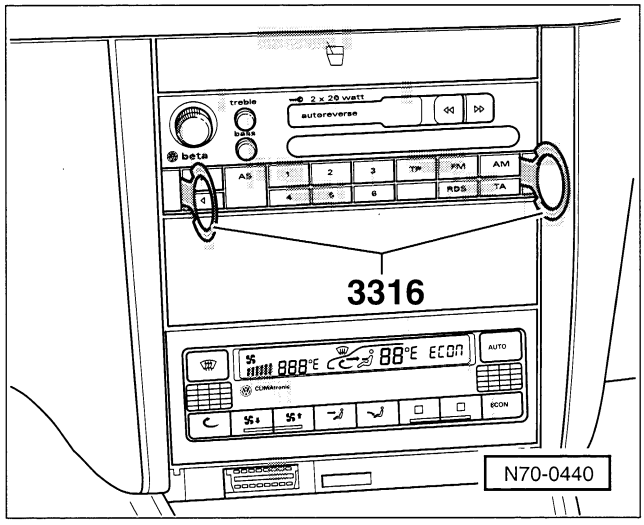


- Unclip and remove left and right-side instrument panel trim pieces with a screwdriver.



➢ Remove mounting screws (**arrows**) above and below fuse panel.

– Remove steering column lower trim as shown earlier.



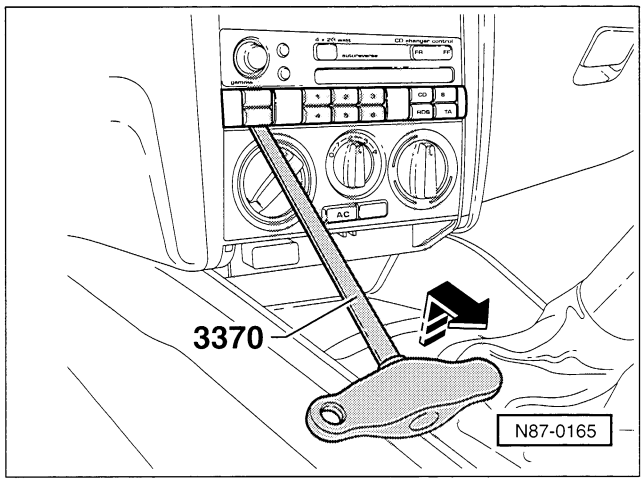
➢ Slide Volkswagen radio release special tools 3316 into slots until they engage.

– Pull radio out of instrument panel using grip rings of release tools and disconnect harness connectors on back of radio.

NOTE —

- *Do not push the radio release tool 3316 to the side or tilt it.*
- *Press the locating tabs on the side of the radio inward to remove the release tools.*
- *Do not install radio with release tools in place.*

– For vehicles without radio, remove radio block-off trim.



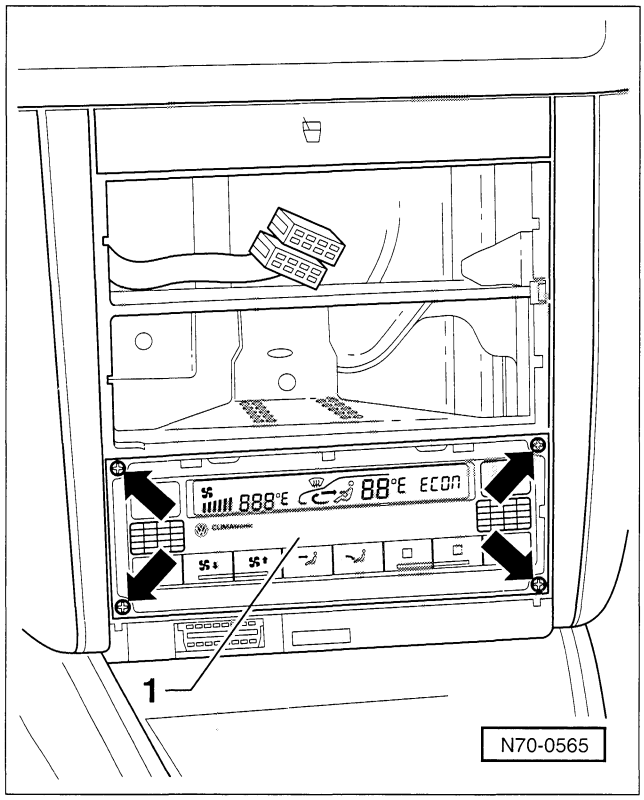
Vehicles with manual A/C system

➢ Use VW special trim removal tool 3370, or equivalent tool with hooked end to remove trim for manual A/C system.

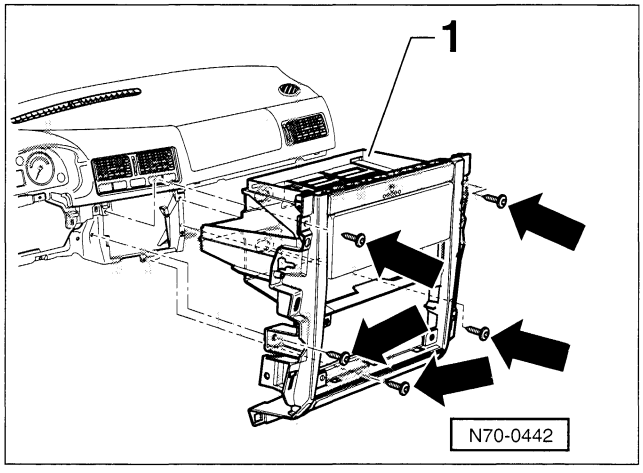
– Remove mounting screws for cable operated heating and A/C control unit and press control unit with cables attached into instrument panel.

Vehicles with Climatronic A/C system

– Carefully pry out trim panel around Climatronic control head using a small screwdriver or plastic trim pry tool. See **87 Air Conditioning**.



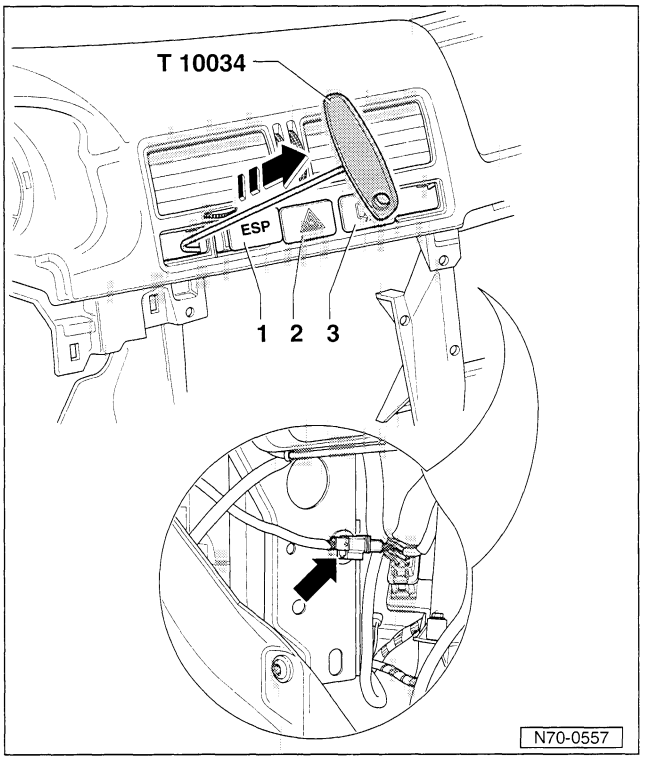
➢ Remove mounting screws (**arrows**) and Climatronic control unit (**1**).



Continued for all vehicles

➢ Remove mounting screws (**arrows**) and radio/climate control unit carrier (**1**) from center of dash.

– Unclip data link connector from under driver's side of instrument panel.

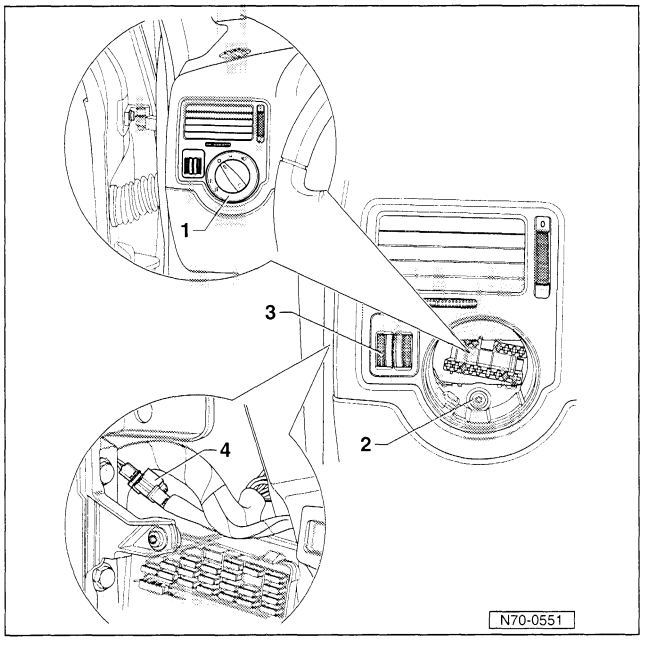


– Use a flat screwdriver to pry out seat heater switches. Disconnect harness connectors.

➢ Use VW special assembly tool T10034 to unclip ESP switch (**1**), hazard light switch (**2**) and rear window defroster switch (**3**) from center vent housing in direction of upper **arrow**. Disconnect harness connectors from switches.

> ***WARNING —***
> *Due to high spring tension, do not use screwdriver to remove switches for ESP, hazard lights and rear window defroster.*

– Disconnect harness connector for air outlet indicator (inset **arrow**).



➢ Press in headlight switch (**1**), turn toward right and remove. Disconnect harness connectors from switch.

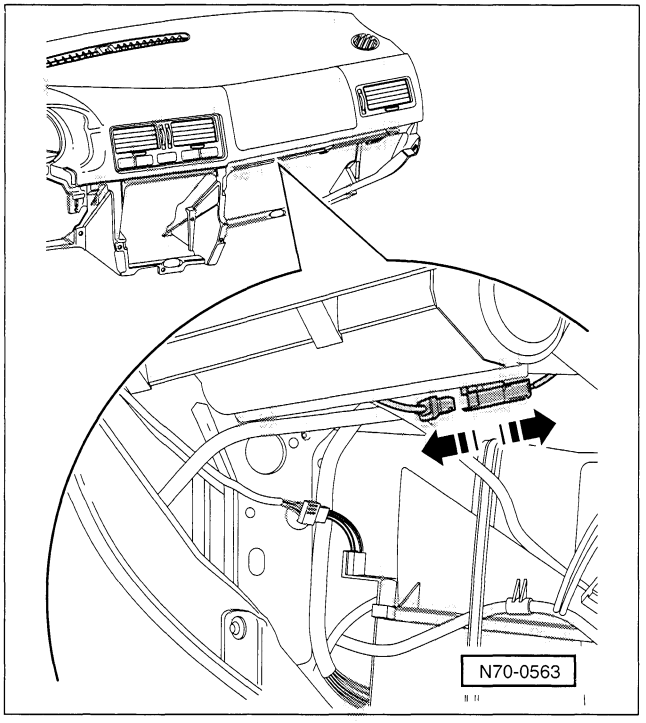
– Remove screw (**2**) and remove driver's side air outlet from instrument panel.

– Disconnect harness connector for dimmer switch (**3**).

Jetta and Jetta wagon models

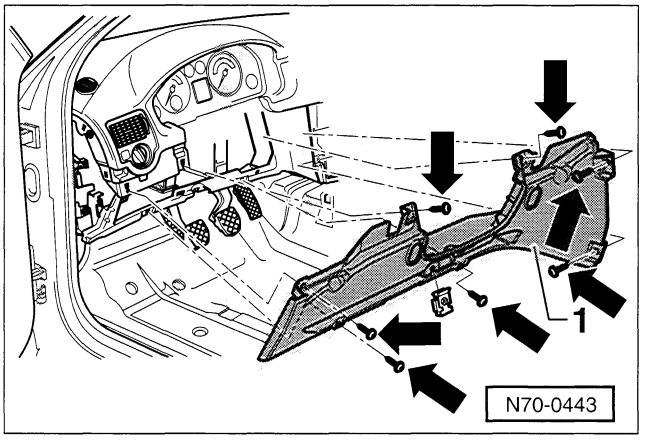
– Disconnect harness connector for driver's side air outlet indicator light (**4**) as applicable.

Continued for all vehicles



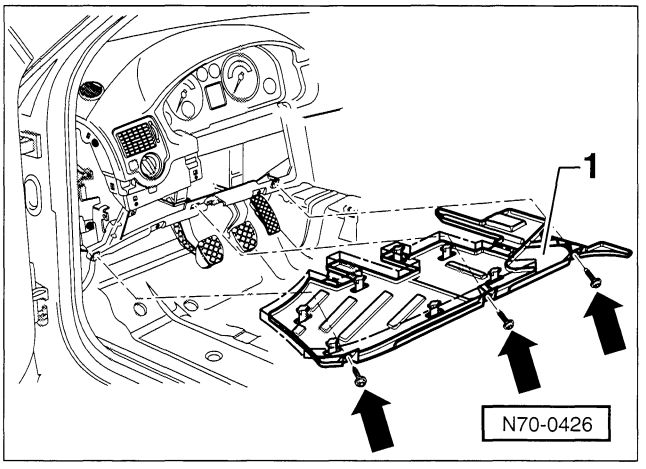
- Disconnect harness connector for passenger side airbag.

> ***WARNING —***
> *Electrostatic charges may result in involuntary deployment of airbag. Therefore, mechanic must be electrostatically discharged before disconnecting ignition- and Ground (GND) wires. This is done e.g. by briefly grasping chassis or door striker.*



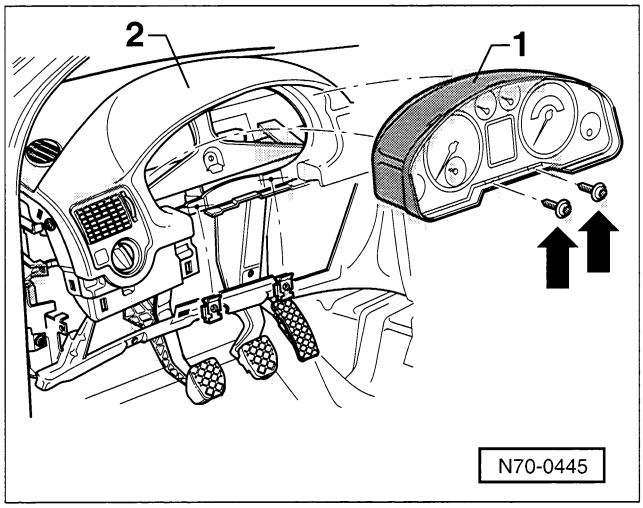
- Remove mounting screws (**arrows**) and reinforcement plate (**1**) from below steering column.

– Remove glovebox as described earlier, see **Glovebox, removing**.



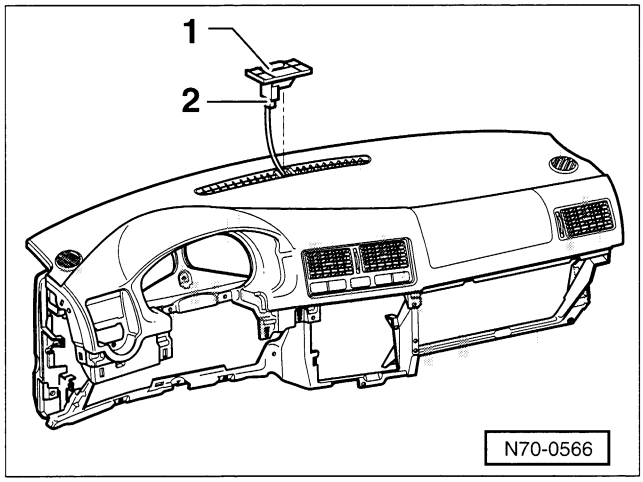
- Remove mounting screws (**arrows**) and footwell trim panel (**1**).

> ***NOTE —***
> *Footwell trim panel may also be secured with clips rather than screws.*



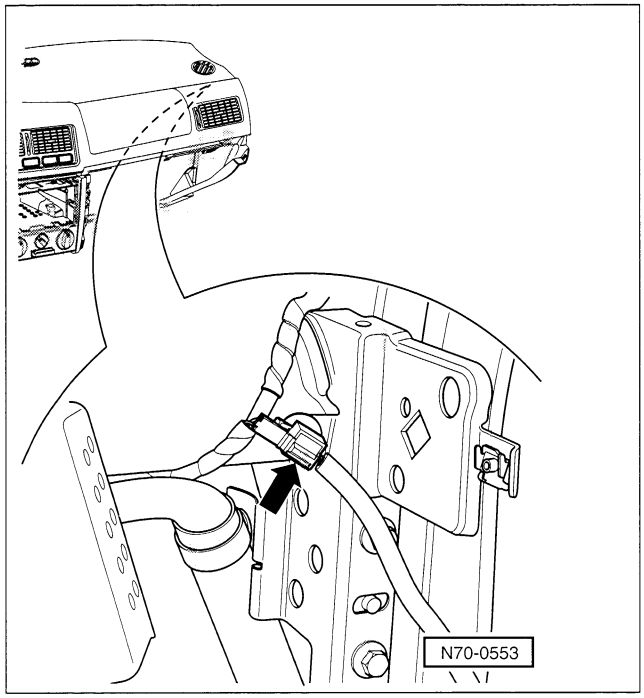
- Remove mounting screws (**arrows**) in bottom of instrument cluster (**1**). Lower cluster slightly and pull out from instrument panel (**2**). Disconnect harness connectors on back of cluster and remove.

Vehicles with Climatronic A/C system

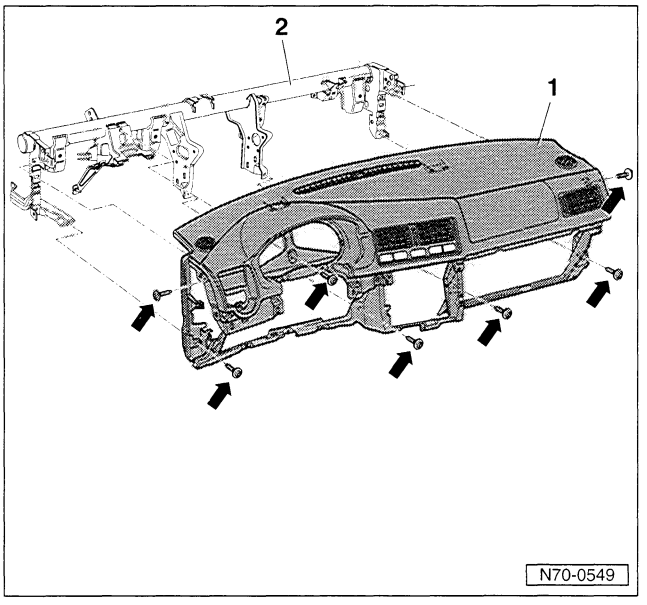


- Unclip temperature sensor (**1**) (Climatronic) from top of instrument panel and separate harness connector (**2**).

Jetta and Jetta wagon models



- Disconnect harness connector for air outlet indicator (**arrow**).



Continued for all vehicles

➤ Remove instrument panel mounting screws (**arrows**).

– Remove instrument panel from crossmember (**2**).

– Install instrument panel in reverse order of removal, noting the following:

- Always replace steering wheel mounting bolt when installing steering wheel.
- After connecting battery check operation of vehicle equipment (radio, clock, power windows).
- After connecting battery, readiness code for the ECM will need to be re-set using VAG 1551/5051 scan tool or equivalent.
- If airbag malfunction indicator lamp (MIL) signals a malfunction after installing instrument panel, the Diagnostic Trouble Code (DTC) memory must be erased and checked again with VAG 1551/5051 scan tool or equivalent.

HEADLINER

Headliner, removing and installing

WARNING —

• Disconnect the battery Ground strap (GND) from negative (–) battery terminal before working on the electrical system.

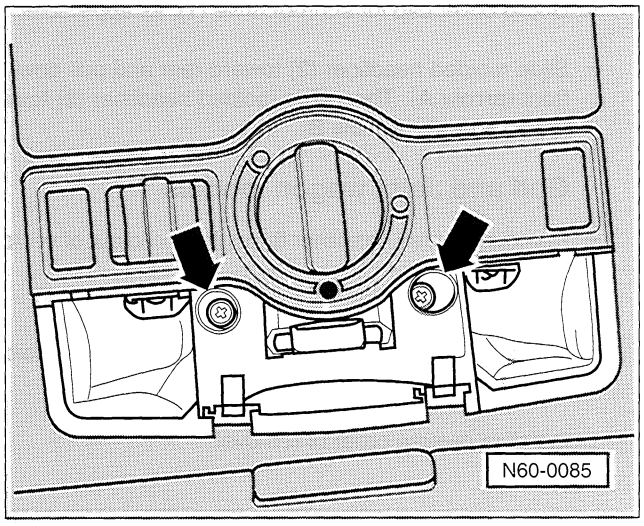
• Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using a VAG 1551/5051 or equivalent scan tool.

NOTE —

Be sure to have the anti-theft radio code on hand before disconnecting the battery.

– Remove the following trim panels and components as shown previously:

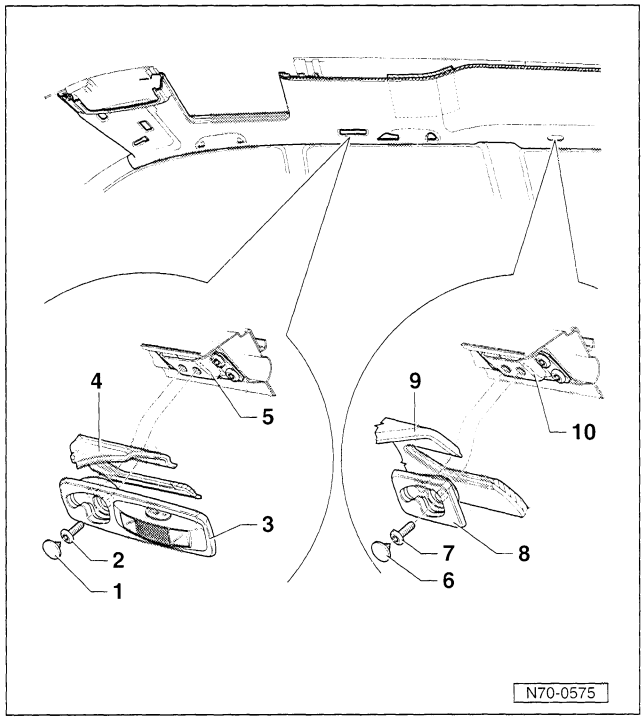
- Upper A-pillar
- Upper B-pillar
- Upper C-pillar
- Upper D-pillar (Golf and Jetta wagon models)
- Roof end strip (Golf and Jetta wagon models)
- Sun visors
- Grab handles (roof)
- Upper door inner seals



- Remove front interior light lens by pulling and mounting screws underneath domelight lens (**arrows**).

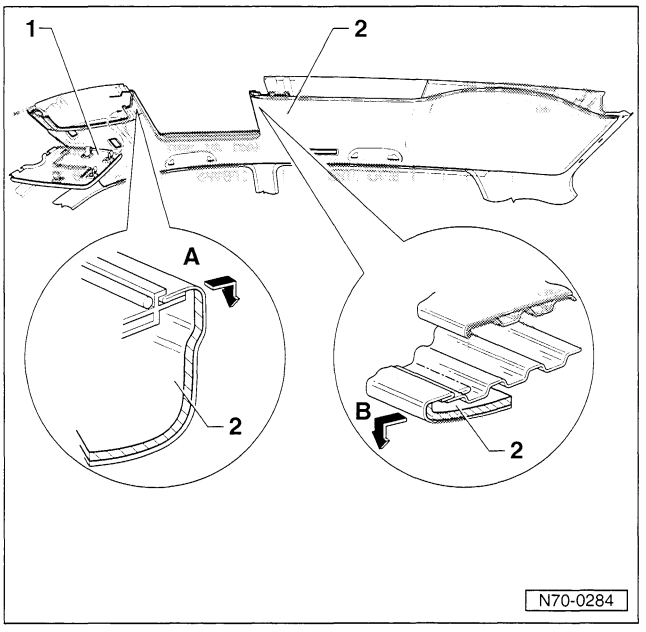
NOTE —
Sunroof equipped vehicle shown at left. Removal of domelight lens and mounting screws is the same for sunroof and non-sunroof equipped vehicles.

- Remove sunroof switch and disconnect harness connector. See **96 Lights, Accessories–Interior**
- Remove interior lights in headliner and disconnect harness connectors. See **96 Lights, Accessories–Interior**.



Jetta wagon models

- Unclip caps (**1** and **6**), remove bolts (**2** and **7**) and front and rear lifting eyelets (**3** and **8**).



- Unclip cover cap for sunroof drive (**1**), as applicable.
- Slide molded headliner (**2**) toward rear and pull down at front (**arrow A**). Then slide molded headliner (**2**) toward front and lower (**arrow B**).

Golf and Jetta wagon models

- Remove molded headliner through rear lid out of vehicle.

Jetta models

- Fold passenger seat backrest down and remove molded headliner through rear door.
- Install in reverse order of removal.

QUALITY REVIEW

When you have finished working under the hood and around other areas of the vehicle, it is advisable to take a moment to quality check or review your work. This helps to insure that the operation or repair has been completed properly with all affected systems functioning within normal parameters. These may include the following:

- Ensure that all cable ties and clamps that were removed as part of the repair are replaced.
- Ensure that all fasteners and hardware were replaced and torqued as specified.
- Make sure that all other components involved in the repair are positioned correctly, properly torqued and function properly.
- Make sure that all tools, shop cloths, fender covers and protective tapes are removed.
- Clean grease and fingerprints from painted surfaces, steering wheel, upholstery and shifter.
- Make sure that seatbelt and airbag warning lights function correctly.
- Unlock anti-theft radio and reset the clock.

72 Seats

FRONT SEATS 72-1
Front seat, removing and installing 72-2
Front seat assembly 72-4
Head restraint guides, removing 72-5
Locking backrest assembly (2-door) 72-6
Locking backrest cable, removing (2-door) 72-6
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8-way seat backrest adjustment drive, removing 72-12

REAR SEATS 72-13
Rear seat bottom, removing and installing (Golf, Jetta sedan) 72-13
Rear seat bottom, removing and installing (Jetta wagon) 72-13
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Rear backrest padding and armrest, removing and installing 72-14
Backrest lock, removing and installing 72-16

FRONT SEATS

Both driver and passenger front seats are equipped with airbags mounted in the seat backrest frames. These airbags are designed to deploy under certain side impact conditions and are triggered by separate sensors mounted to the front floor crossmembers under the front seats. Before removing the front seats, a safety device (VAS 5094 or VAS 5232/1) must be installed to prevent accidental deployment of the airbag units.

WARNING —

- *Observe all cautions, warnings and notes before starting repairs involving airbag systems, see* **69 Seatbelts, Airbags**.

- *Volkswagen of America specifically warns against the installation of aftermarket upholstery on any vehicle equipped with side airbags. The factory-installed upholstery is designed to separate in specific places at specific rates, and in specific directions. Installation of non-factory upholstery including, but not limited to, "beads" and "sheepskins", may cause seat mounted airbags to deploy when they are not supposed to; fail to deploy when they should; or to deploy in some manner other than designed. This is a safety hazard and could result in serious injury or death to occupants of the vehicle.*

Front seat, removing and installing

– Disconnect the battery ground (–) strap before working on the electrical system.

> ***WARNING —***
> *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using a VAG 1551/5051 or equivalent scan tool.*

NOTE —

- *The removal and installation procedures may have to be modified slightly depending on equipment variations.*
- *Obtain the radio code before disconnecting the battery.*

– Slide seat forward.

➤ Remove screw cover (**1**) and screw (**2**).

– Unclip cover strip (**3**) from inner seat rail (**arrow A**) and remove toward rear (**arrow B**).

– Remove screw cover (**4**) and screw (**5**).

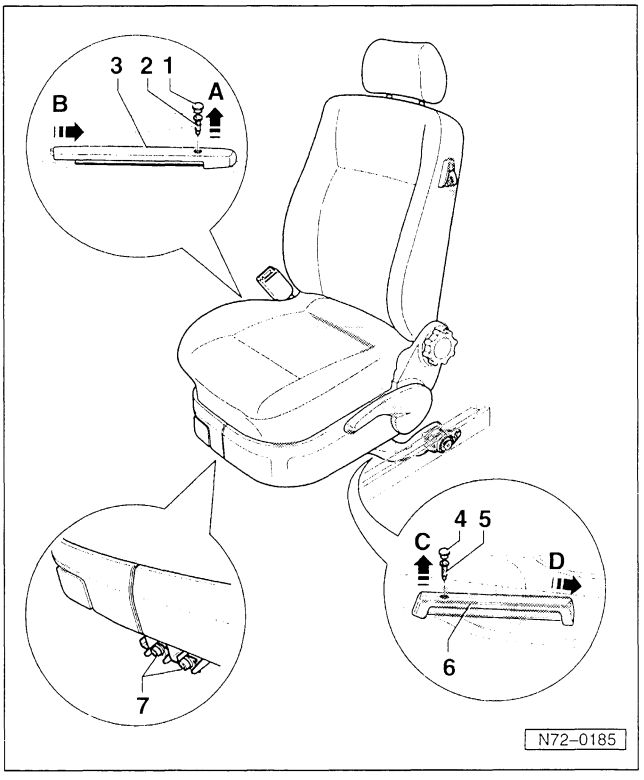
– Unclip cover strip (**6**) from outer seat rail (**arrow C**) and remove by sliding forward (**arrow D**).

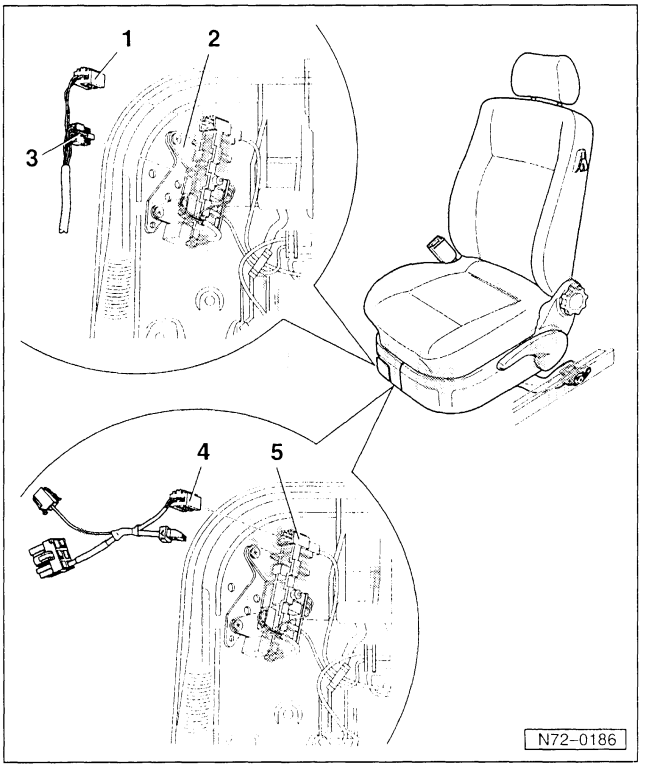
– Slide seat to rear.

– Remove retaining bolts (**7**).

Tightening torque

- Front seat retaining bolts . . . . . 23 Nm (17 ft-lb)





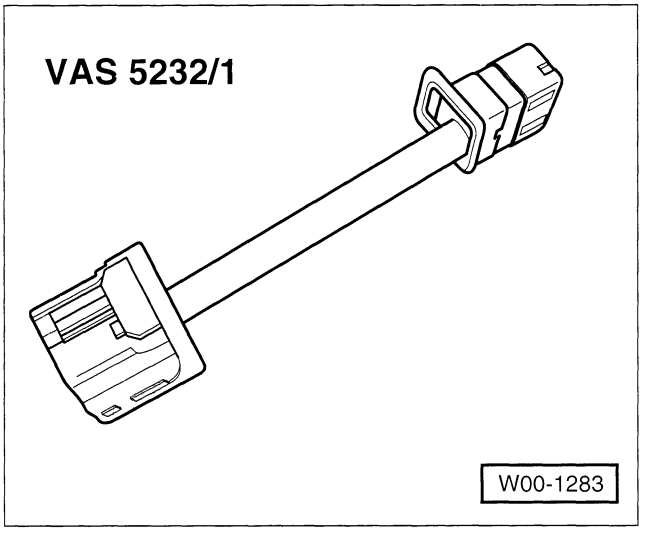
➢ Separate side airbag wiring harness connector (**1**) at seat connector station (**2**).

> ***WARNING —***
> *Before disconnecting the side airbag connector for the seat, a technician must discharge him/herself electrostatically by briefly touching door striker or vehicle body.*

– Separate connector (**3**) for seat heating (as applicable) and seat adjustment connector (as applicable).

– For vehicles produced **through 07/00**, insert connector (**4**) of Volkswagen special tool VAS 5094 airbag adapter into connector housing (**5**).

> ***WARNING —***
> *Failure to install VAS 5094 could result in deployment of the side airbag.*



➢ For vehicles produced **from 08/00**, insert connector of Volkswagen special tool VAS 5232/1 airbag adapter into connector housing (item #**5** shown above).

> ***WARNING —***
> *Failure to install VAS 5232/1 could result in deployment of the side airbag.*

continued for all vehicles

– Slide seat out of guide rails.

– Install in reverse order of removal, noting the following:

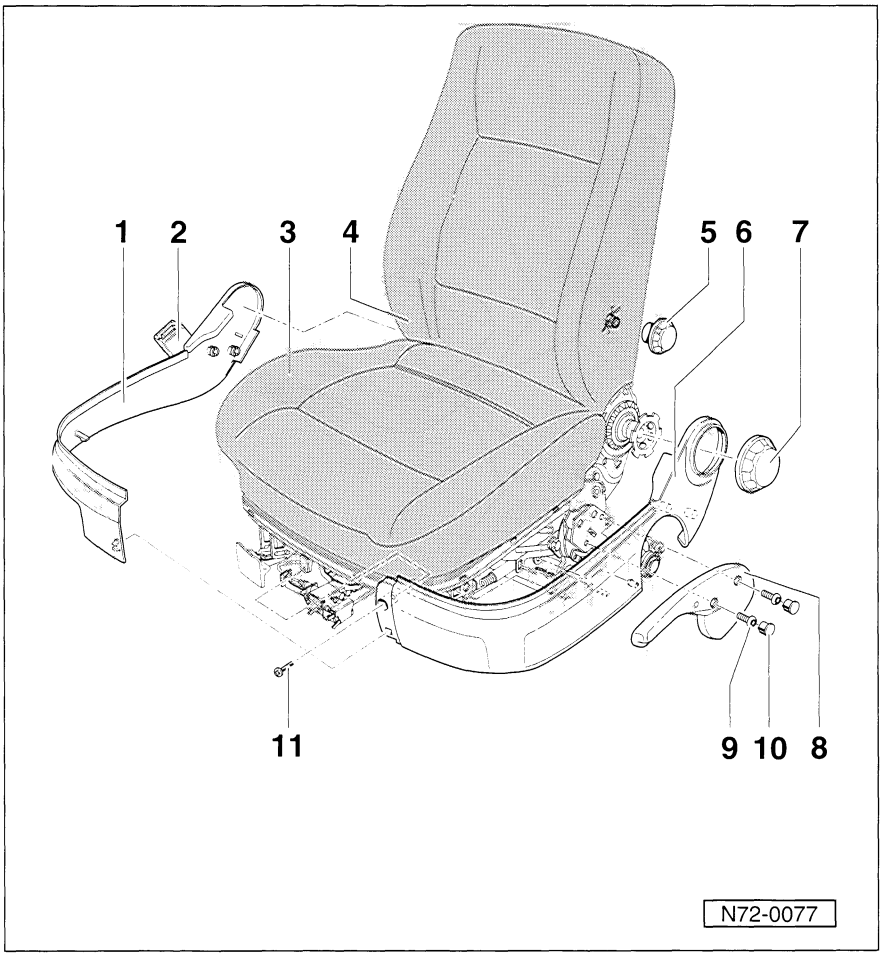
- After all components are installed, switch ignition on.
- Connect battery ground strap.

> ***WARNING —***
> *Make sure the passenger compartment is not occupied before connecting the battery ground strap.*

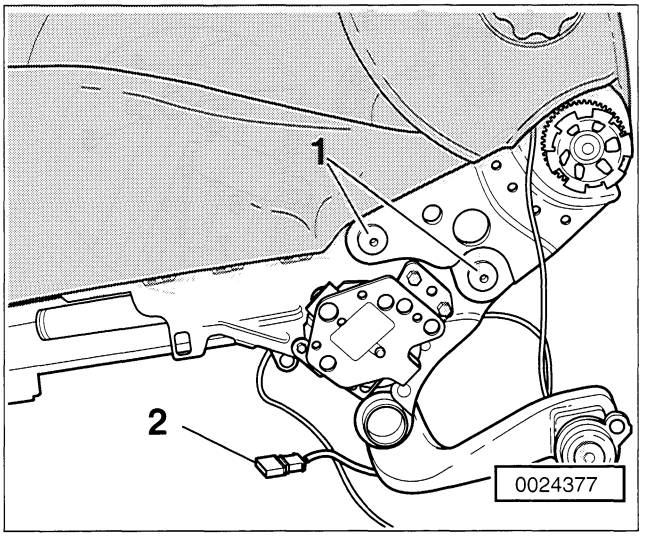
- After connecting the battery ground (–), ensure proper operation of vehicle equipment (radio, clock, power windows).

Front seat assembly

NOTE —
4-door seat shown. For 2-door seat, see **Height adjuster, assembly**, *given later.*



1. **Seat trim, right**
   - 2-piece on 2-door models
2. **Belt lock**
3. **Seat bottom**
4. **Backrest**
   - Removal:
     Remove seat belt lock (**2**)
     Remove seat from vehicle
     Pull off adjusting knob (**7**)
     Remove adjusting lever (**8**)
     Pull off trim (**1**)
     Remove screw and left-side trim (**11** and **6**)
     For remainder of removal procedure see **Front backrest, removing and installing**
5. **Adjusting knob (lumbar support)**
6. **Seat trim, left**
7. **Adjusting knob (backrest)**
   - 4-door shown
   - 2-door similar with additional spacer under knob
8. **Adjusting lever (seat height)**
9. **Screws**
10. **Cap**
    - Qty. 2
11. **Screw**
    - Qty. 2



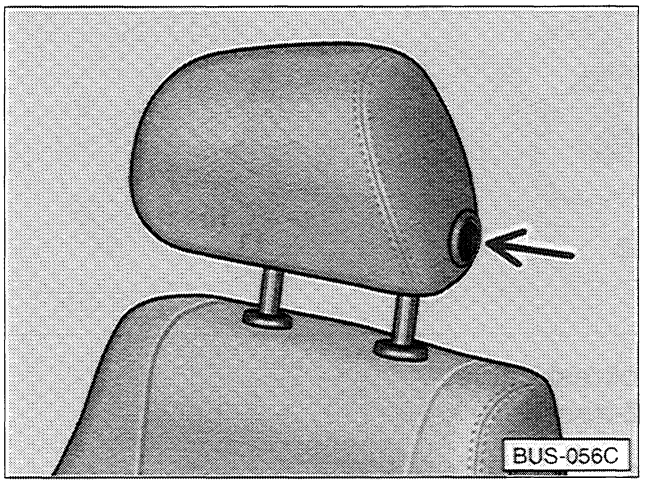
Front backrest, removing and installing

– Unclip wiring guides under seat.

➤ Disconnect wiring connector (**2**) for backrest heating, if equipped.

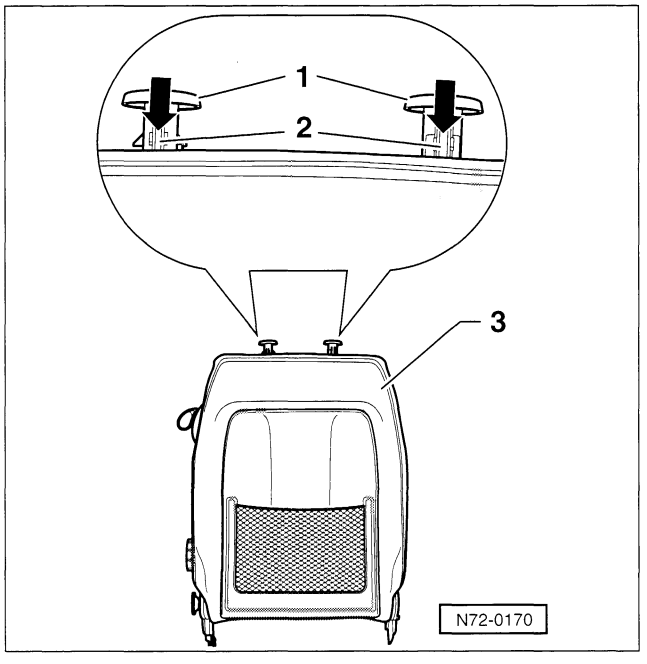
– Remove bolts (**1**) from both sides of seat and take off backrest.

– When installing, bolts (**4**) must be secured with thread locking compound and tightened to 24 Nm (18 ft-lb).



Head restraint guides, removing

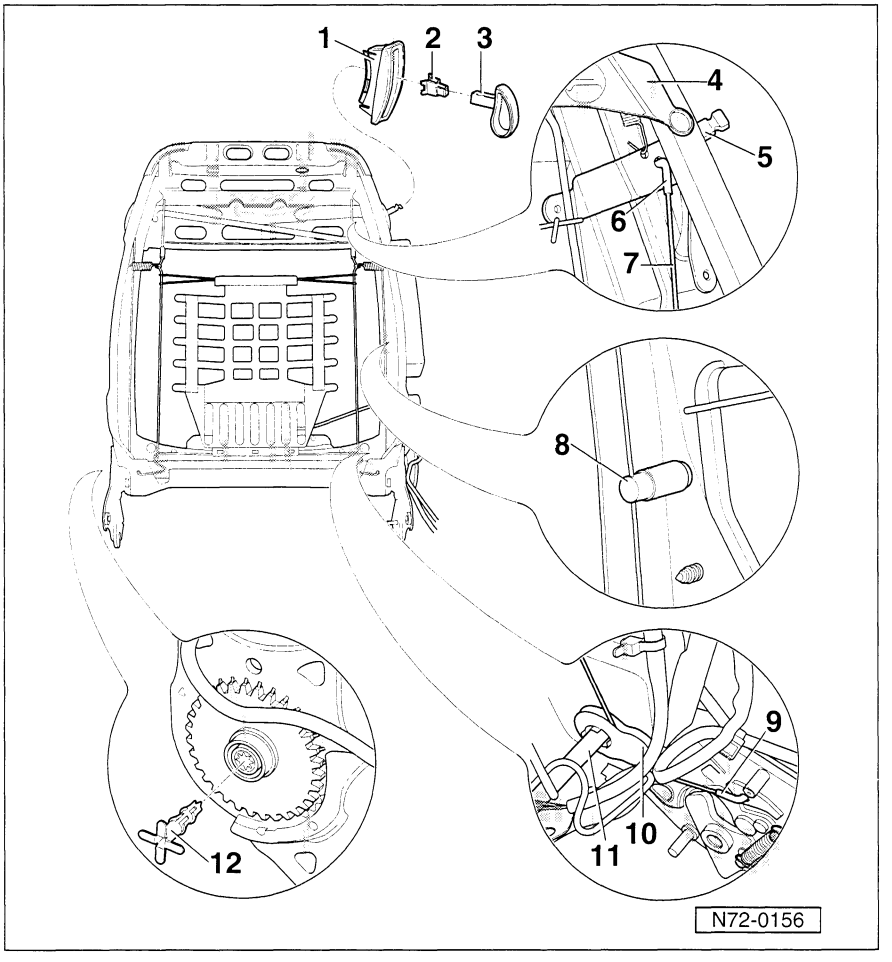
➤ Remove head restraint from backrest by pulling the restraint up until it stops. Then, press the release button (**arrow**) on the side of head restraint while pulling the head restraint up and out.



➤ Press in locking lugs (**2**) on head restraint guides (**1**) and pull out guides from backrest (**3**).

Locking backrest assembly (2-door)

1. **Cover**
2. **Clip**
3. **Grip**
4. **Backrest frame**
5. **Locking lever**
6. **Cable upper hook**
7. **Cable**
8. **Cable center guide**
9. **Cable lower hook**
10. **Cable lower guide**
11. **Transfer rod**
12. **Locking sleeve**
    - Always replace when replacing cable (**7**)



Locking backrest cable, removing (2-door)

– Remove seat and backrest as described earlier.

– Pry off grip (**3**) and unclip cover (**1**).

– Remove backrest cover and padding, as described later.

– Break off the four small tabs of the locking sleeve (**12**) and drive sleeve into transfer rod (**11**) using punch.

– Press locking lever (**5**) down and pull out cable hook (**6**).

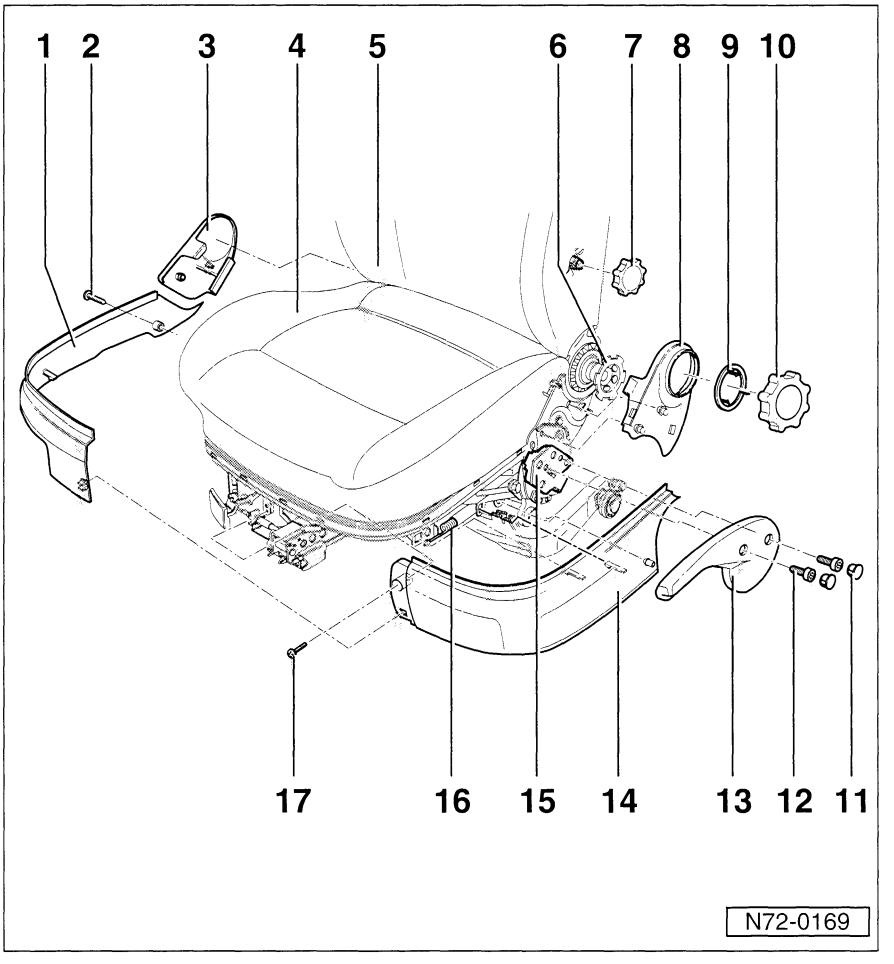
– Unclip cable center guide (**8**) from backrest frame (**4**).

– Pull transfer rod (**11**) out from backrest frame enough to allow lower cable guide (**10**) to be unhooked.

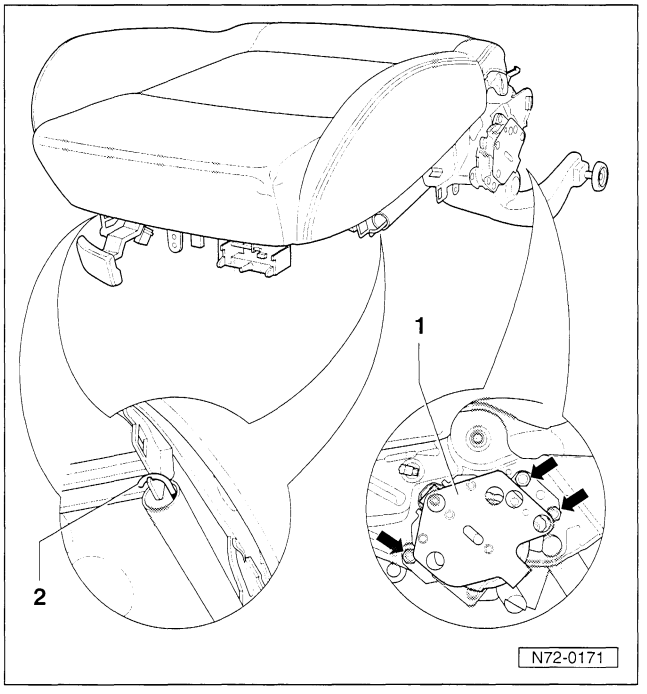
– Unhook cable hook (**9**) and pull cable (**7**) out from backrest frame (**4**).

Seat height adjuster assembly

1. **Seat trim, inner front**
2. **Screw**
3. **Seat trim, inner rear**
4. **Seat bottom**
5. **Backrest**
6. **Transfer rod**
   - For backrest adjustment
7. **Adjusting knob**
8. **Seat trim, outer rear**
9. **Spacer**
   - only on 2-door models
10. **Adjusting knob**
    - For backrest angle
    - 2-door shown, 4-door similar
11. **Cover cap (2)**
12. **Screw (2)**
13. **Adjusting lever**
    - For seat height
14. **Seat trim, outer front**
15. **Seat height adjusting element**
16. **Spring (2)**
17. **Screw**



Seat height adjuster, removing and installing



– Remove front seat as described earlier.

– Remove mounting screws and inner front trim piece (item 2 in illustration N72-0169, shown previously)

– Unclip cover caps, remove screws and adjusting lever (items 11, 12, 13 in illustration N72-0169, shown previously)

– Remove front mounting screw and front outer trim piece (items 17 and 14 in illustration N72-0169, shown previously)

➤ Unhook spring (**2**) at bottom front corners of seat. Remove mounting bolts (**arrows**) and pull seat adjuster (**1**) out of mounting frame.

– Installation is the reverse of removal.

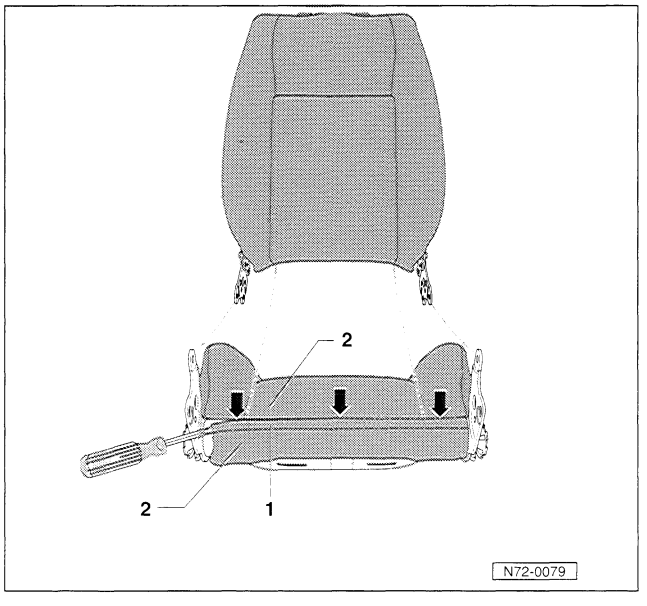
Tightening torque

• Seat adjuster to seat frame . . . . . 10 Nm (7 ft-lb)

Front seat backrest cover and padding, removing and installing

NOTE —

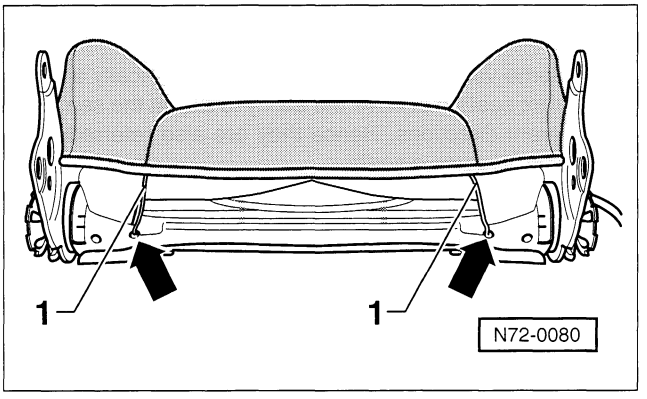
The front seat backrest cover must be removed to access the lumbar support mechanism and the cable and mechanism for the locking backrest on 2-door Golf/GTI models.



– Remove head restraint, seat and backrest as described earlier.

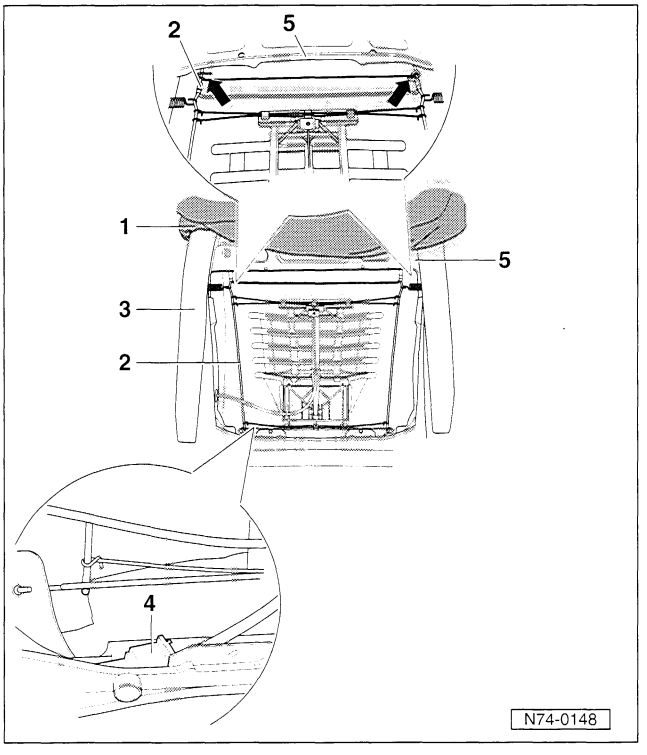
– Unclip bottom of trim on rear of backrest and unhook upwards.

➤ Separate cover (**2**) beading strip (**1**) using screwdriver (**arrows**).



➢ Unhook tensioning wire (**1**) for seat cover.

– Pry off adjustment knob on side of seat.



➢ Pull cover (**1**) up and release from tensioning frame (**2**). Pull cover up over padding (**3**) and head restraint guides.

NOTE —
Seat padding is connected to lumbar frame with Velcro.

– If applicable, separate backrest heater harness connector (**4**) and pull padding off backrest.

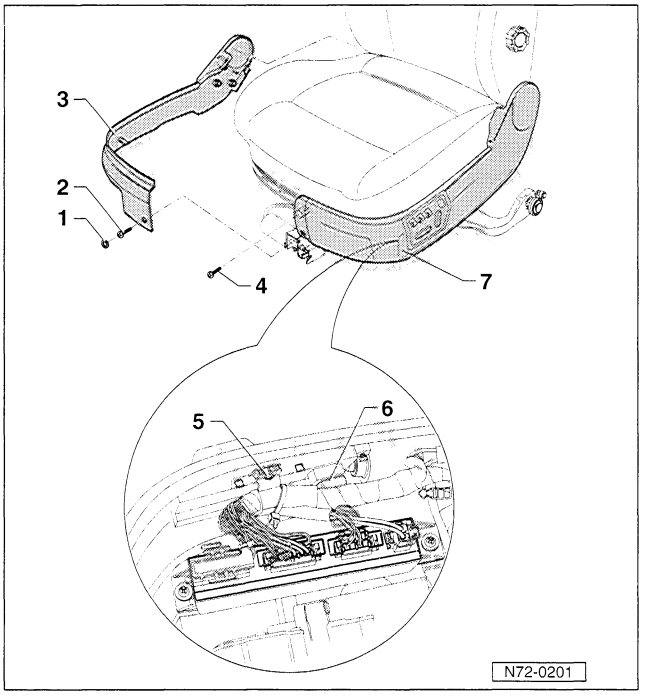
– Installation is the reverse of removal.

Electrically Adjustable Front Seats

Some vehicles are equipped with electrically adjustable front seats that have the ability to adjust the seat in 8 different directions. Hence they are also referred to as 8-way adjustable seats.

8-way seat adjusting unit, removing

– Remove seat and belt lock as described earlier.



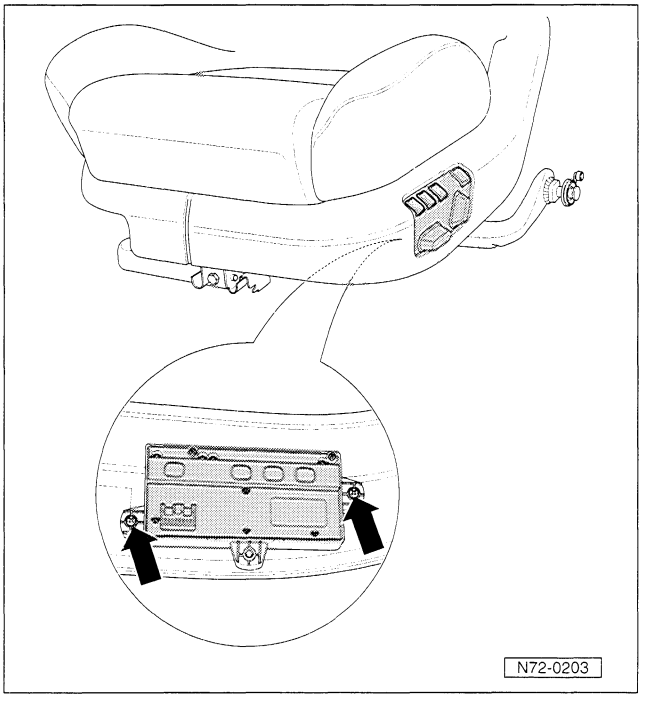
➤ Remove screw cover (**1**) and screw (**2**) at the lower front of seat.

– Unclip seat trim (**3**) on right-hand side.

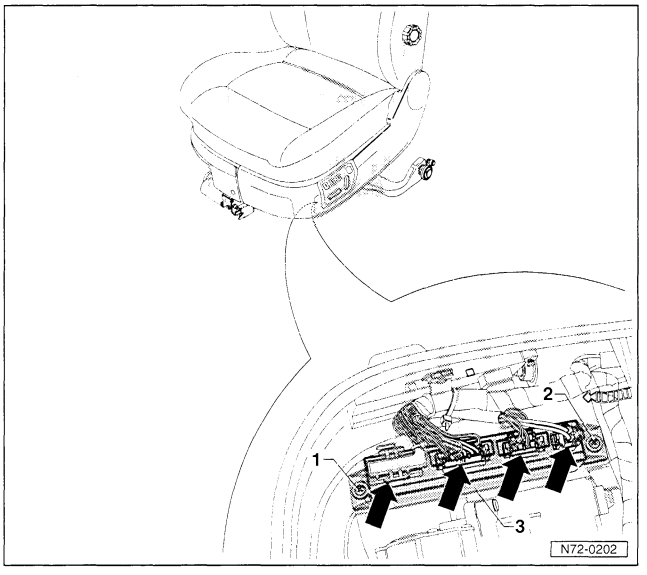
– Remove mounting screws (**4**, **5**) for left-side trim (**7**).

– Separate harness connector (**6**) for 8-way adjustable switch and unclip left-side trim.

– Unclip left seat trim (**7**).



➤ Remove two screws (**arrows**) on either side of 8-way adjusting unit and remove unit.

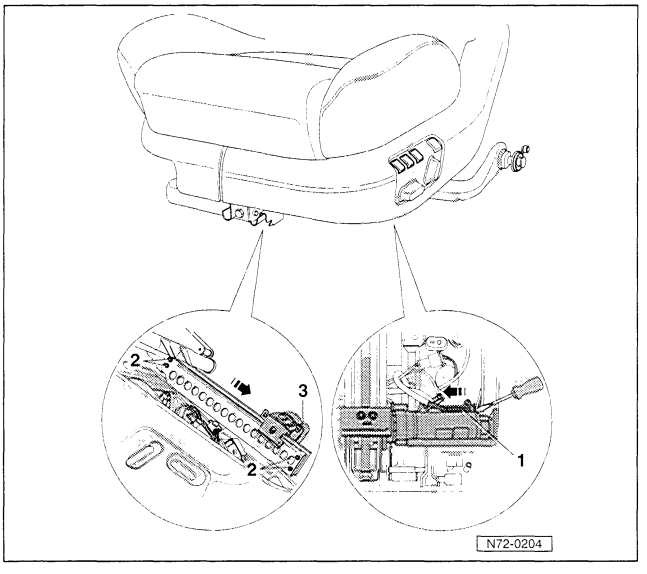


8-way adjustable seat control unit, removing

– Remove seat as described earlier.

➢ Separate the four harness connectors (**arrows**) from the 8-way adjustable control unit.

– Remove control unit mounting screws (**1, 2**) and remove control unit (**3**).

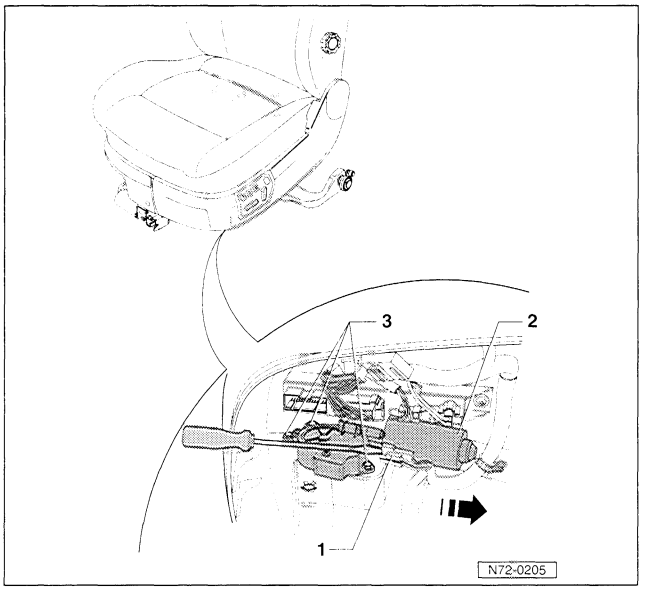


8-way seat fore/aft adjustment, removing

– Remove seat as described earlier.

➢ Separate fore/aft harness connector (**1**) by prying with screwdriver in direction of **arrow**.

– Remove eight mounting screws (**2**) (four on each side) and pull seat fore/aft adjustment mechanism out in direction of **arrow**.



8-way seat front height adjustment drive, removing

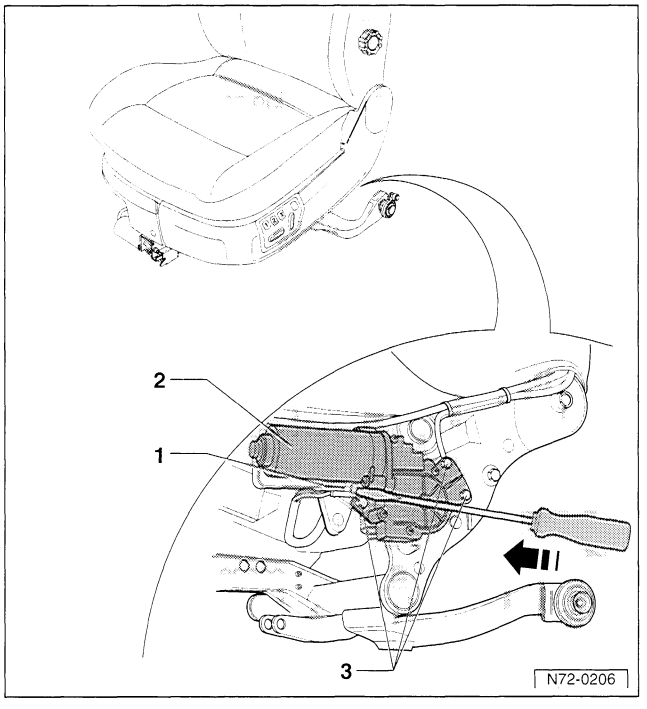
– Remove seat as described earlier.

➢ Use a screwdriver to disconnect harness connector (**1**) in the direction of **arrow**.

– Remove mounting bolts (**3**) and remove front drive (**2**).

8-way seat rear height adjustment drive, removing

– Remove seat and trim as described earlier.



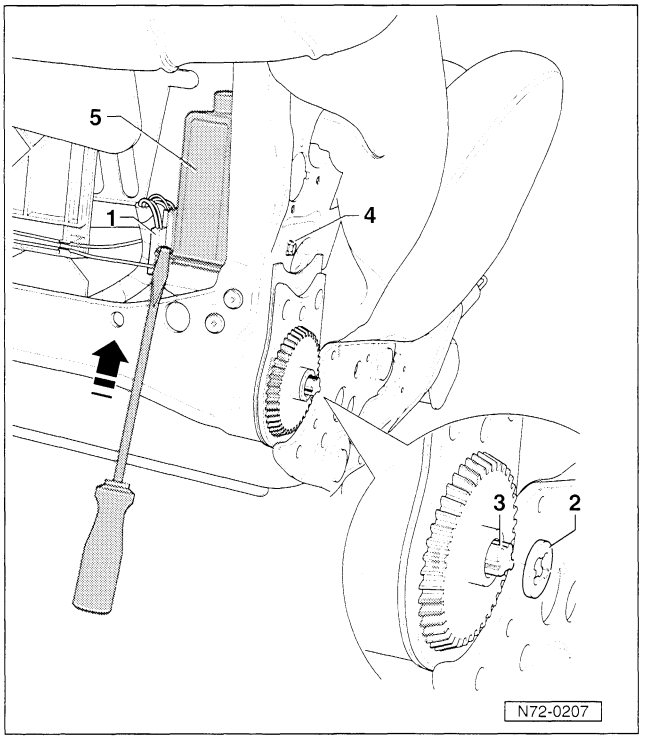
➢ Separate rear height adjustment harness connector (**1**) by prying with screwdriver in direction of **arrow**.

– Remove three mounting screws (**3**) and rear height adjustment drive motor (**2**).

8-way seat backrest adjustment drive, removing

– Remove seat and trim as described earlier.

– Release backrest cover at bottom and roll up. See **Front seat backrest cover and padding, removing and installing** given earlier.

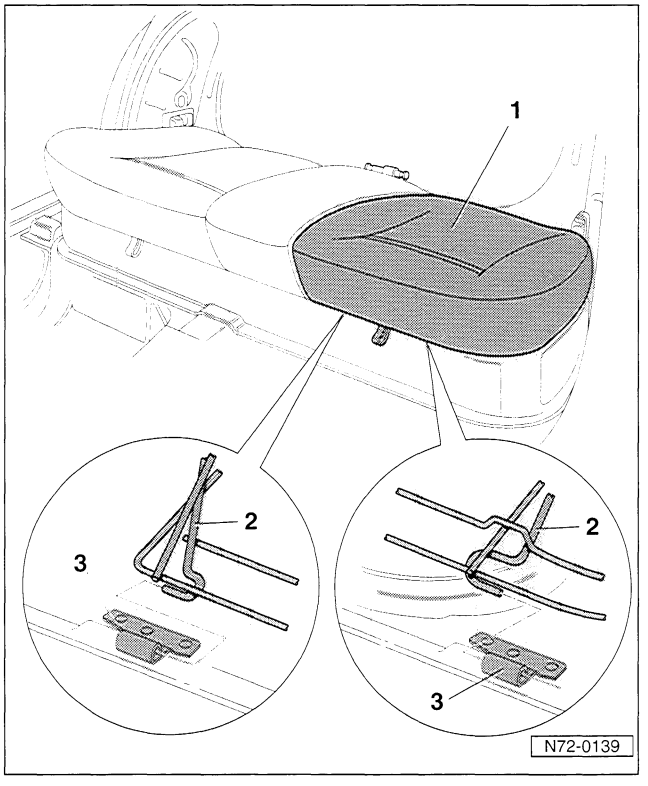


➢ Separate backrest adjustment harness connector (**1**) by prying with screwdriver in direction of **arrow**.

– Pry off securing washer (**2**) and drive shaft (**3**) into backrest frame approx. 15 cm (6 in.) with hammer and drift. Remove drive unit mounting nut (**4**) and drive unit (**5**).

REAR SEATS

Rear seat bottom, removing and installing (Golf, Jetta sedan)

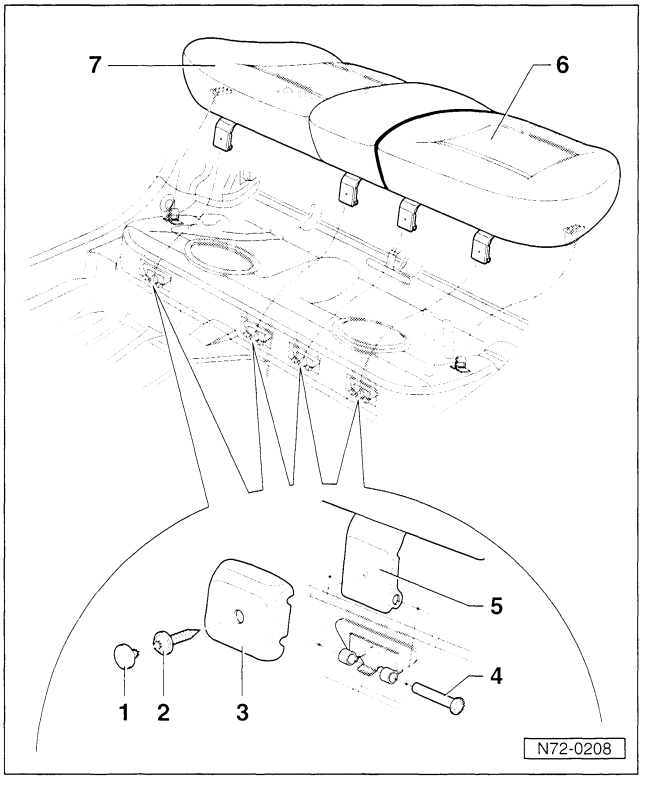


– Lift seat cushion and pull forward.

➤ Unhook seat retaining rods (**2**) from retainers (**3**).

– To install, hook rods into retainers, fold seat cushion back and push down at front.

Rear seat bottom, removing and installing (Jetta wagon)



➤ Unclip cover cap (**1**), remove screws (**2**) and take off seat hinge cover cap (**3**).

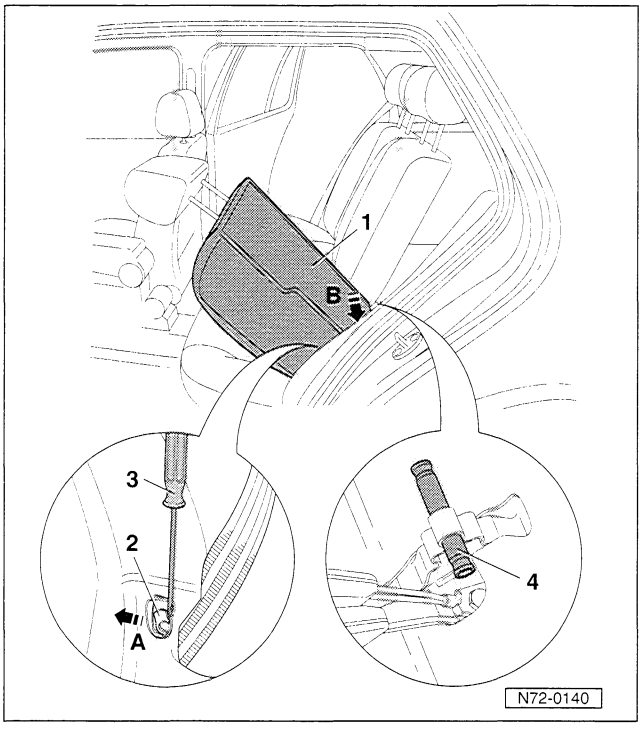
– Pull pin (**4**) out off seat hinge (**5**).

– Remove left seat cushion (**6**) and right seat cushion (**7**).

– Install in reverse order of removal.

Rear seat backrest, removing and installing

– Fold backrest forward.

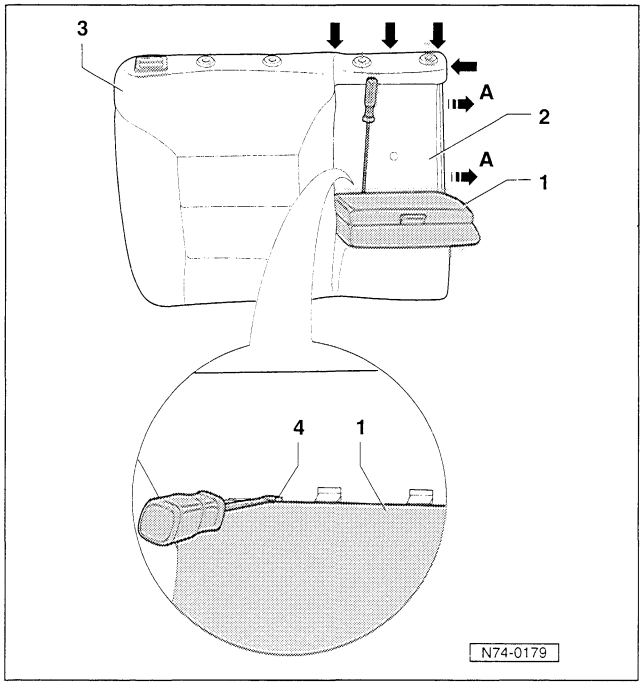


Using a screwdriver (**3**), press back backrest retaining hooks (**2**) on right and left sides in direction of **arrow B**. Lift backrest (**1**) up slightly and pull off from center mount (**4**) at **arrow B**.

– Installation is reverse of removal.

Rear backrest padding and armrest, removing and installing

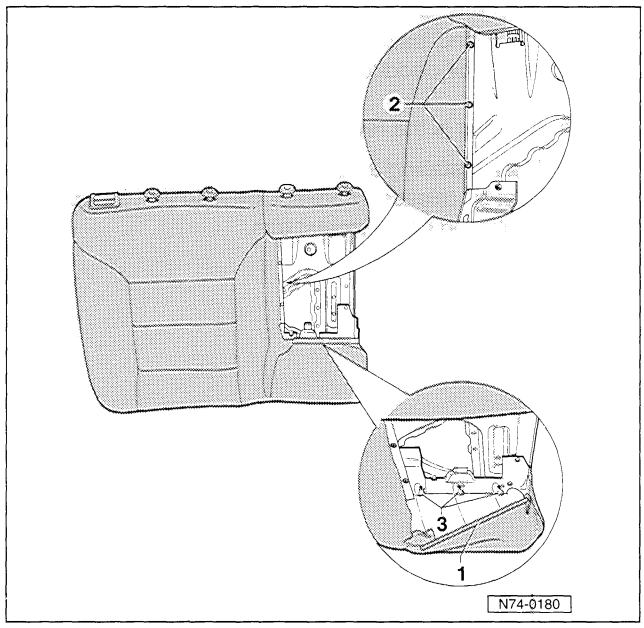
– Remove right-hand rear seat backrest as described earlier.



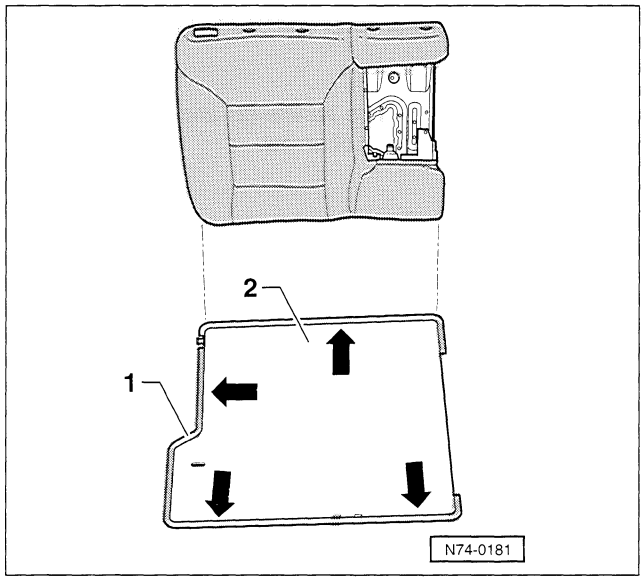
Fold down rear seat armrest (**1**) and pull trim panel (**2**) behind armrest in direction of **arrows A**.

– Release top of trim panel (**2**) from seatback cover (**3**). Use screwdriver to unclip retaining hooks (**4**) and pull out trim panel upward. Pull armrest out of backrest.

– Remove head restraints.

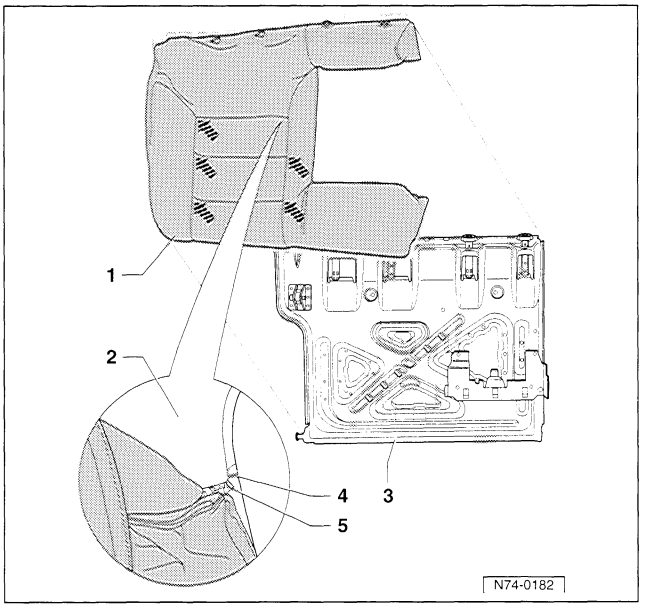


➤ Pull out three retaining clips (**2**) located on the side of the armrest storage area. Release beading (**1**) from locking hooks (**3**).



➤ Release rear cover (**1**) around backrest from (**2**) at **arrows**.

– Remove seat cover and padding from backrest frame.



➤ To separate cover from padding, disconnect tensioning wire (**4**) and padding wire (**5**) located at arrows. Take cover (**1**) off padding (**2**).

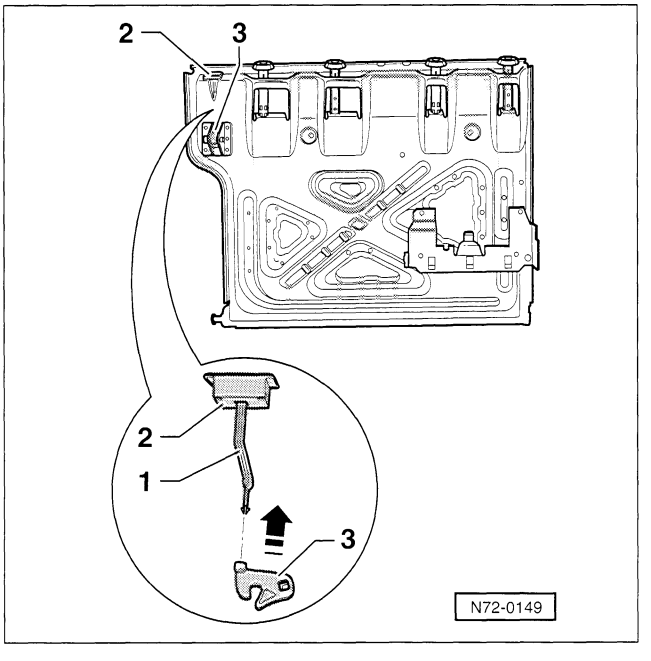
– Installation is the reverse of removal.

• When installing armrest trim, top of seatback cover must be released from backrest so that beading can be clipped onto armrest trim.

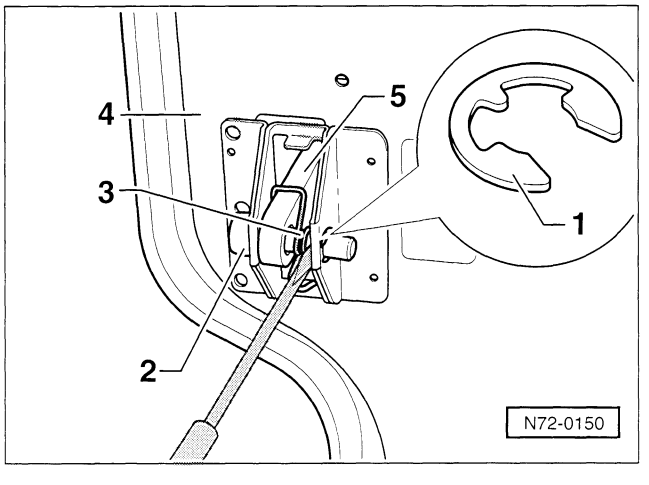
Backrest lock, removing and installing

– Remove backrest as described previously.

– Remove backrest cover and padding as described previously.



➤ Pull backrest release handle (**2**) and rod (**1**) out of lock hook (**3**) in direction of **arrow**.



➤ Pry out circlip (**1**) from latch retaining pin (**2**). Release spring (**3**) from backrest (**4**) using screwdriver.

– To install, pin (**2**), spring (**3**) and locking hook (**5**) must be inserted together.

– Engage circlip (**1**) on pin (**2**).

– Tension spring (**3**).

– Remaining installation is the reverse of removal.

80 Heating and Ventilation

GENERAL 80-1

HEATING AND VENTILATION CONTROLS 80-2
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- Driver side air outlet, removing 80-4
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- Heating and ventilation controls, adjusting 80-9
- Central flap cable, installing and adjusting 80-10
- Footwell/defrost flap cable, installing and adjusting 80-10
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HEATING AND VENTILATION COMPONENTS 80-11
- Dust and pollen filter, removing and installing . 80-11
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QUALITY REVIEW 80-15

GENERAL

This section primarily applies to heating and ventilation components of the HVAC system. For those vehicles with A/C, the refrigerant must first be discharged using specialized equipment before working on most of the heating and ventilation components, see **87 Air Conditioning**.

This section also covers removal and installation of the heating and ventilation controls for vehicles equipped with manual A/C. For vehicles equipped with electronic A/C (Climatronic), see **87 Air Conditioning**.

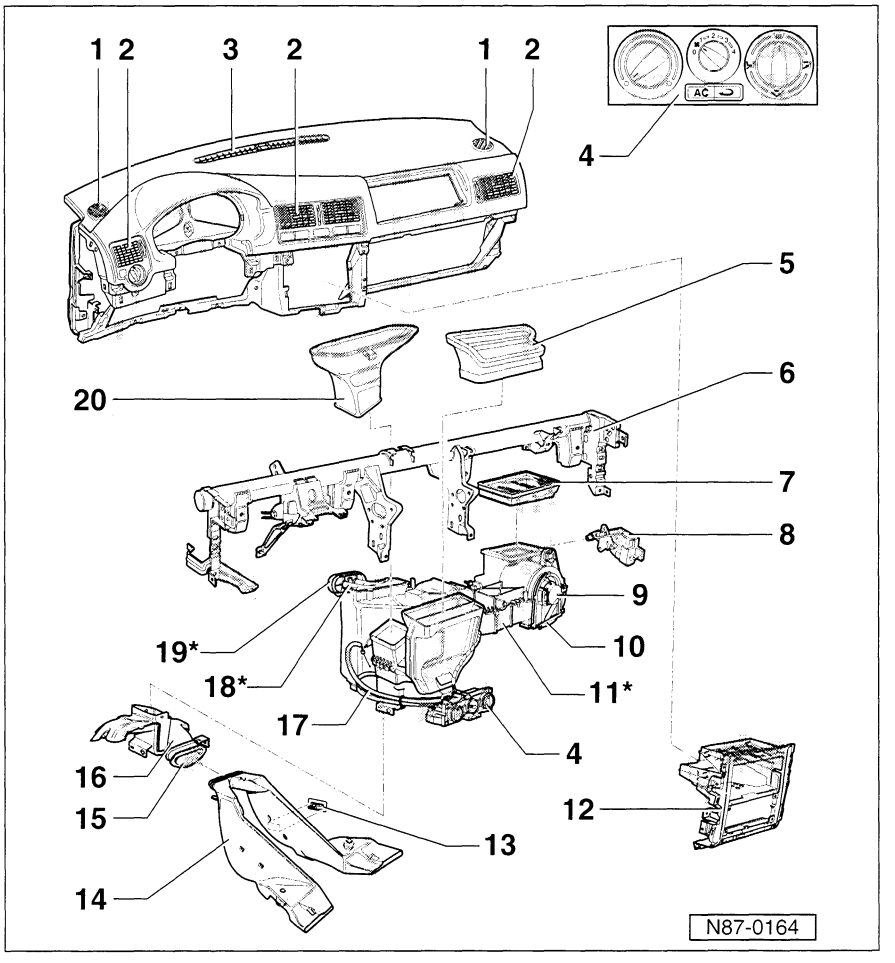
WARNING —

- *The cooling system is pressurized when the engine is warm. Wear gloves and other protection and carefully release system pressure if necessary, before performing repairs.*
- *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using a VAG 1551/5051 or equivalent scan tool.*

HEATING AND VENTILATION CONTROLS

Passenger compartment air is vented to the outside through openings in the parcel shelf (Jetta) below the rear window. In order for the ventilation system to work properly, these openings must not be blocked.

Passenger compartment components, overview



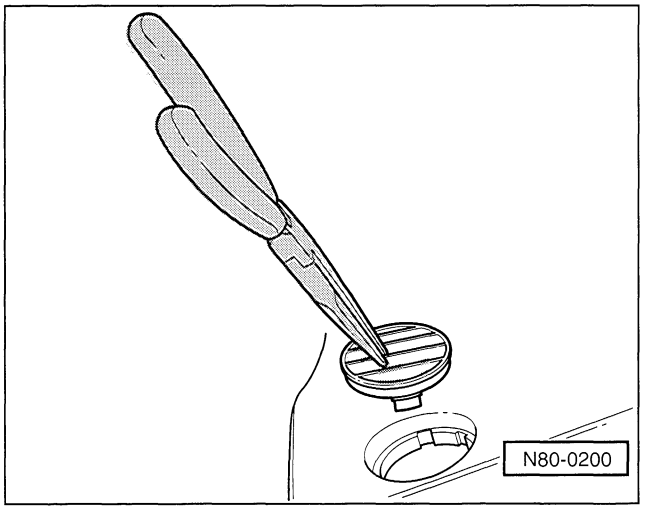
1. **Side window air outlet**
   - Removing, see **Side window fixed air vents, removing and installing**
2. **Dashboard air outlets**
   - Removing, see **Air outlets, removing**
3. **Defroster air outlet**
4. **Heating and ventilation controls**
   - With A/C switch, as applicable
   - With fresh air blower fan switch (E9)
   - With fresh air and recirculation switch (E184)
5. **Intermediate duct**
6. **Instrument panel cross member,** see **Instrument panel crossmember, loosening and tightening**
7. **Dust and pollen filter**
   - Covers outside air inlet to passenger compartment
   - Filters all incoming air
8. **Servo motor for recirculation door (V154)**
9. **Blower fan (V2)**
10. **Blower fan series resistance pack (N24)**
    - With thermal fuse
11. **Heating and ventilation unit**
    - Removing:
      Remove instrument panel, see **70 Trim–Interior**
      Loosen instrument panel cross member, see **Instrument panel crossmember, loosening and tightening**
      Carefully pinch off both coolant hoses to heater core and disconnect hoses
      Seal off heater core to prevent coolant from running out
      Remove heating and ventilation unit

    NOTE —

    The cooling system is pressurized when the engine is warm. Wear gloves and other protection and carefully release system pressure, if necessary, before performing repairs.
12. **Center trim**
13. **Footwell air outlet**
14. **Rear footwell air outlet**
15. **Gasket**
16. **Connecting duct**
    - With driver's side footwell air outlet
    - Removing, see **Connecting duct, removing**
17. **Cables**
    - Color code yellow - air distribution control knob to central flap
    - Color code green - air distribution control knob to footwell/defrost flap
    - Color code beige - temperature control knob to temperature flap
18. **Heater core**
    - Always replace coolant after removal/replacement
19. **Heater core/bulkhead seal**
20. **Defroster duct**
    - Instrument panel must be removed and support beam loosened to replace duct
    - Note installed position, see **Defroster duct, installation position**

Side window fixed air vents, removing and installing

– Protect vanes of vent before removing.

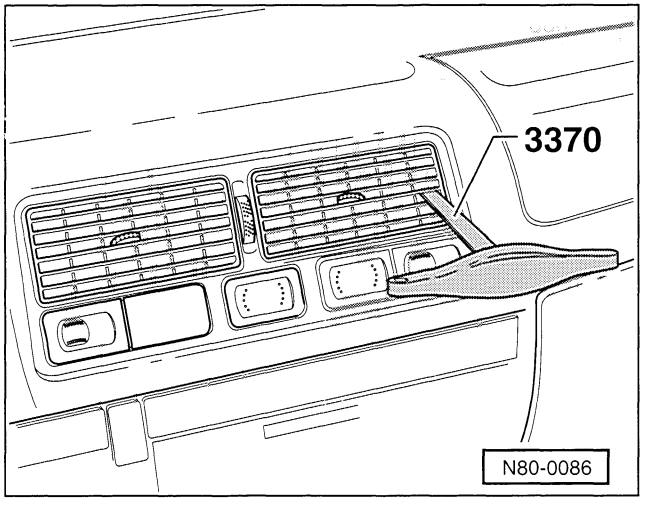


➢ Apply cloth tape to the pliers or vanes or use needle nose pliers with plastic or rubber protective jaws.

– Carefully remove air outlet by pulling out with needle nose pliers.

Center air outlets, removing

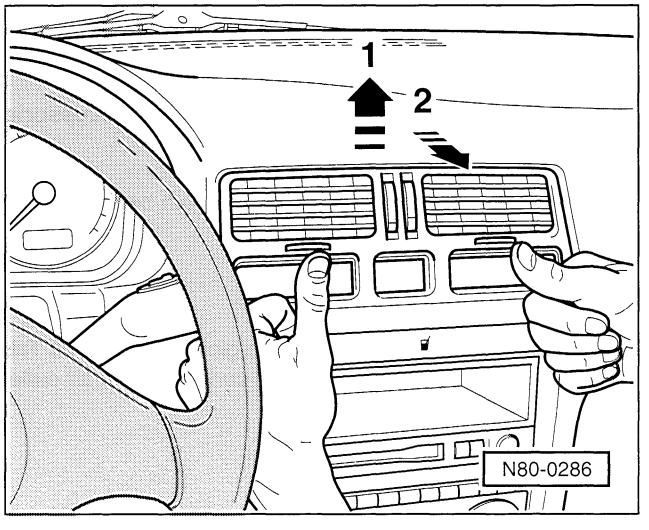
Golf models



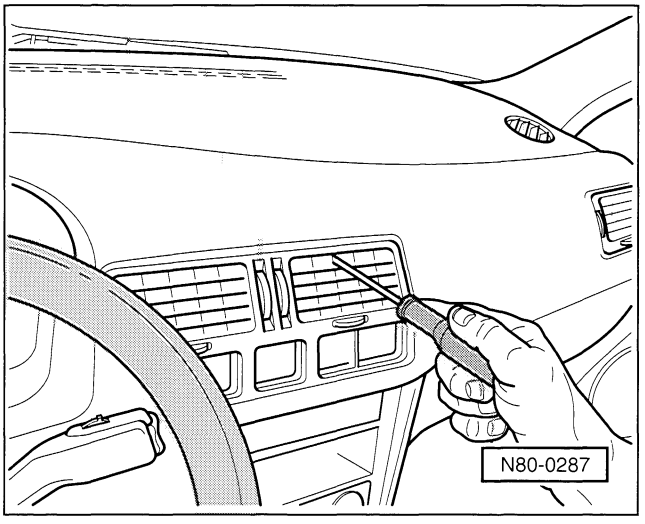
➢ Attach Volkswagen special tool 3370, or equivalent, at center of right or left side of air outlet pull out.

– An illustration of special tool 3370 is shown in **70 Trim–Interior** in the Instrument Panel section.

Jetta models



➢ Carefully push trim panel upwards (**arrow 1**) in order to disengage lower mounting clips. While doing so, pull lower portion of trim out from instrument panel (**arrow 2**).



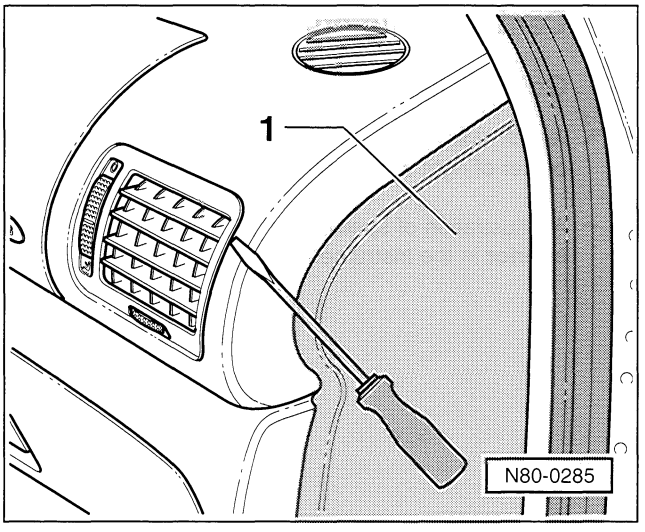
➢ Slide screwdriver into center of air outlet and disengage upper mounting retainers.

– Pull out air outlet.

– Remove glove box, see **70 Trim–Interior**. Disconnect electrical connection for air outlet illumination.

Passenger side air outlet, removing

Golf and Jetta



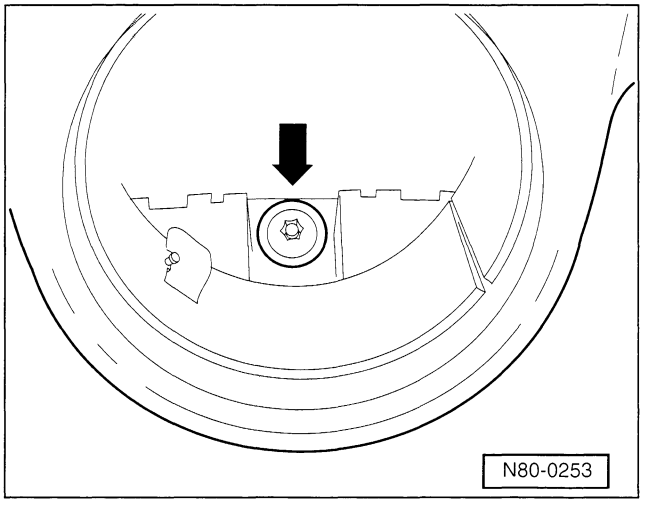
➢ Slide screwdriver into center of air outlet and disengage upper mounting retainers.

– Pull out air outlet.

– For Jetta models only, remove glove box, see **70 Trim–Interior**. Disconnect electrical connection for air outlet illumination.

Driver side air outlet, removing

Golf and Jetta

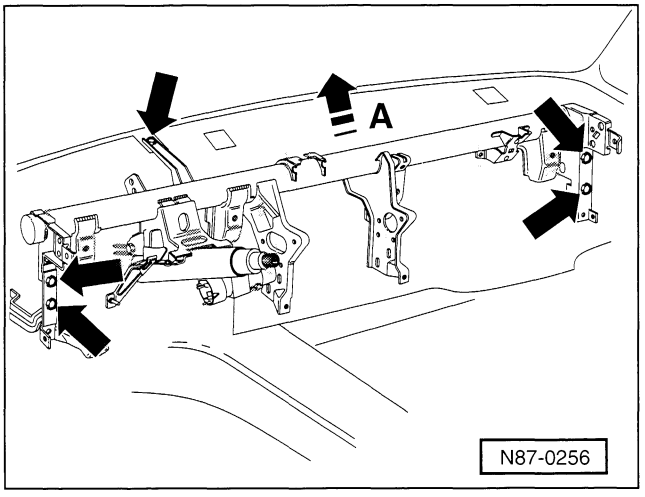


– Remove headlight switch, see **96 Lights, Accessories–Interior**.

➢ Remove mounting screw (**arrow**) from behind headlight switch.

– Pull out air outlet.

– For Jetta models only, remove glove box, see **70 Trim–Interior**. Disconnect electrical connection for air outlet illumination.



Instrument panel crossmember, loosening and tightening

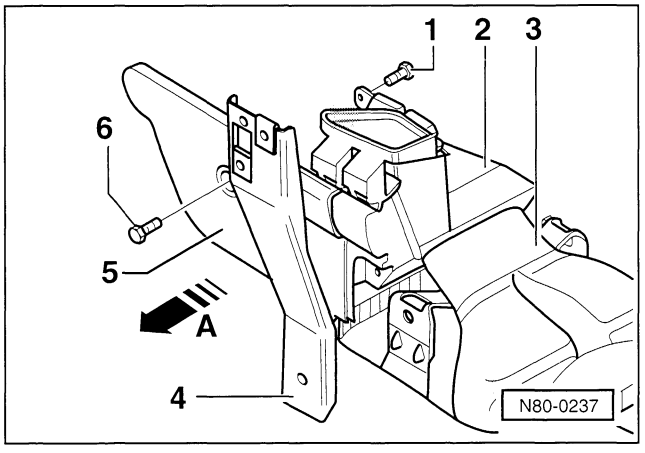
➢ Remove securing bolts (**arrows**).
Tightening torque: 25 Nm (18 ft-lb)

– To access or remove heating and ventilation unit, lift cross member in direction of **arrow A** and support unit.

– To prevent damage to the steering column, work should be done with aid of another technician.

– If removed component(s) are not to be reinstalled immediately, re-secure the cross member to the bulkhead.

- Any wiring harnesses released from their retainers must be secured again at the same point, using the same method of securing.

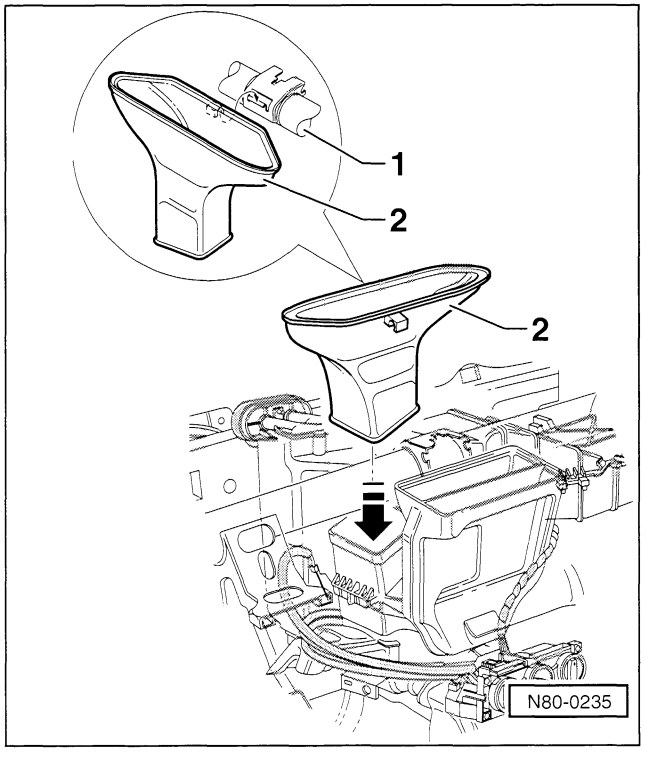


Connecting duct, removing

– Remove glovebox and steering column lower trim, see **70 Trim–Interior**.

➢ Remove bracket (**4**), bolt (**6**), and cover (**5**).

– Remove bolt (**1**) and connecting duct (**2**) in direction of arrow. Leave rear footwell duct (**3**) in place.

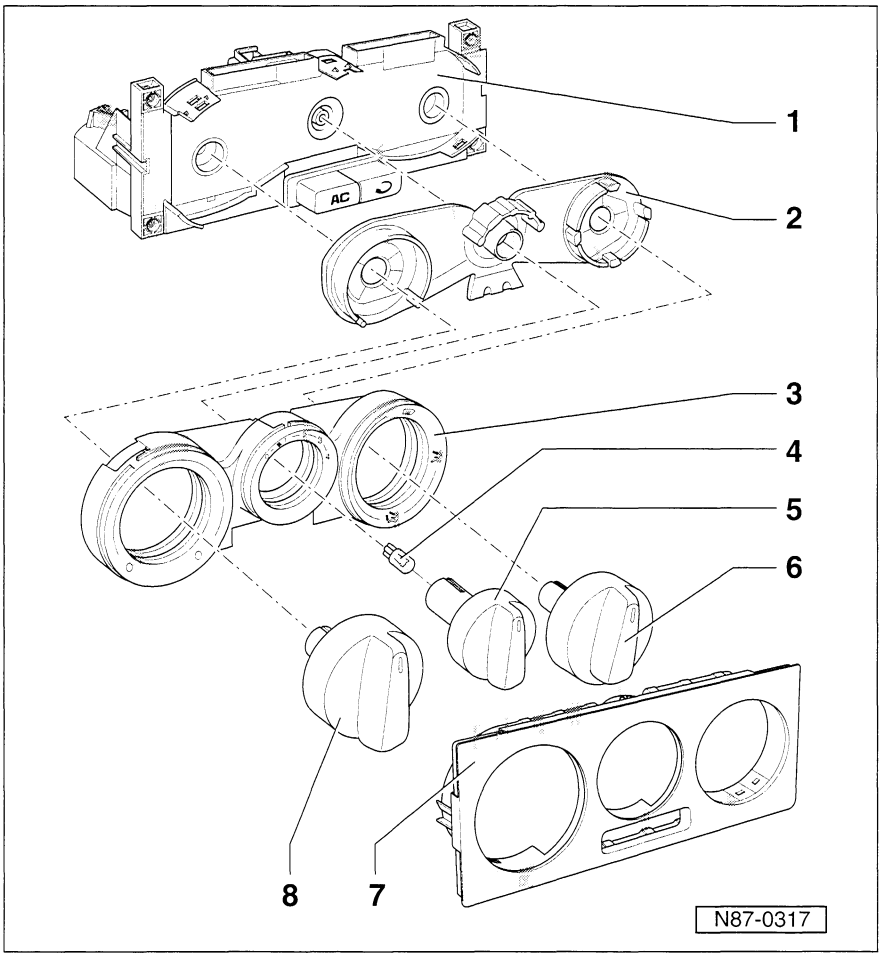


Defroster duct, installation position

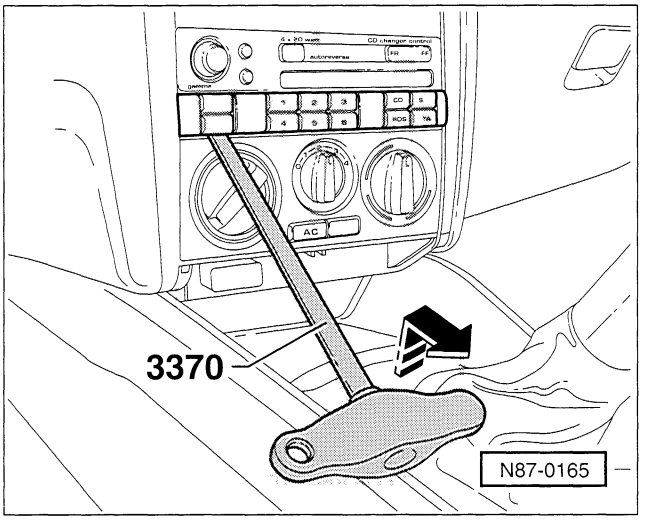
➢ Attach defroster duct (**2**) to heater unit. At the same time position defroster duct in instrument panel cross-member (**1**).

Heating and ventilation controls (manual A/C system)

1. **Heating and A/C control unit**
   - With fresh air blower switch and recirculation switch
2. **Illumination filter**
3. **Trim panel**
4. **Fresh air control lever light**
   - 12V, 1.2W
   - Unclip trim panel (item 7) and rotary control (item 5) to remove
5. **Rotary control**
   - For blower speed
   - Use pliers with plastic or rubber protection on jaws to pull off
6. **Rotary control**
   - For air distribution
   - Use pliers with plastic or rubber protection on jaws to pull off
7. **Trim panel**
8. **Rotary control**
   - For interior temperature control
   - Use pliers with plastic or rubber protection on jaws to pull off



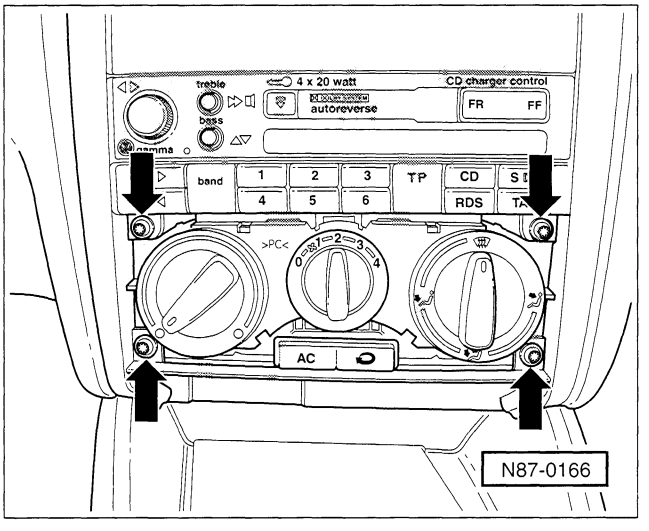
Heating and ventilation controls, removing and installing (manual A/C system)



– Remove glovebox, lower steering column trim and center console, see **70 Trim–Interior**.

➢ Remove HVAC control trim panel with VW special tool 3370, or equivalent.

NOTE —
An illustration of VW special tool 3370 can be found in **70 Trim–Interior** *in the Instrument Panel section.*

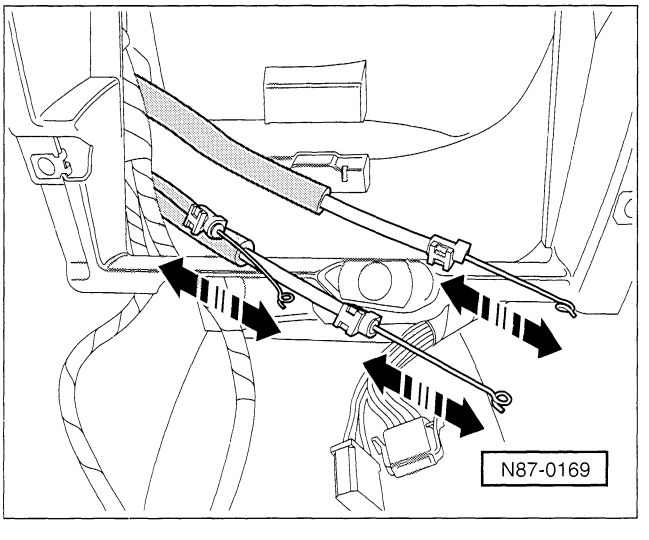


➢ Remove HVAC control unit mounting screws (**arrows**).

– Unclip cables and detach from control unit.

– Disconnect harness connector and remove control unit.

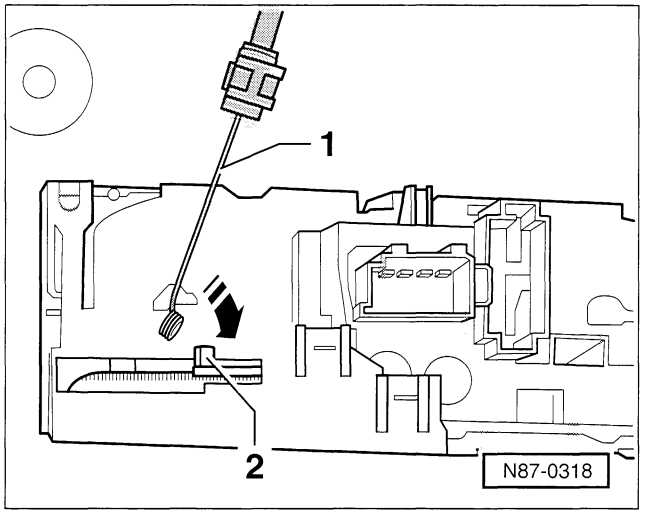
– Before installing controls, check operation of cables by moving each cable back and forth. Replace cables with damage or stiff/binding operation.



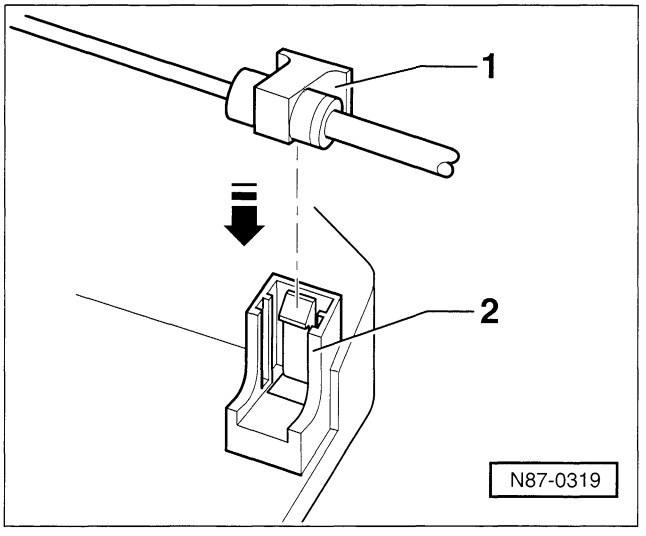
➢ Move cables back and forth in direction of **arrows**.

– Replace cables that are damaged or hard to move.

NOTE —
- *Cable sleeve ends are color coded.*
- *All air flaps must audibly move onto end stops when turning controls.*
- *Always check cables before installing. Replace binding or damaged cables.*



➢ Attach color coded cable (**1**) to correct control arm (**2**).



➢ Snap each cable (**1**) into appropriate retainer (**2**).

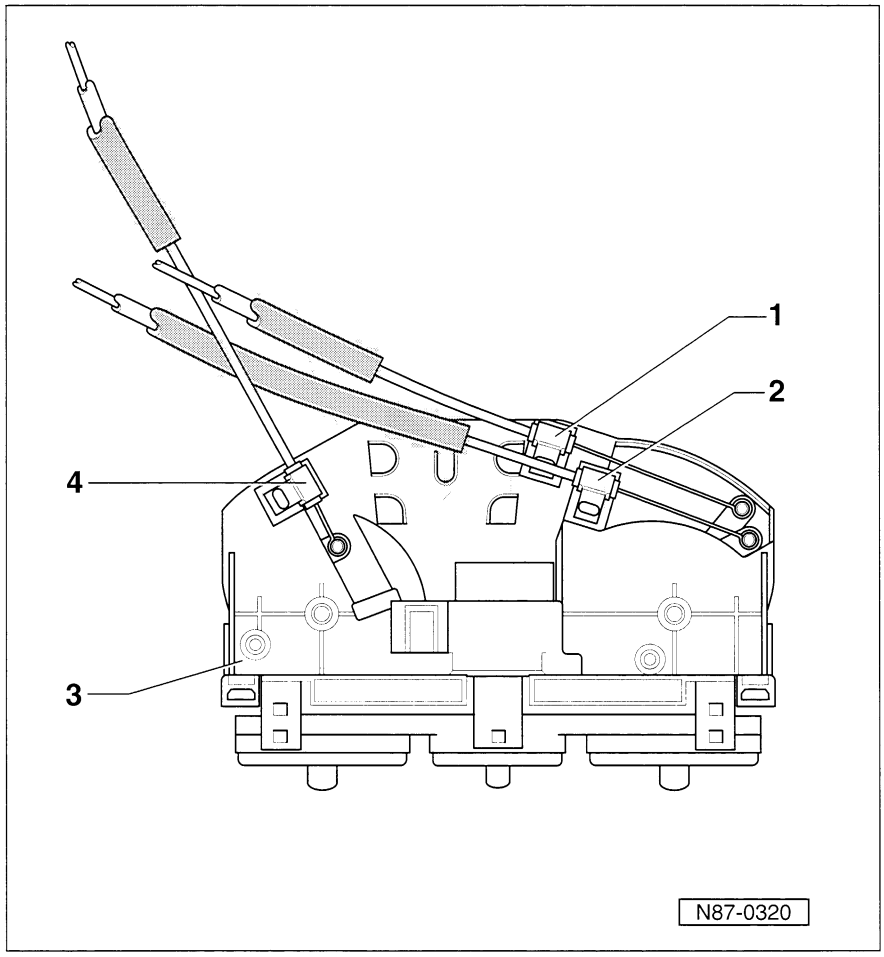
– Install harness connector.

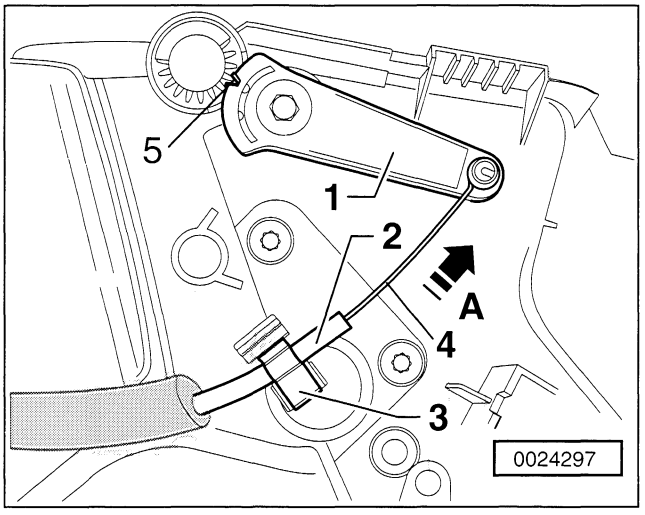
– Fit controls into instrument panel opening and install mounting screws.

– Adjust cables as needed.

Heating and ventilation controls, adjusting

1. **Central flap cable**
   - From air distribution rotary control to central flap
   - Cable sleeve color code: Yellow
   - Adjusting, see **Central flap cable, installing and adjusting**
2. **Footwell/defrost flap cable**
   - From air distribution rotary control to footwell/defrost flap
   - Cable sleeve color code: Green
   - Adjusting, see **Footwell/defrost flap cable, adjusting**
3. **Heating and ventilation controls**
   - First attach cables to removed controls then to appropriate levers
   - All air flaps must be heard to move onto end stops when operating controls
4. **Temperature flap cable**
   - From temperature rotary control to temperature flap
   - Cable sleeve color code: Beige
   - Adjusting, see **Temperature flap cable, installing and adjusting**





Central flap cable, installing and adjusting

NOTE —

Cable sleeve color code: yellow.

➢ Install/adjust with controls installed, connecting duct removed and flap lever correctly indexed (**5**).

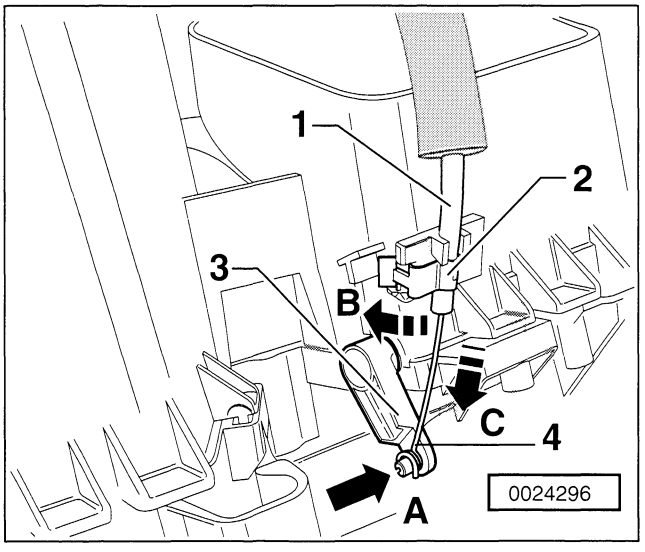
– Turn air distribution rotary control knob fully counterclockwise against stop.

– Attach center wire of cable (**4**) to the central flap lever (**1**).

– Press central flap lever against stop (**arrow A**) and attach outer cable (**2**) with clip (**3**).

– Turn air distribution rotary control knob fully to left and right against stops.

– When turning the rotary control knob both end stops must be reached.



Footwell/defrost flap cable, installing and adjusting

NOTE —

- *Cable sleeve color code: green*
- *Install/adjust with controls installed.*

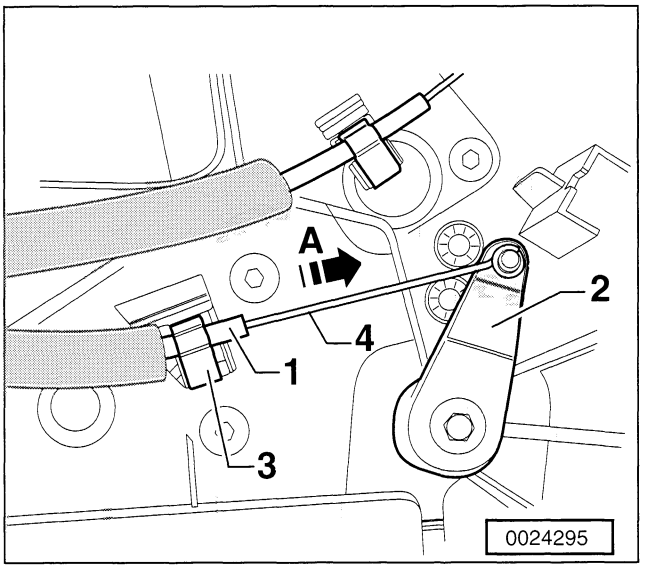
– Turn air distribution rotary control knob fully counterclockwise against stop.

➢ Attach center wire of cable (**4**) to the footwell/defrost flap lever (**3**) at arrow (**A**).

– Press footwell/defrost flap lever against stop (**arrow C**) and secure outer cable (**1**) with clip (**2**) (**arrow B**).

– Turn air distribution rotary control knob fully to left and right against stops.

– When turning the rotary control knob both end stops must be reached.



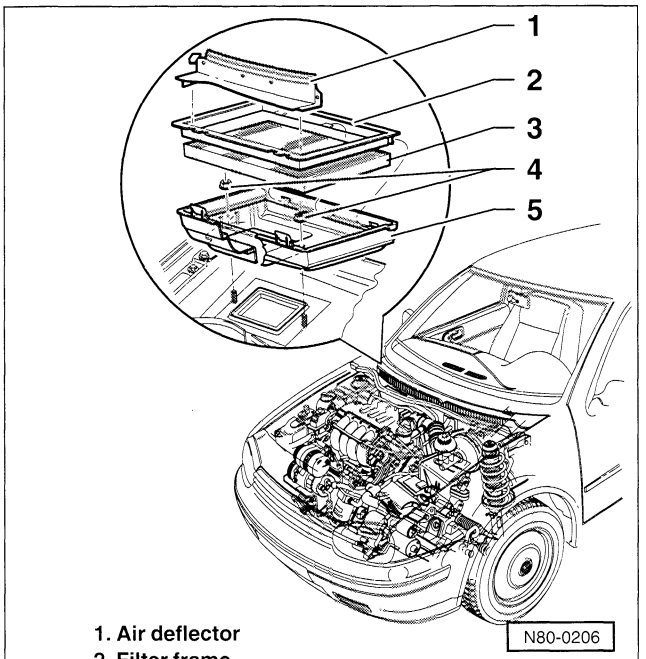
Temperature flap cable, installing and adjusting

NOTE —
Cable sleeve color code: beige.

- Install/adjust with controls installed and connecting duct removed.
- Turn temperature rotary control knob fully counter-clockwise against stop.
- Attach center wire of cable (**4**) to the temperature flap lever (**2**).
- Push temperature flap lever (**2**) against stop (**arrow A**) and secure outer cable (**1**) with clip (**3**).
- Turn temperature rotary control knob fully to left and right against stops.
- When turning the rotary control knob both end stops must be reached.

HEATING AND VENTILATION COMPONENTS

Dust and pollen filter, removing and installing



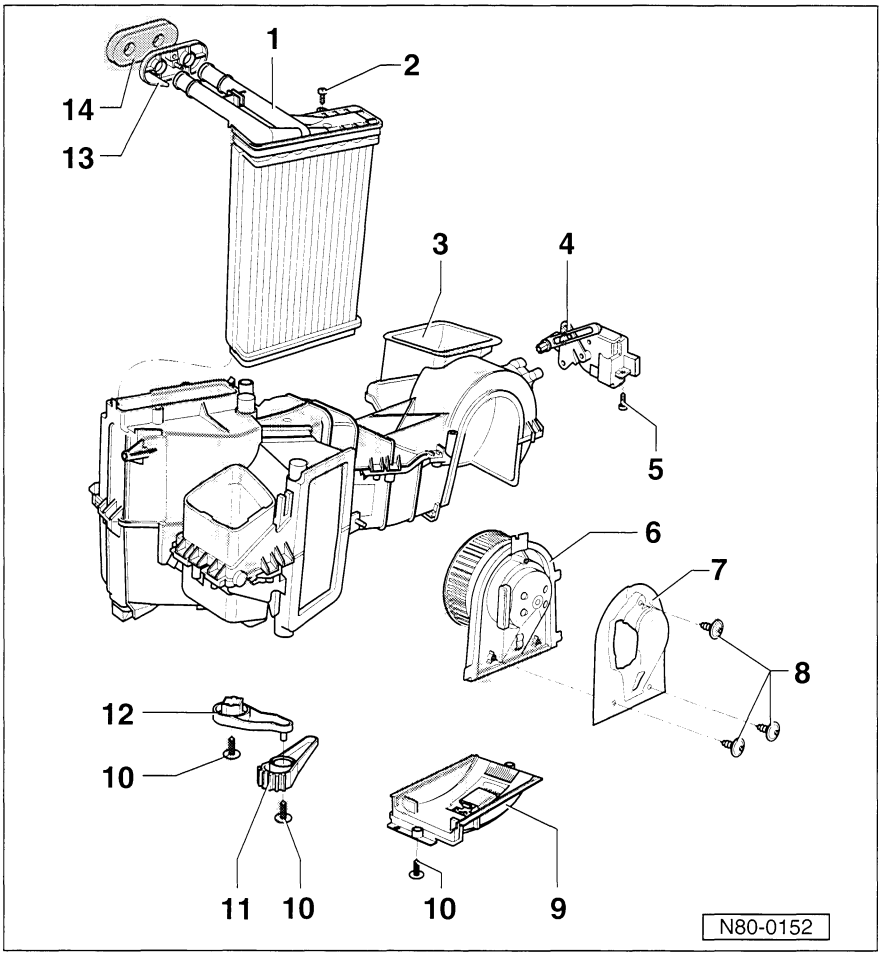
1. Air deflector
2. Filter frame
3. Filter element
4. Plastic nut
- Tighten to 2.5 Nm (20 in-lb)

5. Filter housing

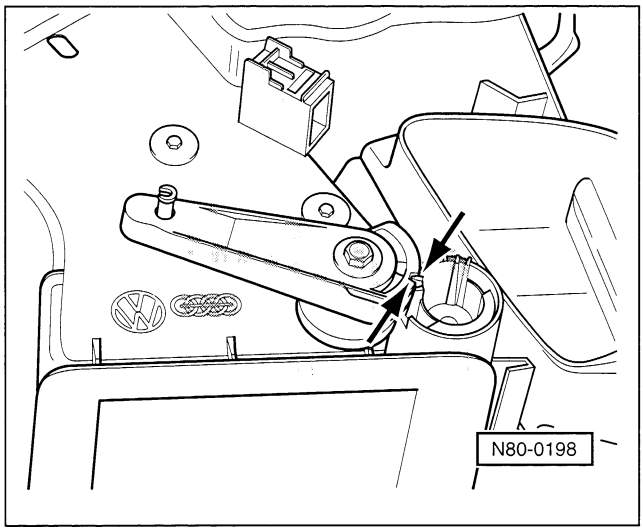
The dust and pollen filter is located in the far right side of the plenum (the area between the engine compartment and the passenger compartment). It is covered by trim panels removed from behind the engine compartment of the vehicle.

- Open hood and remove rubber gasket between engine compartment and plenum. Unclip and remove plastic plenum cover.
- Depress tabs at front edge of dust and pollen filter frame (**2**)
- Lift and pull filter element with frame out toward front.
- When installing, position filter element into frame. Insert frame with locating pins correctly oriented into filter housing and clip into place.
- Install remaining components in the reverse of removal.

Heater assembly, overview



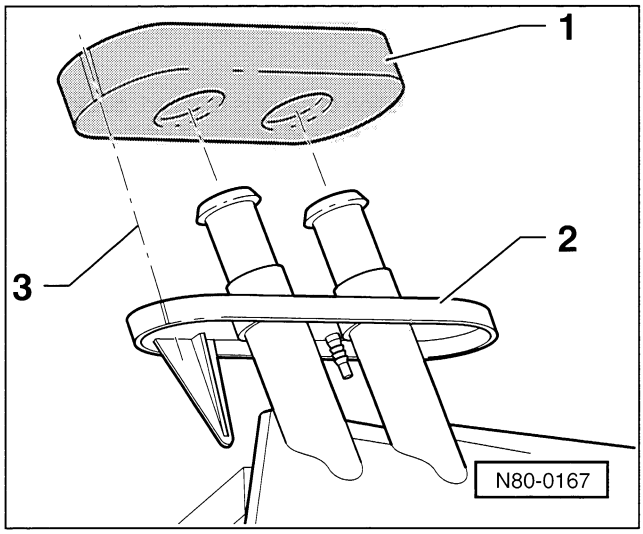
1. **Heater core**
   - Drain coolant before removal
   - Always use new coolant after replacement
   - Secured to housing with retainer clips
2. **Screw, self-tapping**
   - Use if retainer clips break
3. **Air distribution housing**
   - With air distribution flaps
4. **Servo motor for recirculation flap (V154)**
5. **Screw, self-tapping**
6. **Blower fan (V2)**
7. **Cover**
8. **Screw, self-tapping**
9. **Series resistor pack (N24)**
10. **Screw, self-tapping**
11. **Central flap lever**
    - Installed position, see **Central flap lever, installing and adjusting**
12. **Temperature flap lever**
13. **Base plate**
14. **Heater core bulkhead seal**
    - Installed position, see **Heater core bulkhead seal, installed position**



Central flap lever, installing and adjusting

– Central flap pinion shaft has an index mark.

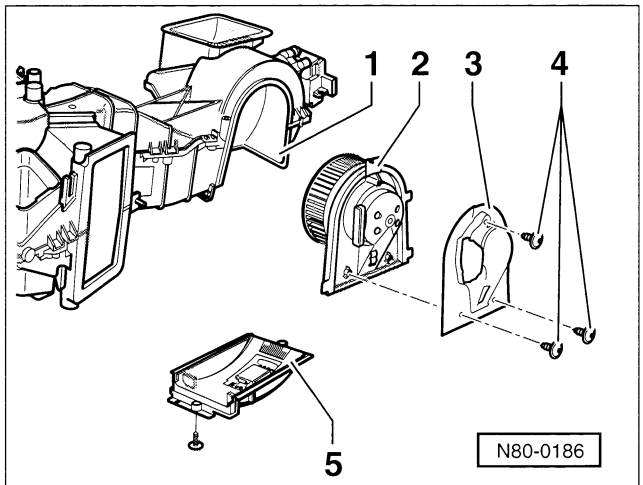
➢ Install the lever so that index notches on lever and pinion shaft are aligned (**arrows**).



Heater core bulkhead seal, installed position

– Seal between heater core and bulkhead has a positioning mark on the side.

➢ Install seal (**1**) so that the notches on the seal and notches on the base plate (**2**) are aligned (**3**).



1. Heater assembly
2. Blower fan assembly (V2)
3. Cover (early vehicles only)
4. Screws
5. Blower fan series resistor pack with thermal fuse (N24)

Blower fan, removing and installing

– Remove glovebox, see **70 Trim–Interior**

➢ Remove screws (**4**) and cover (**3**) where applicable.

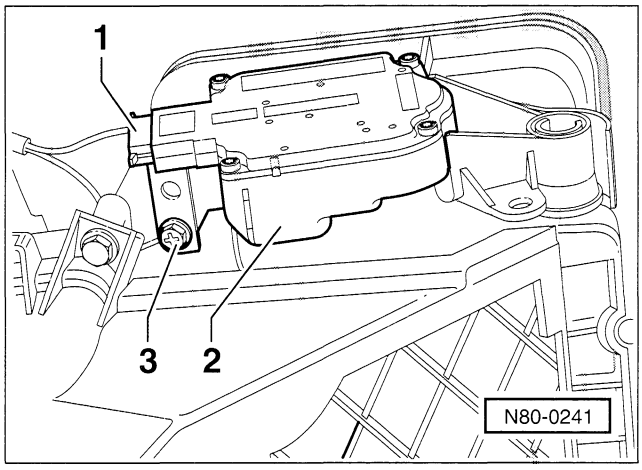
– Remove lower cover containing series resistor pack (**5**) and disconnect harness connector.

– Disconnect harness connector from blower fan (**2**).

– Pull blower fan out and downward.

– Installation is the reverse of removal.

Recirculation flap servo, removing and installing



– Remove glovebox, see **70 Trim–Interior**.

➢ Disconnect harness connector (**1**) and remove securing screw (**3**) from flap servo.

– Remove securing screw and swing motor downwards.

– Disconnect motor from recirculation flap lever.

– Before installing a new servo, attach harness connector to the new servo and switch on ignition.

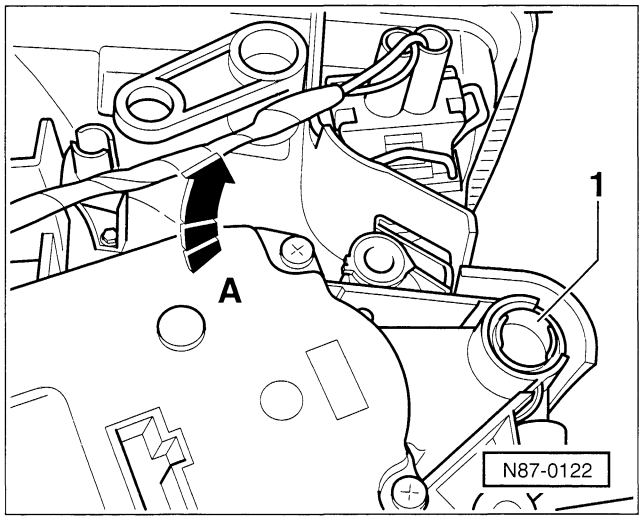
NOTE —
Replacement servos are supplied with operating levers in the "recirculation" position.

– Operate switch for recirculation flap and observe lever position.

– When center position of travel is reached, quickly unplug the harness connector and switch off ignition.

– Install servo onto recirculation flap shaft.

NOTE —
If it is difficult to align and fit the servo to the recirculation flap shaft, remove the blower fan and position the flap and shaft as required.



➢ When servo has been installed onto recirculation flap shaft (**1**), move motor in direction of arrow (**A**) into mounting position and install securing screw.

– Install harness connector.

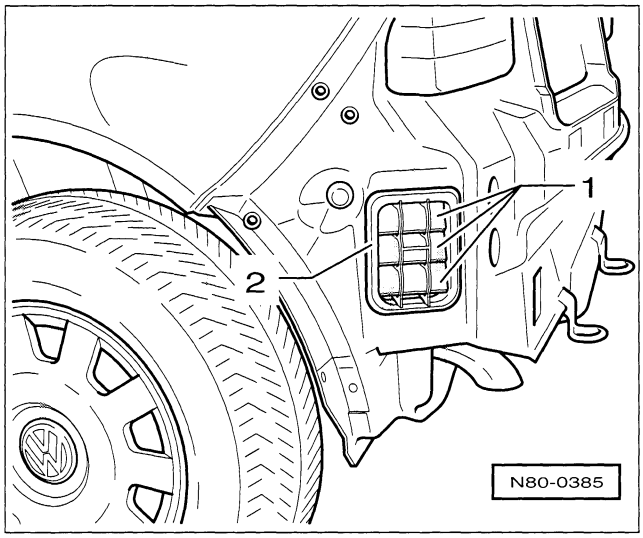
– Install glovebox and remainder of removed components.

Ventilation system, checking

NOTE —

- *On sedan models, passenger compartment air is vented to the outside through openings in the parcel shelf below the rear window.*
- *On wagon models, passenger compartment air is vented to the outside through openings in the rear luggage compartment trim below the rear side windows.*
- *In order for the ventilation system to work properly, these openings must not be blocked.*
- *The outside vent frames are located in both left and right rear quarter panels behind the bumper cover.*

Checking rear vent flaps



➤ Vent flaps (**1**) in frame (**2**) must move freely and not stick.

NOTE —

Rear vent flaps are located under rear bumper cover which is shown removed for clarity.

– Observe installation position.

QUALITY REVIEW

When you have finished working under the hood and around other areas of the vehicle, it is advisable to take a moment to quality check or review your work. This helps to insure that the operation or repair has been completed properly with all affected systems functioning within normal parameters. These may include the following:

- Ensure that all cable ties and clamps that were removed as part of the repair are replaced.
- Ensure that all fasteners and hardware were replaced and torqued as specified.
- Make sure that all other components involved in the repair are positioned correctly, properly torqued and function properly.
- Make sure that all tools, shop cloths, fender covers and protective tapes are removed before closing the hood.
- Clean grease and fingerprints from painted surfaces, steering wheel, upholstery and shifter.
- Make sure that warm/hot air is delivered by the appropriate air vents when the heater is switched on.
- Unlock anti-theft radio and reset the clock.

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e. Temperature drop and pressure tests 87-20

GENERAL

This section covers the Air Conditioning (A/C) refrigerant system and related components. Service and adjustment to the ventilation control cables is covered in **80 Heating and Ventilation.**

> ***WARNING —***
> *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using a VAG 1551/5051 or equivalent scan tool.*

The refrigerant system of the vehicles covered by this manual are designed to work only with a refrigerant known as R-134a. In this section, the refrigerant will always be referred to as R-134a, however, this chemical is marketed and sold under several trade designations such as: Tetrafluoroethane, $CH_2F\ CF_3$, H-KW 134a, SUVA® 134a, and ARCTON® 134a.

Other refrigerants may be available in the marketplace, however, Volkswagen specifically recommends that no other refrigerant be used. Serious damage will usually result and performance will be reduced.

Special precautions for A/C systems

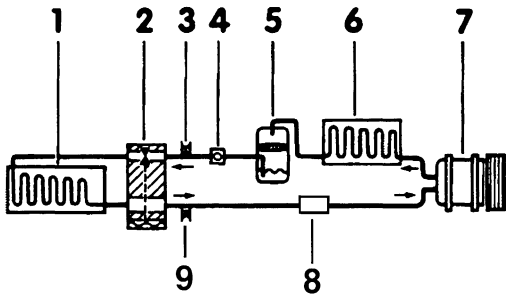
The air conditioning system is filled with refrigerant R-134a under pressure. The unique characteristics of this chemical necessitate special servicing and handling procedures which may be governed by Federal, State, Provincial and Local regulations.

WARNING —

- *Work in a well ventilated area. Refrigerant gases are heavier than air, displace oxygen and may cause suffocation in areas of poor air circulation, for example under the vehicle.*
- *Pressurized R134a refrigerant in the presence of oxygen may form a combustible mixture. Never introduce compressed air into any R-134a container (full or empty), capped off A/C component, or piece of service equipment.*
- *As of January 1, 1992 any person who services a motor vehicle air conditioner in the USA MUST, by law, be properly trained and certified and use approved refrigerant recycling equipment. Technicians must complete an EPA approved recycling course to be certified.*
- *State, Provincial and Local governments may have additional requirements regarding air conditioning servicing. Always comply with all applicable laws and regulations.*
- *The A/C system is filled with refrigerant gas which is under pressure.*
- *Avoid breathing refrigerant vapors. Exposure may irritate eyes, nose and throat.*
- *Always be careful that refrigerant does not come in contact with your skin. Always wear hand and eye protection (gloves and goggles) when working around the A/C system. If refrigerant has come in contact with your skin or eyes:*
  - *Do not rub skin or eyes.*
  - *Immediately flush with cool water for 15 minutes.*
  - *Rush to a doctor or hospital.*
  - *Do not attempt to treat yourself.*
- *Keep refrigerant containers stored below 50°C (122°F) and use care to avoid dropping.*
- *DO NOT warm refrigerant containers with an open flame. If refrigerant needs to be warmed, place bottom of tank in warm water.*
- *Do not expose any component of the A/C system to high temperatures above 80°C (176°F) or open flames. Excessive heat will cause system pressure increases which could burst the system.*
- *Switch on exhaust/ventilation systems when working on the refrigerant system.*
- *Keep refrigerant away from open flames. Poisonous gas will be produced if it burns. Do not smoke when refrigerant gases are present for the same reason.*
- *Electric welding near refrigerant hoses causes R-134a to decompose from ultraviolet light. Discharge system before electric welding.*

WARNING —

- *Always use an Underwriter's Laboratory (UL) approved refrigerant recovery/recycling/recharging unit such as Kent-Moore ACR4, or equivalent, whenever servicing an R-134a A/C system.*
- *Do not steam clean condensers or evaporators. Use only cold water or compressed air on the outside of the component.*
- *Refrigerant oils used for the R-134a system and R-12 (FREON®) systems are NOT compatible. Use only the specified synthetic oil (Polyalkylene Glycol/PAG) for the R-134a refrigerant system. DO NOT use R-12 system oil in an R-134a system or R-134a system oil in an R-12 system. If the refrigerant oils are mixed, system contamination will occur and compressor failure may result.*
- *R-134a refrigerant system oil (PAG oil) absorbs moisture very rapidly. Moisture combines with the refrigerant to form acids which will damage the system. Use only the specified oil from a sealed container and ALWAYS reseal oil container immediately after use. DO NOT use oil if it has become contaminated with moisture.*
- *Only use R-134a in Volkswagen A/C systems. Never use substitute or "drop-in" replacement refrigerants. Vehicle safety will be compromised and severe damage to vehicle and servicing equipment will result.*
- *Immediately plug open connections on A/C components to prevent dirt and especially moisture contamination. Likewise, DO NOT remove new components from packaging until ready to install. Immediately tighten component connections after installation.*
- *Always use separate refrigerant recovery/recycling/recharging servicing equipment for R-12 and R-134a systems. DO NOT use one piece of equipment for both R-12 and R-134a systems. The residual traces of refrigerant will contaminate and damage the equipment. Servicing equipment includes recovery/recycling/recharging unit, charging station, vacuum pump, manifold gauges, etc. Use only equipment designed to meet Society of Automotive Engineers (SAE) standards.*
- *Always replace O-rings, DO NOT reuse. Use only the correct size and type of O-rings specified for use with R-134a refrigerant. Lubricate O-ring with refrigerant oil before installing.*
- *Always replace damaged and/or leaking A/C system components. Do not attempt repair by soldering or welding.*
- *Always reinstall caps over A/C service valves.*
- *Work area must be extremely clean when working on A/C system components.*



0024300

1. Evaporator
2. Expansion valve
3. High pressure service valve
4. Sight glass (if equipped)
5. Receiver drier
6. Condenser
7. Compressor
8. Damper
9. Low pressure service valve

A/C refrigerant circuit

The variable displacement compressor compresses the R-134a refrigerant and moves it from the discharge port in a gaseous state to the condenser. The condenser is mounted in the front of the vehicle where air from the radiator fans or the motion of the vehicle passes through it. The motion of the air removes the heat from the refrigerant and a change of state from gas to liquid occurs. The liquid refrigerant flows (**arrows**) to the receiver-drier where it is temporarily stored and a desiccant removes any moisture. The refrigerant then moves past a sight glass (early vehicles only) and a high pressure service port to the expansion valve unit. The expansion valve has a small internal orifice which sprays the liquid refrigerant into the evaporator. The resulting change of state from liquid to gas and the associated pressure drop causes the evaporator to become cold. Air from inside the passenger compartment is passed over the evaporator by a fan where it gives up its heat and becomes cold. It is then distributed through the vent system. The gaseous refrigerant passes back through a port on the expansion valve, past a low pressure service port and damper and finally back to the suction side of the compressor to be compressed again.

Several other components are used to control and protect the system in addition to those mentioned above. The compressor runs when needed by means of an electro-magnetic clutch which is in turn controlled by several relays. A pressure switch in the refrigerant line also controls operation of the compressor clutch and the radiator cooling fans. A pressure relief valve is mounted to the compressor cylinder head plate. Switches for operation are mounted within easy reach of the driver and fuses and relays are mounted under the instrument panel.

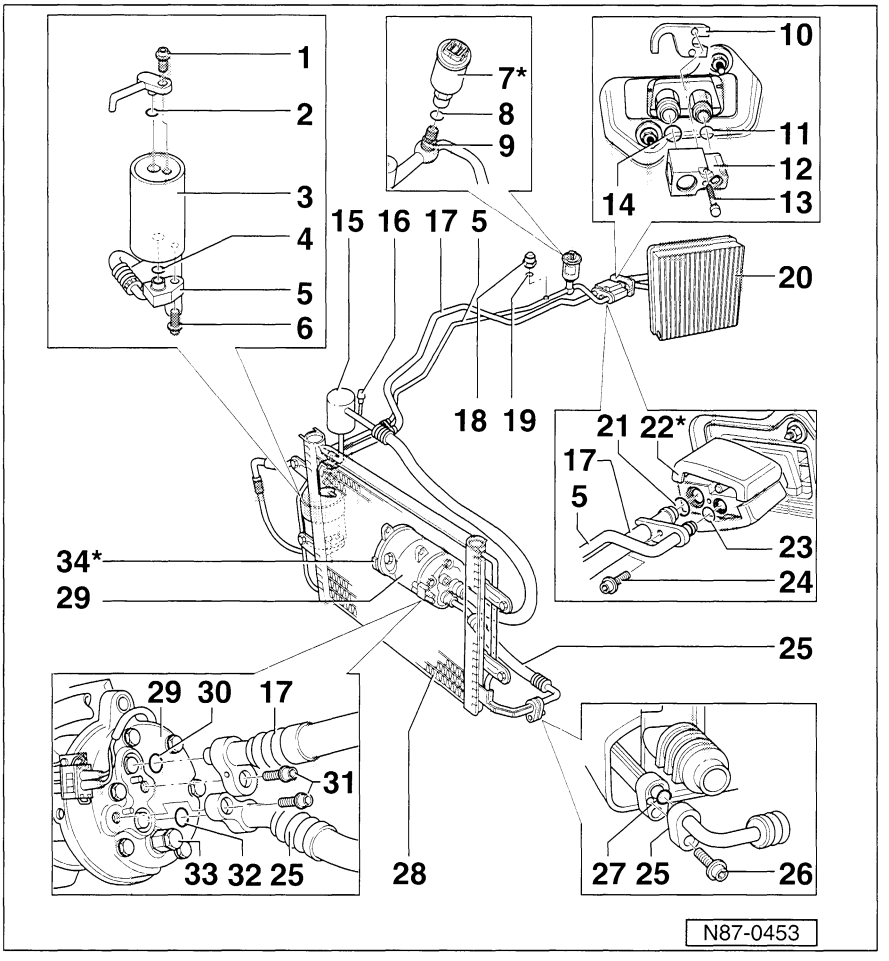
A/C REFRIGERANT SYSTEM

The air conditioning system is comprised of components that can be grouped into several areas. This heading covers those components that are used to handle and contain the R-134a refrigerant.

WARNING —
Observe all cautions, warnings and notes before starting repairs involving air conditioning system.

NOTE —
Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*

A/C refrigerant system, component overview



1. **Bolt**
   - Tighten to 15 Nm (11 ft-lb)
2. **O-ring, see O-rings**
   - Always replace
   - 10.8 mm x 1.8 mm
3. **Receiver drier, see Receiver drier**
   - Always replace
   - Location: attached to right side of condenser
4. **O-ring**
   - Always replace
   - 10.8 mm x 1.8 mm
5. **Liquid refrigerant line**
   - Location: between receiver drier outlet and expansion valve inlet
6. **Bolt**
   - Tighten to 15 Nm (11 ft-lb)
7. **A/C pressure switch (F129), or high pressure sensor (G65)***
   - Location: liquid refrigerant line near expansion valve
   - Pressure switch (F129) and pressure sensor (G65) can be removed without discharging the A/C system
   - See **A/C pressure switch, checking**
   - Pressure sensor (G65) is monitored by the ECM
   - G65 supplies refrigerant system pressure signal to coolant fan control module (J239) and ECM
8. **O-ring**
   - Always replace
   - 10.8 mm x 1.8 mm
9. **Schrader valve**
10. **Threaded plate**
11. **O-ring**
    - Always replace
    - 10.8 mm x 1.8 mm
12. **Expansion valve**
    - Location: near bulkhead on right side of engine compartment
    - Hole for refrigerant lines at bulkhead must be sealed against splashing water
13. **Bolt**
    - Tighten to 8 Nm (71 in-lb)
14. **O-ring**
    - Always replace
    - 14.0 mm x 1.8 mm
15. **Damper**
16. **Low pressure service valve**
    - Only use Kent Moore ACR4 or equivalent
    - See **Low pressure service valve, assembly**
17. **Refrigerant hose**
    - From expansion valve to compressor
    - With damper
18. **High pressure service valve port**
    - Only use Kent Moore ACR4 or equivalent
    - See **High pressure service valve, assembly**
19. **O-ring**
    - Always replace
    - 10.8 mm x 1.8 mm
20. **Evaporator**
    - Location: in heater/evaporator housing
21. **O-ring**
    - Always replace
    - 16.7 mm x 1.8 mm
22. **Insulation***
    - Wrapped around expansion valve
23. **O-ring**
    - Always replace
    - 7.6 mm x 1.8 mm
24. **Bolt**
    - Tighten to 8 Nm (71 in-lb)
25. **High pressure refrigerant line**
    - From compressor to condenser
26. **Bolt**
    - Tighten to 15 Nm (11 ft lb)
27. **O-ring**
    - Always replace
    - 10.8 mm x 1.8 mm

(**continued on following page**)

A/C refrigerant system, component overview (continued)

28. Condenser
- Location: ahead of radiator

29. Compressor
- Location: attached to mounting bracket on engine
- Replacement compressors are filled with the total system refrigerant oil quantity

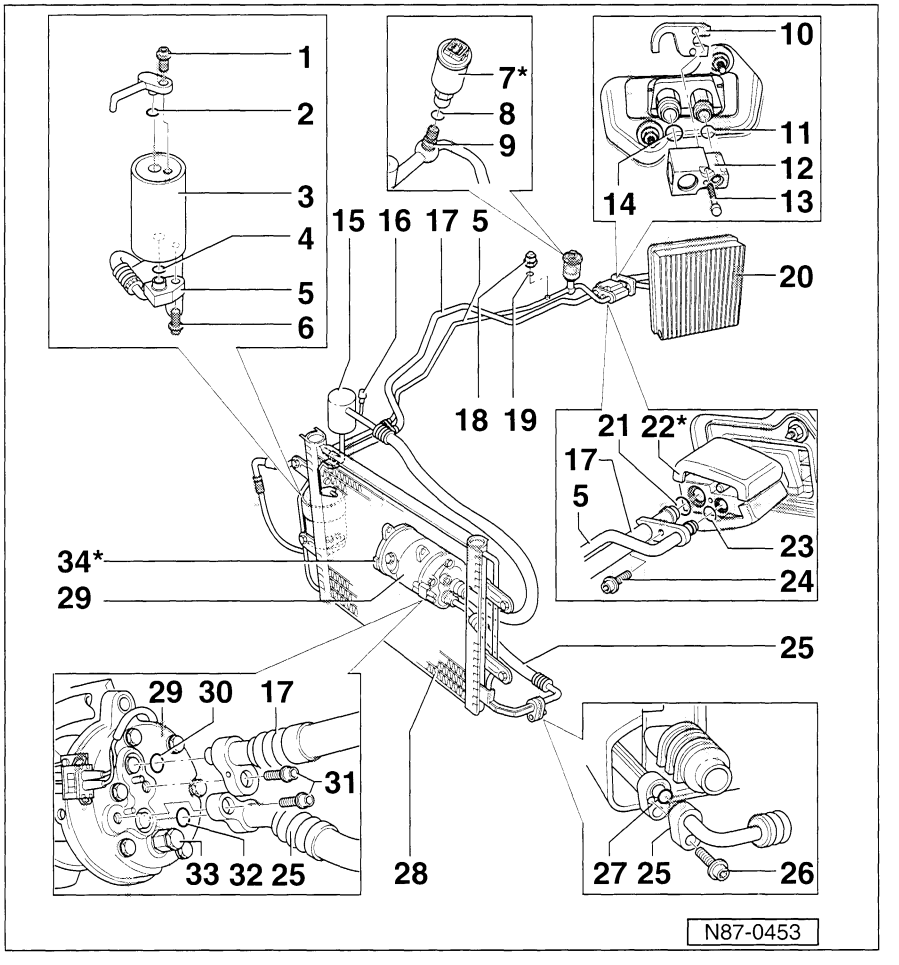
30. O-ring
- Always replace
- 14.3 mm x 2.4 mm

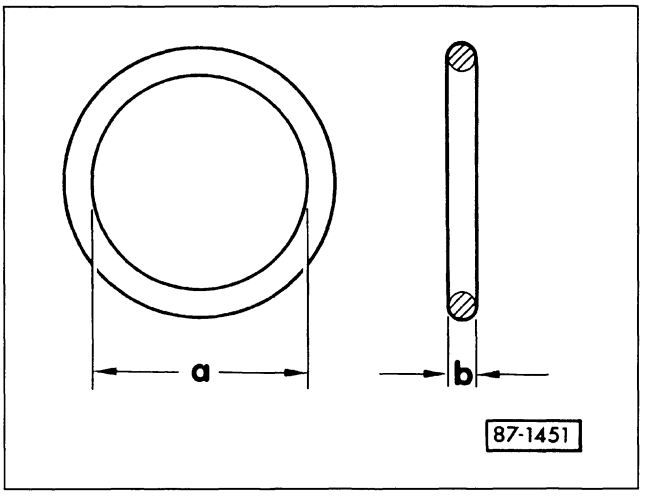
31. Bolt
- Tighten to 20 Nm (15 ft-lb)

32. O-ring
- Always replace
- 10.8 mm x 1.8 mm

33. Pressure relief valve
- Location: on compressor cylinder head plate
- Checking, **see Pressure relief valve**

34. A/C compressor clutch (N25)*
- Location: attached to front of A/C compressor
- Type: Sanden or Zexel

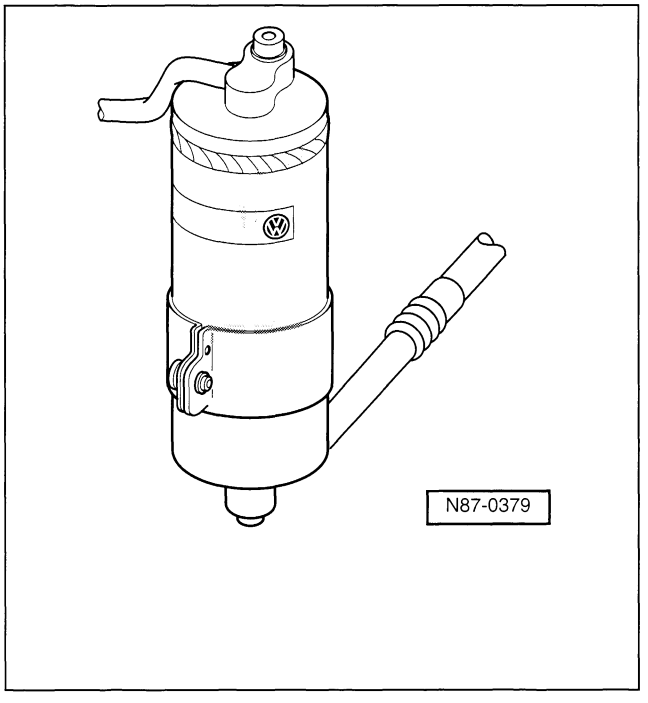




O-rings

Note inner diameter (**a**) and thickness (**b**).

- Lubricate with PAG oil before installing.
- Always replace during repairs, never reuse.
- Only use O-rings that are compatible with R-134a.
- May be color coded green, red, violet or black.



Receiver drier

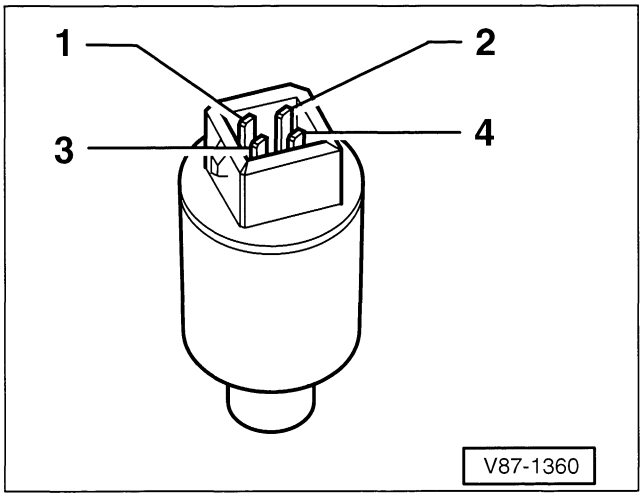
Reservoir for liquid refrigerant.

- Contains desiccant to absorb moisture from refrigerant.
- Must have green identification markings to indicate compatibility with R-134a.
- Never use R-12 FREON parts.
- To ensure optimum system operation, always replace every time refrigerant system is opened.

A/C pressure switches, checking

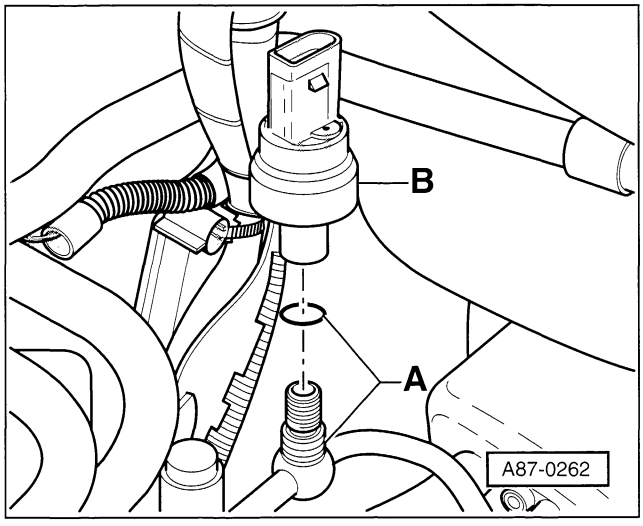
NOTE —

- *The presence of (F129) is engine dependant. Where (F129) is not used, high pressure sensor (G65) is used instead.*
- *Always confirm system use of either (F129) or (G65) and applicable wiring circuit using applicable "Engine" and "Air conditioning" wiring diagrams. See* ***97 Wiring Diagrams, Fuses and Relays*** *at back of this repair manual.*
- *Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See* **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*



High pressure switch (F129)

- Switch can be replaced without discharging refrigerant due to schrader valve in threaded fitting.
- Switches A/C clutch off when refrigerant pressure exceeds 32 bar (464 psi) and resets when pressure drops to 24 bar (348 psi).
- Switches A/C clutch off when refrigerant pressure falls below 1.2 bar (17.4 psi).
- Switches radiator coolant fan to second speed when pressure reaches 16 bar (232 psi).
- Terminals **1** and **2** switch A/C clutch.
- Terminals **3** and **4** switch radiator coolant fan.
- Checking: with the engine running and switch installed, briefly bridge terminal **1** and **2** of connector. If the A/C clutch engages, the refrigerant circuit is empty.

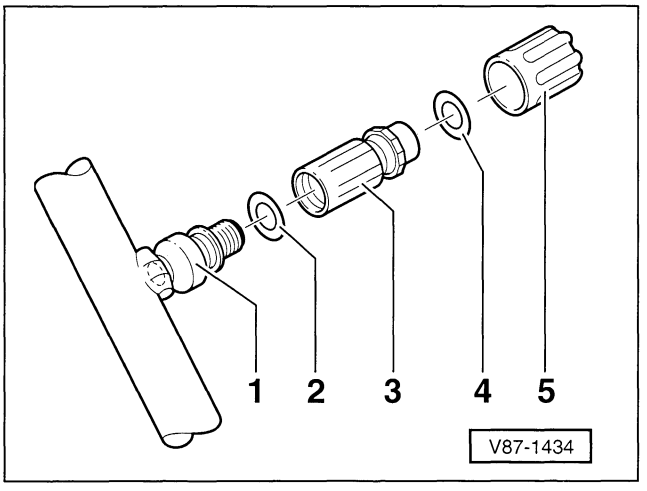


High pressure sensor (G65)

Where applicable, high pressure sensor (**B**), transmits a square wave signal to Coolant Fan Control (FC) Module (J293) at a rate which varies according to the refrigerant system pressure. J293 reacts to the pulse rate of the signal from G65 as follows:

- If the refrigerant system pressure rises, J293 switches the radiator fan(s) to the second speed.
- Where excessive or insufficient refrigerant system pressure is present (i.e.: insufficient air flow over condenser or when overcharged), J293 switches A/C clutch (N25) off (N25 is controlled by J293).
- On Climatronic equipped models it informs the A/C control head (E87) that the pressure in the refrigerant system is OK and that A/C clutch (N25) can be switched on (N25 is controlled by J293).

On applicable engines, the signal generated by G65 is also provided as an input to the Motronic Engine Control Module (ECM). As the amount of torque needed to drive the A/C compressor varies according to the refrigerant system pressure, the ECM processes this signal in order to enhance engine performance.



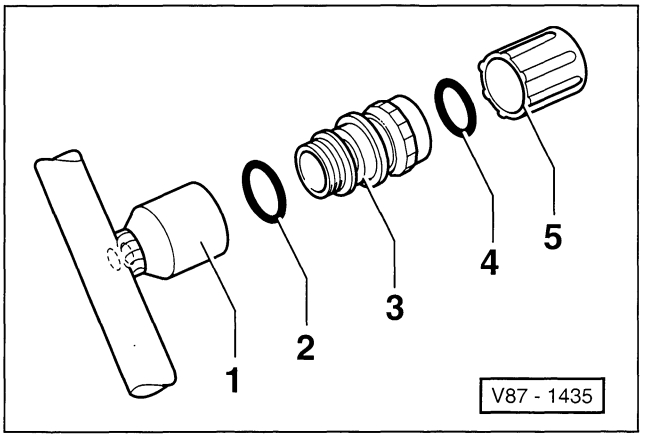
Low pressure service valve assembly

Discharge refrigerant system before replacing service valve (**3**). Protect all components against dirt and moisture contamination with suitable plastic caps.

1. Threaded base with groove for O-ring
2. O-ring
- Always replace
- 7.6 mm x 1.8 mm

3. Service valve
4. O-ring
- Always replace
- 7.6 mm x 1.8 mm

5. Cap



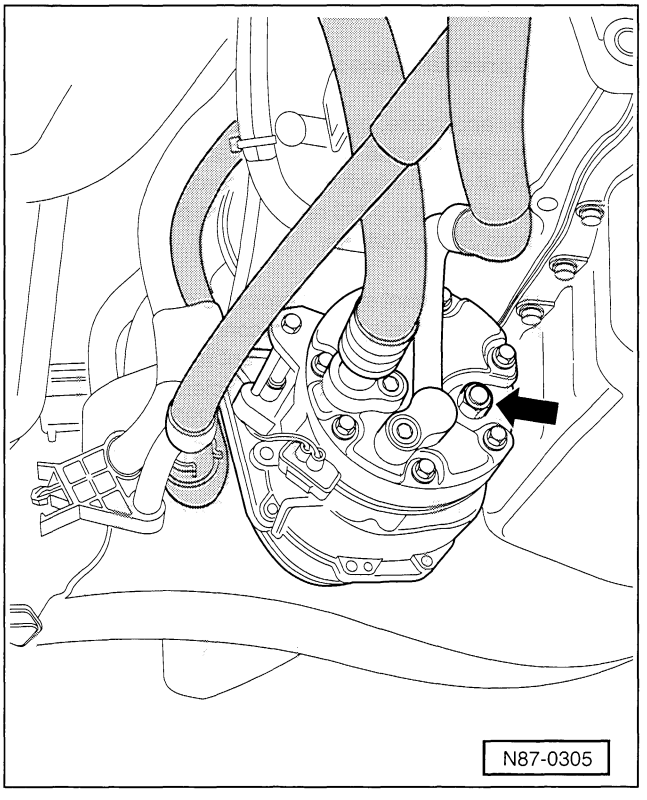
High pressure service valve assembly

Discharge refrigerant system before replacing service valve (**3**). Protect all components against dirt and moisture contamination with suitable plastic caps.

1. Threaded base with groove for O-ring
2. O-ring
- Always replace
- 10.8 mm x 1.8 mm

3. Service valve
4. O-ring
- Always replace
- 10.8 mm x 1.8 mm

5. Cap



Pressure relief valve

NOTE —

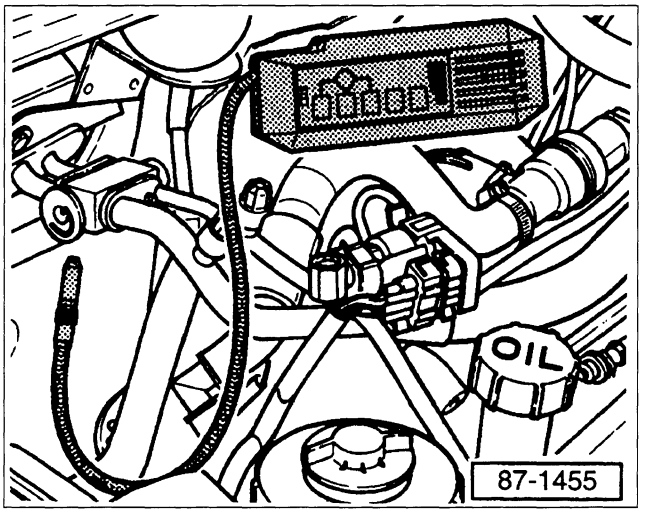
- *Pressure relief valve protects refrigerant circuit from over-pressure.*
- *It opens to vent pressures over 40 bar (580 psi) and then closes to prevent total refrigerant loss.*

Adhesive plate (**arrow**) is pushed out if valve has opened.

A/C refrigerant R-134a

Refrigerant R-134a has the following characteristics:

- Colorless and is invisible as a gas.
- R-134a when viewed through the sight glass may appear milky due to the mixture of refrigerant and lubricating oil (PAG oil).
- Escaped R-134a gases are heavier than air and will gather first in low places, such as under the car.
- R-134a refrigerant gas displaces oxygen and may cause suffocation in low areas or areas of poor air circulation.
- Refrigerant R-134a will deteriorate some plastics. Therefore, when making system repairs, use only genuine VW replacement parts or parts which are specified for use with R-134a refrigerant.
- R-134a in an enclosed container will have a specific temperature/pressure relationship.
- Refrigerant R-134a is not poisonous in any state (liquid or gas) and is safe when used properly.
- Refrigerant R-134a, in its pure state, is chemically stable and will not attack iron, copper, brass or aluminum. However, the mixture of R-134a and PAG oil may deteriorate certain metals (copper). Therefore, when making system repairs, use only genuine VW replacement parts or parts which are specified for use with R-134a refrigerant.
- Liquid R-134a refrigerant will absorb only very minute quantities of moisture. However, R-134a vapor can absorb large amounts of moisture.
- R-134a refrigerant is not flammable.
- DO NOT exceed maximum rated capacity of refrigerant stored in containers.



Use halogen leak detector Hitec HI400A-TEL or equivalent to check for R-134a system leaks. This tool can also be used to detect leaks in R-12 systems. Many currently available R-12 leak detectors cannot detect R-134a refrigerant leaks. Always follow the leak detector manufacturer's instructions.

NOTE —

- *Refrigerant gas dissipates very quickly. To make the job easier, avoid drafty or windy areas when checking for leaks.*
- *If the refrigerant system is discharged (empty), it is permissible to temporarily recharge the system with approx. 100 g (3.5 oz) of refrigerant in order to check for leaks. When the source of the leak is found, this refrigerant must be recovered from the system before repairs are started.*

Refrigerant oil, PAG

A special Polyalkylene Glycol (PAG) synthetic oil is used in R-134a systems. This oil is NOT compatible with mineral based oils used in older R-12 systems. Refer to **Special precautions for A/C systems** given earlier. For specifications and quantity, see **Table a**.

Table a. A/C system capacities

Fluid & Specification	Quantity
Refrigerant, R-134a	750 g + 50 g (26 + 1.8 oz.)
Oil (PAG), SP-10	
Sanden compressor (oil part no. G 052 154 A2)	135 cc ± 15 cc (4.6 oz. ± .5 oz.)
Zexel compressor (oil part no. G 052 154 A2/ G 052 300 A2)	115 cc ± 20 cc (3.9 oz. ± .7 oz.)

NOTE —

- *Replacement Sanden compressors from Volkswagen are supplied with 135 cc of refrigerant oil.*
- *Volkswagen part numbers are given for reference only. Always consult with your Volkswagen Parts Department or aftermarket parts specialist for the latest parts information.*
- *A label on the lock carrier in the engine compartment indicates the refrigerant type and capacity and should be consulted before starting any servicing or repairs.*

Refrigerant lines and hoses

Lines and hoses are fastened together with threaded couplings and fittings. They are retained to the bodywork or components with specially isolated hose clamps. During servicing, all couplings, fittings and related fasteners must be torqued to specification.

A/C refrigerant system, replacing components

Replacement A/C compressors, evaporators and condensers supplied by the authorized Volkswagen dealer parts departments are filled with Nitrogen. If gas (Nitrogen) does not escape when component is first opened, the component may be faulty (leaking), do not install. Additionally, replacement A/C compressors are filled with the total refrigerant oil quantity needed for the entire refrigerant system.

Always replace the receiver drier whenever the refrigerant system has been left open. Install immediately after opening to prevent moisture contamination of drier desiccant. Moreover, keep refrigerant system and other replacement components sealed for as long as possible to minimize the chance of dirt and moisture contamination. Even the slightest amount of trapped moisture can freeze within the system causing blockage and erratic perfor-

mance. Always plug any open refrigerant line connections to prevent dirt and moisture contamination during the repair especially if the repair will not be completed immediately.

If the system has been discharged due to a damaged or leaking component (refrigerant hose/line, compressor, evaporator, condenser, etc.), flush the refrigerant system first with compressed air, then with nitrogen (available locally) and collect the oil that runs out. This will remove the refrigerant oil which may be saturated with moisture.

> ***WARNING —***
> *DO NOT flush R-134a refrigerant system with any other type of refrigerant such as R-12 or R-11. Other refrigerants are not compatible with refrigerant R-134a/PAG oil and will cause total system contamination!*

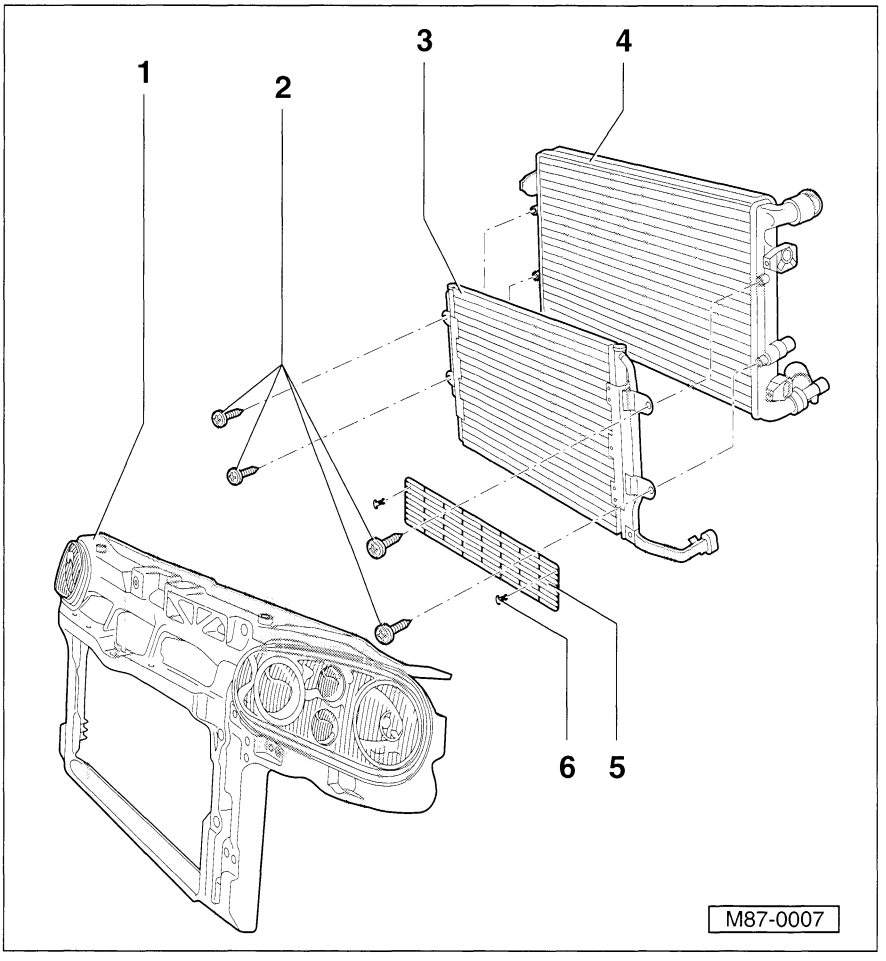
If the compressor is not replaced after flushing the system, fill the compressor with the correct type and quantity of refrigerant oil for the total system as specified in **Table a**. If a new Sanden compressor is used, do not add any additional oil as the total amount of oil required is already in the compressor. Refrigerant oil is distributed in most major parts of the refrigerant system. For approximate capacities, see **Table b**.

Table b. Refrigerant oil distribution

Component	Approximate % of total amount of oil in component
Compressor	50%
Condenser	10%
Suction line	10%
Discharge line	--
Evaporator	20%
Receiver-drier	10%

> ***WARNING —***
> *Dispose of contaminated refrigerant oil following laws governing hazardous waste disposal. Do not combine any refrigerant oil with any other old oils such as engine oil or transmission fluid unless approved by the appropriate governing body.*

Condenser assembly, overview



NOTE —
Observe all cautions, warnings and notes before starting repairs involving air conditioning systems.

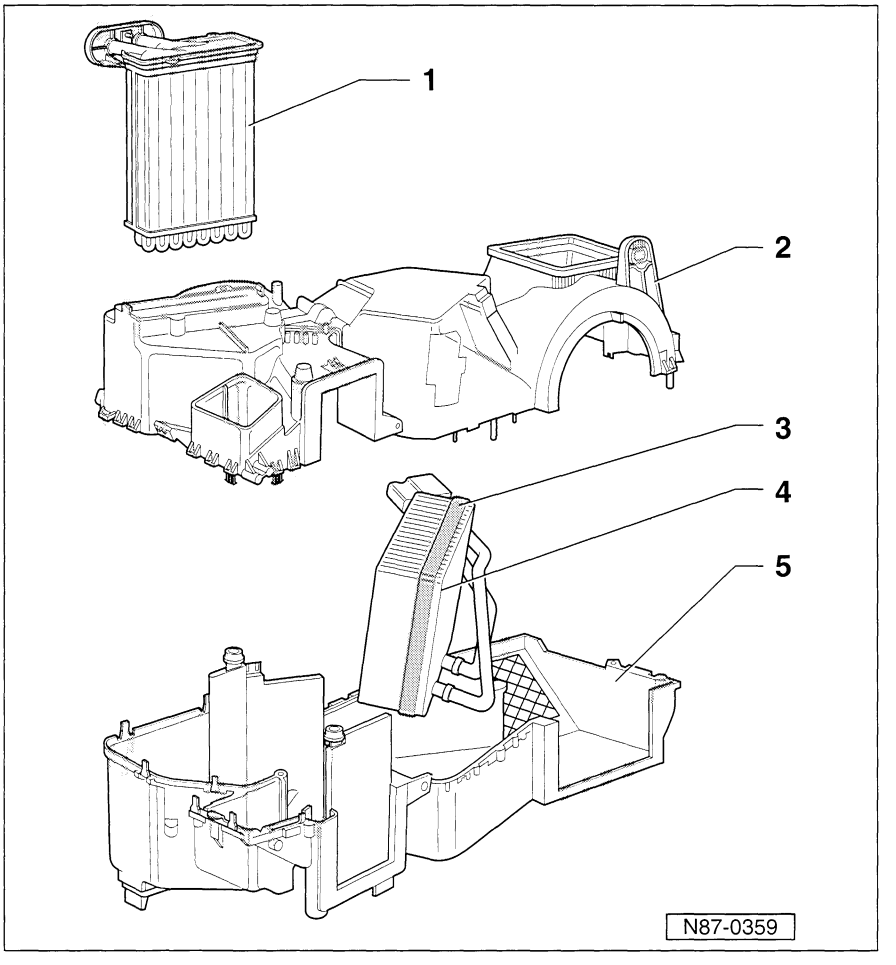
1. **Lock carrier**
   - Bring into service position for condenser removal, see **50 Body-Front**
2. **Screws**
   - Tighten to 8 Nm (71 in-lb)
3. **Condenser**
   - Discharge and recover refrigerant before removal
   - Disconnect refrigerant lines at condenser
4. **Radiator**
   - Drain coolant before removal
   - Always use new coolant after replacement
   - Seal open refrigerant lines immediately
   - Inspect for bent and obstructed fins and physical damage before installing
   - Always replace O-rings for refrigerant lines
5. **Grille**
   - Where applicable
6. **Clips**
   - Where applicable

Evaporator/heater assembly, overview

The A/C evaporator and the heater core are encased in a multi-piece housing inside the vehicle. Access is from the interior and requires A/C refrigerant discharge and removal of the instrument panel and instrument panel crossmember. See **70 Trim–Interior**.

NOTE —

- *Observe all cautions, warnings and notes before starting repairs involving air conditioning systems.*
- *Availability of individual air conditioning components may be limited. Complete assemblies may be required.*



1. **Heater core**
   - Drain coolant before removal
   - Always use new coolant after replacement
2. **Housing, upper section**
   - With fresh/recirculating air flap
3. **Evaporator seal**
   - Install seal to top and sides only, not to bottom
   - Secure with glue
   - Condensate MUST be free to drain out from the bottom of the housing under the evaporator.
4. **Evaporator**
   - Discharge and recover refrigerant before removal
   - Disconnect refrigerant lines at expansion valve
   - Seal open refrigerant lines immediately
   - Inspect for bent and obstructed fins and physical damage before installing
   - Always replace O-rings for refrigerant lines
5. **Housing, lower section**

A/C system odor, checking

An unpleasant smell or "musty" odor can be emitted from any automotive air conditioning system under certain conditions. Many times this "musty" odor is caused by residual condensate in and around the A/C evaporator mixing with airborne pollutants. This environment is suitable for the formation and growth of bacteria and/or fungi which can cause undesirable odors. Condensation is normally formed as part of the air conditioning process and must be allowed to flow out of the system.

To minimize the growth of bacteria and/or fungi, there are several steps that can be performed:

- Water drain(s) in the bottom of the plenum chamber(s) under the hood must be open and free of any debris.
- The bulkhead between the engine compartment and the passenger compartment must be sealed along with any cable grommets passing through the bulkhead.
- The evaporator water (condensate) drain must open freely. This valve is located behind the bulkhead insulation.

If the above steps fail to correct an odor problem, professional preparation and treatment using a commercially available product such as Airsept Air Conditioning Treatment™ should be performed. Special tools, equipment and training are required to properly apply Airsept™ Products. These procedures are outside the scope of this repair manual.

A/C REFRIGERANT SYSTEM SERVICING

In accordance with SAE and industry standards, Volkswagen air conditioners are equipped with service fittings that accept standard R-134a charging equipment. Connecting gauges to the refrigerant system and measuring the various pressures during operation is a valuable and accurate way to troubleshoot. The pressures and associated temperatures in the A/C system will vary depending on engine speed (rpm), coolant fan speed, engine coolant temperature, A/C clutch engagement, outside temperature, humidity, etc. and can give an accurate indication of system performance.

> ***WARNING —***
> *Observe all cautions, warnings and notes before starting repairs involving air conditioning systems.*

A/C refrigerant system, testing with pressure gauges

Due to the constant temperature/pressure relationship of refrigerant R-134a, approximate high side and low side system temperature can be determined based on system pressures, see **Table c**.

Table c. R-134a temperature/pressure relationship

Temperature in °C (°F)	Pressure in bar (psi)
-30 (-22)	0.0 (0.0)
-20 (-4)	0.3 (4.4)
-10 (14)	1.0 (14.5)
0 (32)	1.9 (27.5)
10 (50)	3.1 (45.0)
20 (68)	4.7 (68.2)
30 (86)	6.7 (97.2)
40 (104)	9.1 (132.0)
50 (122)	12.2 (177.0)
60 (140)	15.8 (229.0)
70 (158)	20.2 (293.0)

Commercially available manifold gauge sets are specifically calibrated for R-134a and should be connected to the system according to the manufacturers instructions. All commercially available refrigerant recovery, recycling and recharging equipment also have gauges that are appropriate for R-134a and are suitable for system testing.

Pressure and temperature measurements should be made using the following conditions:

- Engine running at 1,500 rpm with A/C switched on.
- Blower fan control set to highest speed.
- A/C temperature control set to maximum cooling and recirculation switched on.
- All passenger compartment air outlets open fully.

For pressure and temperature specifications of the various components, see **Table d**.

Table d. Pressure and temperature specifications[a]

Component	Refrigerant state	Approximate pressure	Approximate temperature
Evaporator, inlet to outlet	Vapor to gas	1.2 bar (17.4 psi)[b]	-7°C (19°F)[c]
Low pressure service valve port	Gas		-1°C (30°F)
Compressor, low pressure (suction) side	Gas		
Compressor, high pressure (discharge) side	Gas	14 bar (203 psi)	65°C (149°F)
Condenser	Gas to vapor to liquid		55°C (131°F) at outlet
Receiver drier	Liquid		55°C (131°F)
Sight glass (where equipped)	Liquid		
High pressure service valve port	Liquid		
Expansion valve	Liquid to vapor	Inlet: 14 bar (203 psi) Outlet: 1.2 bar (17.4 psi)	Inlet: 55°C (131°F) Outlet: -7°C (19°F)

a. Pressure and temperature specifications are based on: 1) Engine speed at 1,500 rpm, 2) Blower fan set to high speed, 3) A/C controls set to maximum cooling.
b. Pressure maintained in the refrigerant system by the variable displacement compressor despite variables in temperature, load and engine speeds (RPM).
c. Temperature maintained in the refrigerant system by the variable displacement compressor despite variable in temperature, load and engine speeds (RPM).

A/C system, troubleshooting

If the A/C system does not cool sufficiently there are a number of different checks that can be done to determine which component might be at fault.

NOTE —

- *Ensure that the electrical system is OK and the air flow distribution system (controls and cables) are OK.*
- *Manual A/C system controls and cables are covered in* **80 Heating and Ventilation**. *Electronic A/C system (Climatronic) controls and flap motors are covered later in this section.*

If A/C does not cool at all, cooling is insufficient at all driving speeds or there is no cooling after a period of driving, check the following:

- A/C system must be fully charged, if necessary discharge system, evacuate and recharge.
- Condenser and radiator must be clean and free of obstructions (spray clean if necessary).
- Air distribution can be adjusted correctly (all air distribution flaps reach end positions) using control knobs or Climatronic control unit.
- Wiring is OK as per 9**7 Wiring Diagrams, Fuses and Relays**.
- Outside (ambient) air temperature is between 20-30° (68-86°F)
- Drive belts for A/C compressor and generator in good condition and properly tensioned, see **0 Maintenance**.

If all of the above conditions are met proceed to test the A/C system as follows.

- Start engine and set temperature control to maximum "cold" (manual A/C) or "LO" (Climatronic).

- For manual A/C, press "A/C" button and select second blower speed. For Climatronic, select minimum blower speed (manual override) by pressing "decrease blower speed" button and observing blower speed display in control head.

- Adjust air distribution to instrument panel outlets and insert thermometer into center outlet and raise engine speed to approx. 1500 RPM.

NOTE —
Outside (ambient) air temperature should be between 20-25°C (68-77°F) for A/C temperature drop test. For higher ambient temperatures and/or higher humidity, air temperature from center instrument panel vent can be slightly higher than specified below.

A/C air temperature

- Maximum temperature at center outlet after 1 minute . . . . . 10°C (50°F)

- If specified A/C air temperature is not obtained after running A/C for 1 minute, shut off A/C and engine. Connect refrigerant recovery/recyling/recharging unit (Kent-Moore ACR4 or equivalent) to high and low pressure service valves of A/C system.

- Disconnect harness connector from coolant fan and start engine.

- Set temperature control to maximum "hot" (manual A/C) or "HI" (Climatronic).

- Press "A/C" button and select highest blower speed (manual A/C only).

- Adjust air distribution to footwell outlets and raise engine speed to approx. 1500 RPM.

- Read A/C system high pressure.

Normal system high pressure

- Within 30 seconds . . . . . 232 psi (16 bar)

- If specificified pressure is not obtained, set temperature control to maximum "cold" (manual A/C) or "LO" (Climatronic).

– Press "A/C" button and select first blower speed (manual A/C) or select minimum blower speed with the manual override by pressing "decrease blower speed" (Climatronic).

– Adjust air distribution to instrument panel outlets and raise engine speed to approx. 1500 RPM.

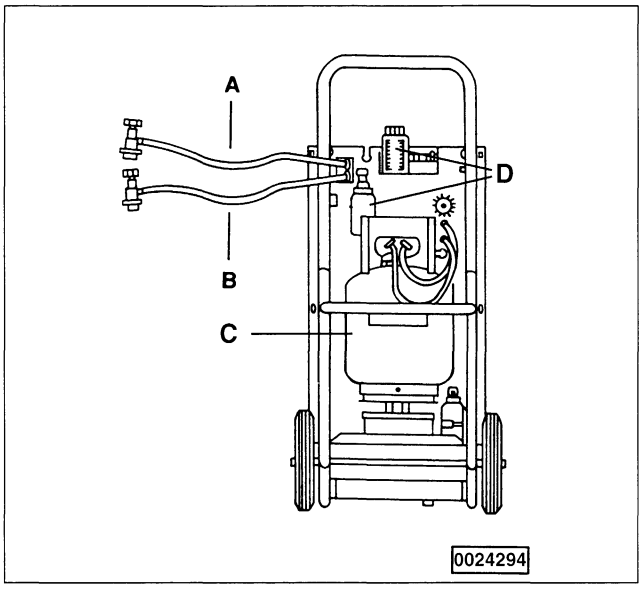
– Read A/C system low pressure.

Normal system low pressure
• Within 30 seconds . . . . . 22-36 psi (1.5-2.5 bar)

– If specified pressure is not obtained, compare the results of the various tests (temperature drop, high pressure and low pressure) to **Table e** for possible causes and corrective measures.

Table e. Temperature drop and pressure tests

Temperature drop result	High pressure result	Low pressure result	Possible causes	Corrective measures
Normal	Normal	Normal	None	---
Too high	Normal	Normal	Temperature flap position incorrect	Adjust temperature flap cable, see **80 Heating and Ventilation**
Too high	Too low	Normal	Compressor	Replace compressor
Normal	Too low	Normal	Compressor	Replace compressor
Normal	Normal	Too high or too low	Expansion valve or compressor	Clean/replace expansion valve or replace compressor
Too high	Normal	Too high or too low		
Normal	Too high or too low	Too high or too low		



A/C refrigerant system, discharging and charging

Before starting repairs involving opening of the refrigerant system, the refrigerant must first be removed. It is not permissible to vent the refrigerant into the atmosphere for environmental, legal and economic reasons. In addition, due to the lack of a sight glass in most vehicles, a measured amount of refrigerant must be installed to insure that the system is fully charged. Equipment suitable for this purpose is available from several manufacturers. All refrigerant servicing equipment attaches to the high and low pressure service valve ports, but exact connection details and operation may differ slightly between individual equipment manufacturers. Always follow the equipment manufacturer's instructions regarding connections to the vehicle. Rear view of R-134a equipment supplied by Kent-Moore. High pressure hose (**A**) is color coded red and low pressure hose (**B**) is color coded blue. Equipment also has a built-in tank for R-134a (**C**) and provisions for adding PAG oil (**D**).

After discharging and recovering the refrigerant, proceed with repairs as required. Do not leave the refrigerant system open. Seal openings to keep dirt and especially moisture from entering. When repairs have been completed, the system must be evacuated for a minimum of 30 minutes. This will "pull the system down" by creating a vacuum. It will remove all traces of the old refrigerant ensuring an accurate recharge. More importantly, however, it will remove any moisture that may have entered the system.

When the system has been repaired and properly evacuated, add refrigerant oil if required and recharge according to the equipment manufacturers instructions. Consult **Table a**. A/C system capacities, given earlier.

After the system has been recharged, switch on the ignition, but do not start the engine. Switch on the A/C and manually rotate the A/C compressor approximately 10 turns before starting the engine to insure adequate compressor lubrication. Start the engine with the A/C switched OFF. After idle speed has stabilized, switch A/C ON and let the engine idle with the compressor running for a minimum of two minutes before raising engine speed. This will allow the refrigerant oil to properly circulate to all parts of the system.

A/C refrigerant system, flushing

Certain circumstances may require complete removal of the refrigerant and refrigerant oil. This process is known as flushing and is accomplished with nitrogen and compressed air. Compressed nitrogen with regulators and adapters are available locally. Flushing is usually needed under the following conditions:

- Refrigerant oil is dark and viscous (thick) or shows metallic particles.
- Too much refrigerant oil is known to be in the system following compressor replacement.
- Do not know how much refrigerant oil is in the system.
- Moisture, dirt or other impurities have entered the refrigerant system, (i.e. following an accident).
- Unable to pull a constant vacuum during evacuation of a leak-free system due to excessive moisture in system.
- Refrigerant system has been open longer than the time required for normal repairs, (i.e. following an accident).
- Based on temperature and pressure measurements, system is diagnosed with moisture contamination.
- Compressor is replaced due to noises or internal damage.

If flushing the system, observe the following points:

- When using compressed nitrogen always use a pressure regulator and the proper adaptor hoses and fittings.
- During flushing, use existing exhaust/ventilation systems to draw off the gas mixture escaping from A/C system.
- Use compressed air and nitrogen (available locally) to remove moisture, impurities and old refrigerant oil from A/C refrigerant system.
- First blow out old refrigerant oil and dirt with compressed air, then dry components with nitrogen.
- DO NOT blow compressed air and nitrogen through the compressor or expansion valve. Only blow compressed air and nitrogen through disconnected, free flowing components (i.e. disconnected hose, condenser, evaporator, etc.)
- DO NOT blow compressed air and nitrogen into a capped off A/C component. Pressurized R-134a refrigerant in the presence of oxygen may form a combustible mixture.
- Always flush components in opposite direction of refrigerant flow.
- Flush evaporator through the low pressure line with the high pressure line removed.
- If any component has dark thick deposits that cannot be removed with compressed air, replace component.

- Thin light gray deposits in refrigerant lines and hoses are normal and do not impair the function of the system.
- Always replace receiver drier and restrictor after flushing.
- Dispose of contaminated refrigerant (PAG) oil following laws governing hazardous waste disposal. Do not combine PAG oil with any other old oils such as engine oil or transmission fluid.

WARNING —

- *DO NOT flush R-134a refrigerant system with any other type of refrigerant such as R-12 or R-11. Other refrigerants are not compatible with refrigerant R-134a/PAG oil and will cause total system contamination!*
- *DO NOT blow compressed air and nitrogen through the compressor or expansion valve. Only blow compressed air and nitrogen through disconnected, free flowing components (i.e. disconnected hose, condenser, evaporator, etc.).*
- *DO NOT blow compressed air and nitrogen into a capped off A/C component. Pressurized R-134a refrigerant in the presence of oxygen may form a combustible mixture.*

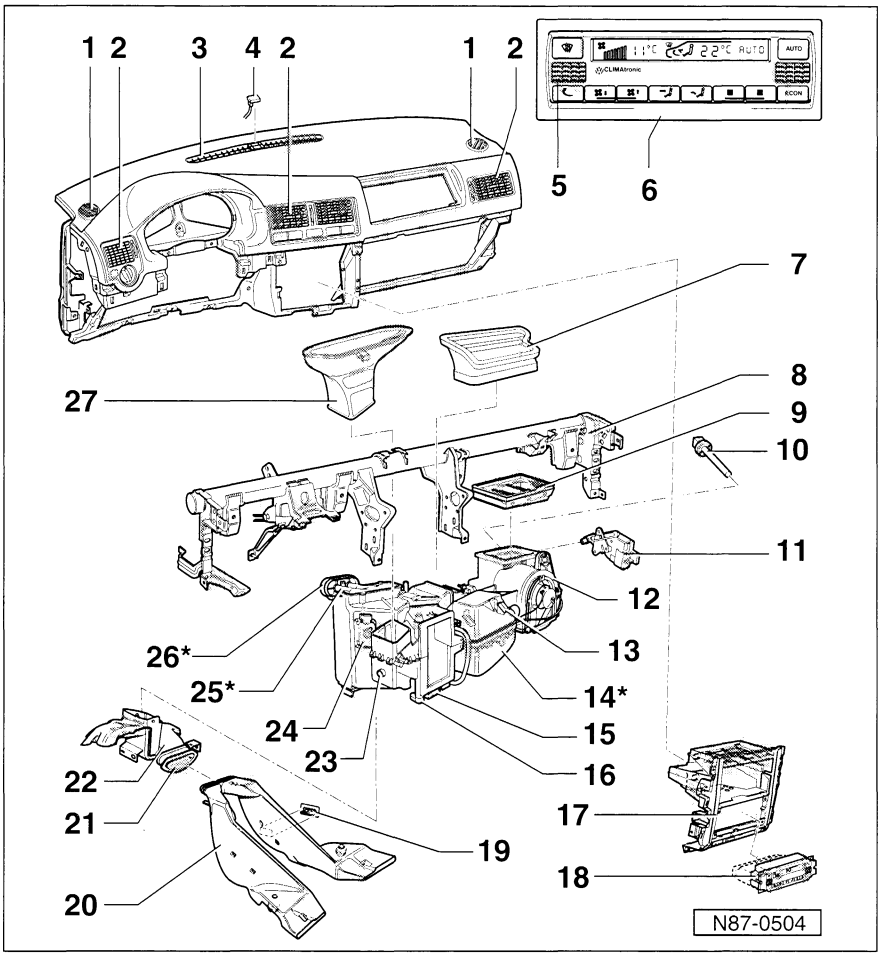
A/C, HEATING AND VENTILATION CONTROLS

An exploded view of the heating and ventilation components in the passenger compartment for vehicles equipped with the electronic (Climatronic) air conditioning system is shown below.

NOTE —

- *For an assembly view of passenger compartment components for vehicles without Climatronic, see* **80 Heating and Ventilation**.
- *Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See* **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*

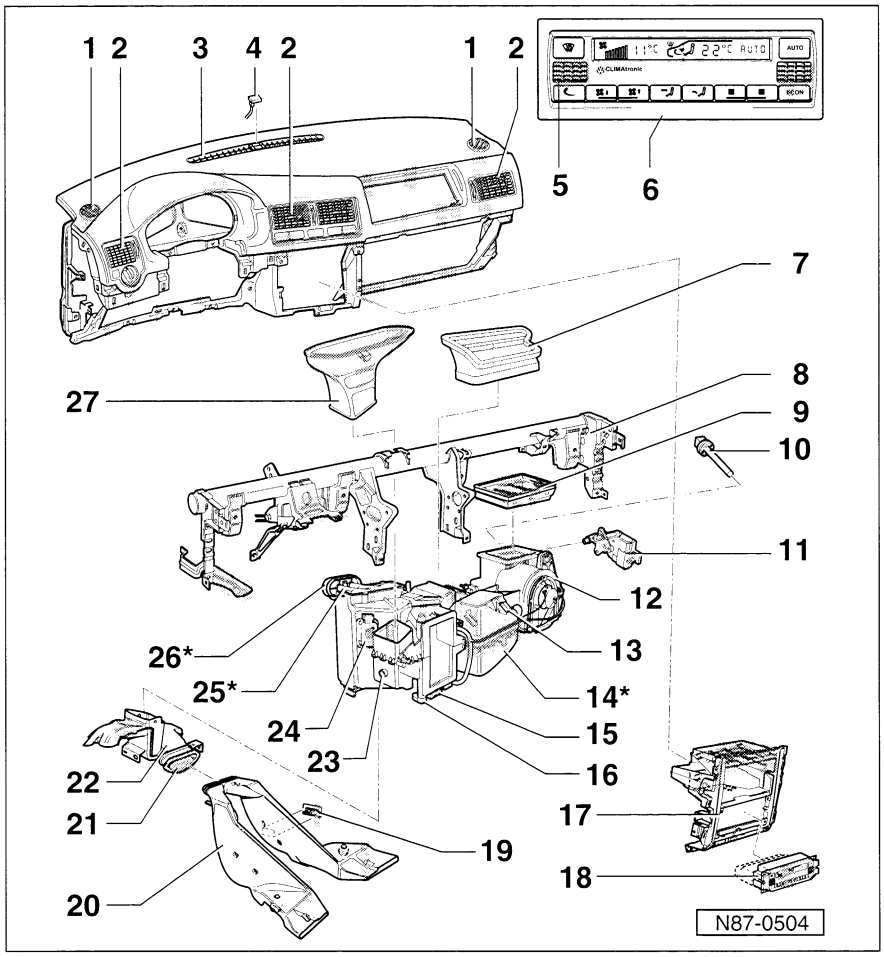
A/C passenger compartment components, overview (Climatronic)



1. **Side window air outlet**
   - Removing, see **80 Heating and Ventilation**
2. **Dashboard air outlets**
   - Removing, see **80 Heating and Ventilation**
3. **Defroster air outlet**
   - Must remove instrument panel to remove, see **70 Trim –Interior**
4. **Sunlight photo sensor (G107)**
   - Controls temperature flap and fresh air blower speed depending on light intensity
   - Climatronic control module will assume a fixed value in the event of sensor failure
   - Removing, **see Sunlight photo sensor, removing**
5. **Instrument panel temperature sensor (G56) with interior temperature sensor fan (V42)**
   - Climatronic control unit, A/C control head and instrument panel temp. sensor with fan are integrated into a single unit which cannot be serviced separately
   - Controls temperature flap and fresh air blower
   - Climatronic control module will assume a fixed value of 24°C (75°F) in the event of sensor failure
6. **A/C control head unit**
   - Climatronic control unit, A/C control head and instrument panel temp. sensor with fan are integrated into a single unit which cannot be serviced separately
   - Replacing and adjusting: Code Climatronic control module, function 07 and then initiate basic setting, function 04 using VAG scan tool 1551/5051 or equivalent
7. **Intermediate duct**
8. **Instrument panel cross member**
   - Loosening and tightening, see **80 Heating and Ventilation**
9. **Dust and pollen filter**
   - With activated charcoal filter
   - Removing and installing, see **80 Heating and Ventilation**
10. **Fresh air intake duct temperature sensor (G89)**
    - Controls temperature flap and fresh air blower
    - If sensor malfunctions, outside temperature sensor value is used instead
    - Replacing: Remove glove box, see **70 Trim–Interior** Reach behind heating and A/C unit and turn sensor 90° and pull out
    - Lubricate seal with oil when installing
11. **Air flow flap motor (V71)**
    - Also operates fresh and recirculating air flap
    - Replacing and adjusting: Initiate basic setting, function 04 using VAG scan tool 1551/5051 or equivalent
12. **Fresh air blower fan (V2)**
13. **Fresh air blower control module (J126)**
    - Controls fresh air blower speed depending on voltage signal
    - Replacing, **see Control module for fresh air module, removing**
14. **Heating and A/C unit***
    - Refrigerant must be discharged before removing
    - With heater core and evaporator
15. **Central air flap motor (V70)**
    - Replacing and adjusting: Initiate basic setting, function 04 using VAG scan tool 1551/5051 or equivalent

(continued on following page)

A/C passenger compartment components, overview (Climatronic) (continued)



16. Temperature regulator flap motor
- Replacing and adjusting: Initiate basic setting, function 04 using VAG scan tool 1551/5051 or equivalent

17. Center trim

18. Climatronic control module
- Climatronic control unit, A/C control head and instrument panel temp. sensor with fan are integrated into a single unit which cannot be serviced separately
- After replacing: Always code Climatronic control module, function 07 and then initiate basic setting, function 04 using VAG scan tool 1551/5051 or equivalent

19. Footwell air outlet
- Passenger side only

20. Rear footwell air duct

21. Gasket

22. Connecting duct
- With driver's side footwell air outlet
- Removing, see **80 Heating and Ventilation**

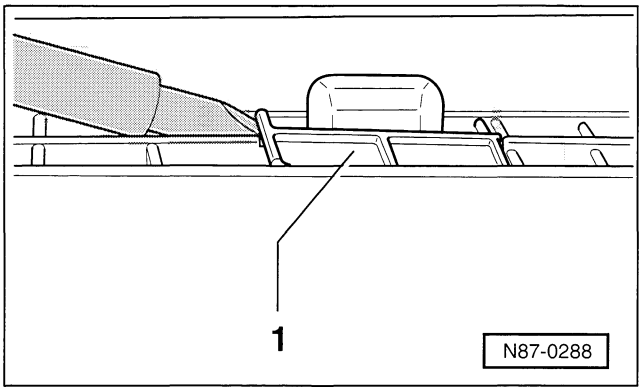
23. Footwell air outlet temperature sensor (G192)
- Controls air distribution defrost/footwell and fresh air blower speed depending on air outlet temperature measurement
- In the event of sensor failure, operation will continue assuming a default value of 80°C (176°F)
- Removing and installing, **see Footwell air outlet temperature sensor, removing and installing**

24. Footwell/defroster flap motor (V85)
- Replacing and adjusting: Initiate basic setting, function 04 using VAG scan tool 1551/5051 or equivalent

25. Heater core
- Refrigerant must be discharged before removing

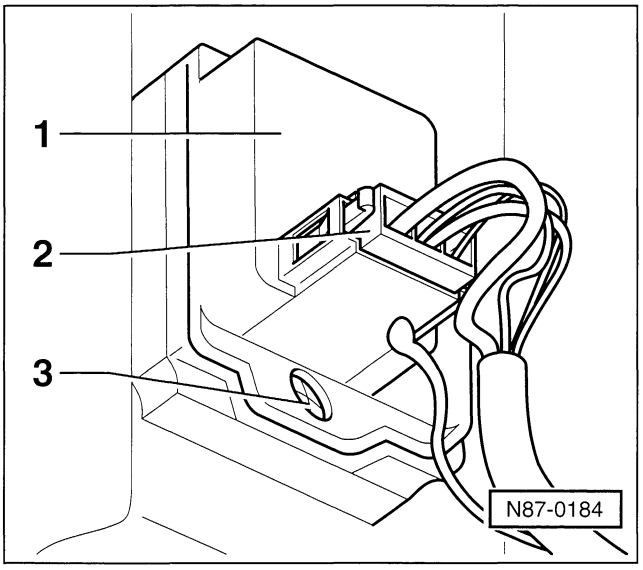
26. Heater core/bulkhead seal
- Refrigerant must be discharged before removing
- Note installed position

27. Defroster duct
- Replacing: Remove instrument panel, see **70 Trim–Interior** Loosen instrument panel cross member, see **80 Heating and Ventilation**



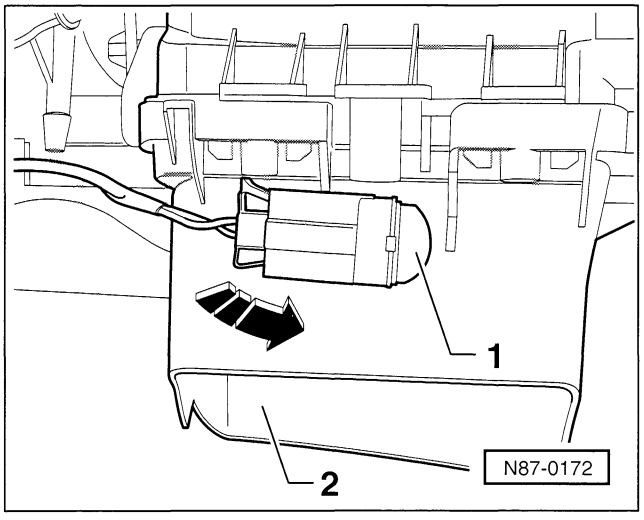
Sunlight photo sensor, removing

- Unclip photo sensor (**1**) with screwdriver.



Control module for fresh air blower, removing

- Remove glove box, see **70 Trim–Interior**.
- Disconnect harness connector (**2**) and remove screw (**3**).

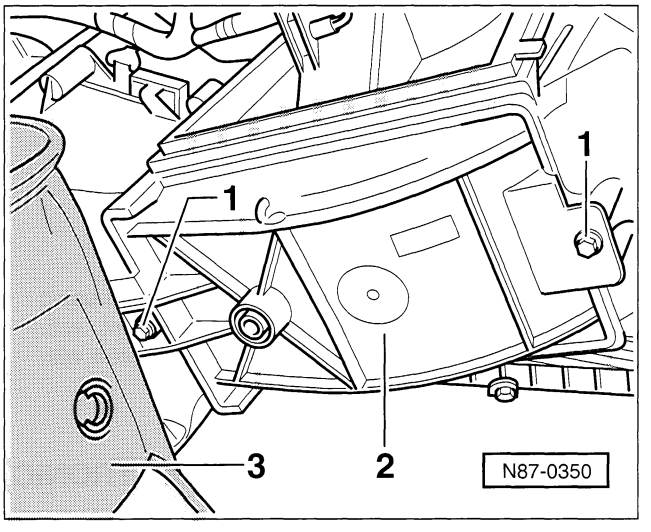


Footwell air outlet temperature sensor, removing and installing

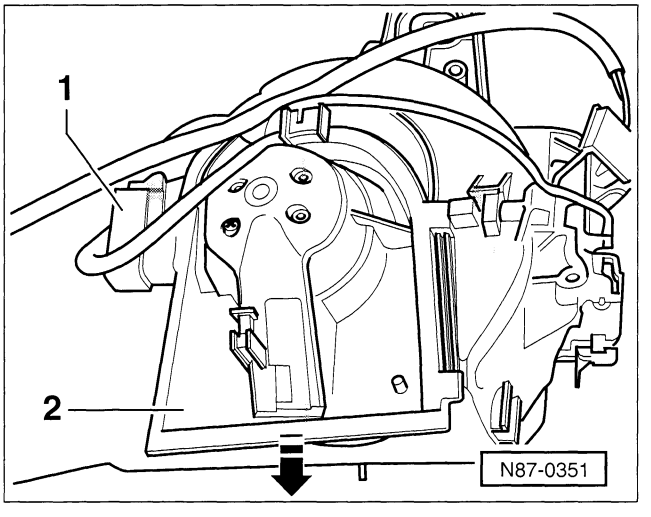
- Remove instrument panel and steering column lower trim, see **70 Trim–Interior**.
- Disconnect harness connector from sensor and turn sensor (**1**) 90° and remove from housing (**2**).
- Lubricate sensor seal with oil when installing.

Fresh air blower, removing

– Remove glove box, see **70 Trim–Interior.**



➤ Remove plastic foam cover (**3**) below A/C unit, remove mounting bolts (**1**) and blower fan lower cover (**2**).

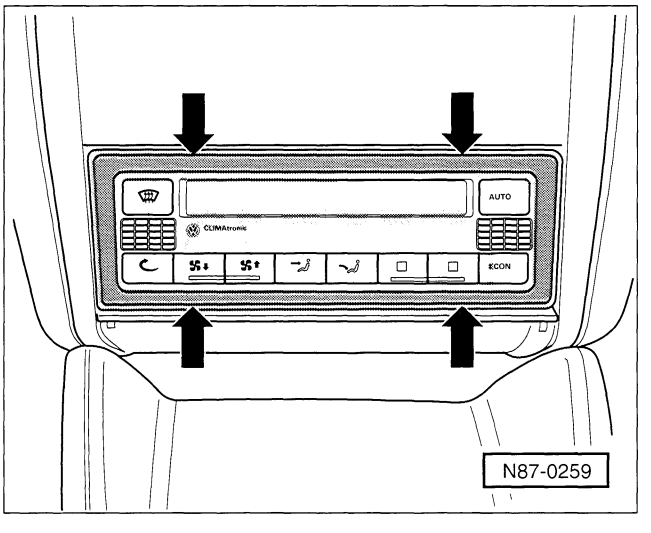


➤ Disconnect harness connector (**1**) and remove blower motor (**2**) in a downward direction (**arrow**).

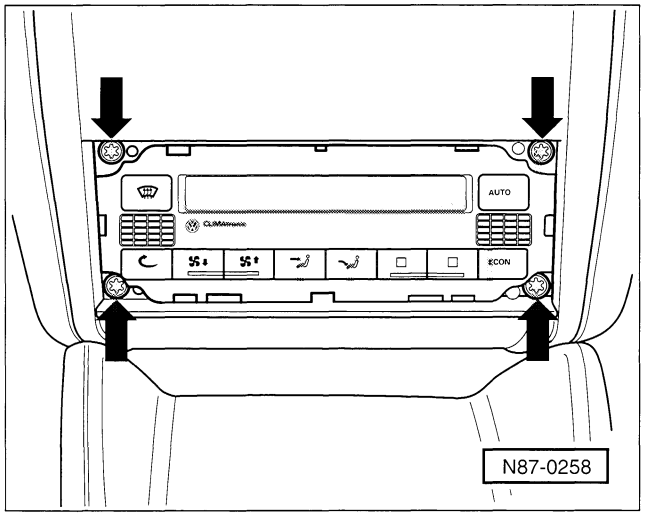
A/C, heating and ventilation control head, removing and installing (Climatronic)

> ***WARNING —***
> *Observe all cautions, warnings and notes before starting repairs involving air conditioning systems.*

NOTE —
*To remove heating and ventilation controls in vehicles without Climatronic, see **80 Heating and Ventilation**.*



➤ Carefully pry out trim panel at **arrows** with plastic trim removal tool or screwdriver with protected tip.



➢ Remove control head mounting screws (arrows).

– Check control cable operation with controls removed. Move cables in and out several times

– Pull out A/C control head and disconnect electrical harness connectors. Remove control head.

– Installation is the reverse of removal.

NOTE —
The control module will need to be coded using VAG scan tool 1551/5051, or equivalent, with function 07 and the basic setting initiated with function 04.

AIR FLAP MOTORS (CLIMATRONIC)

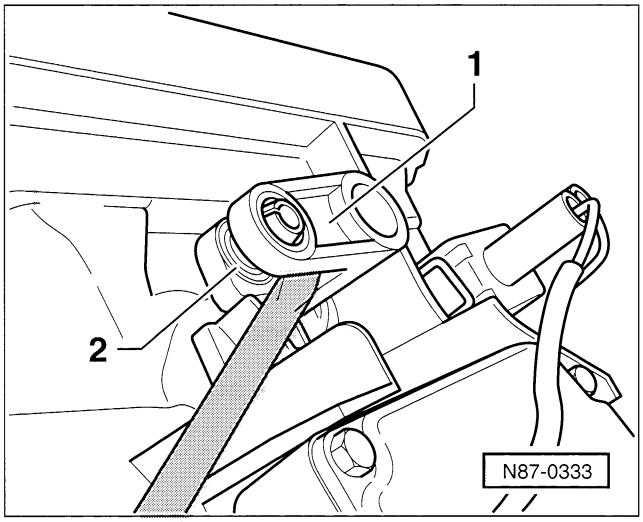
The Climatronic A/C control head is programmed to set the various air flow flaps within the heater/evaporator housing to specific positions in response to passenger requirements and sensor inputs. The flap servo motors move the flaps.

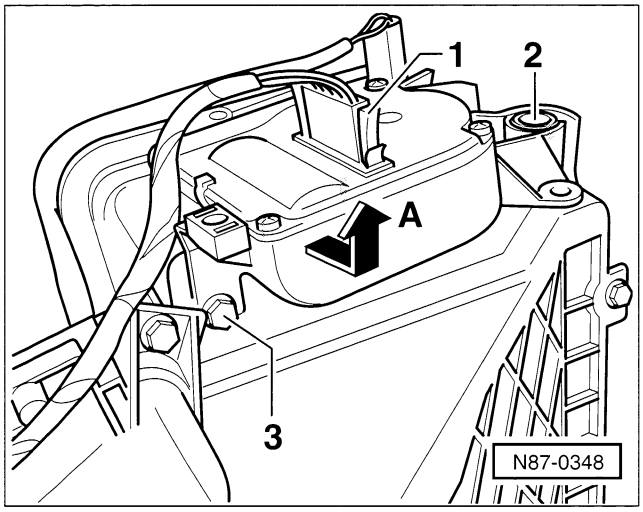
Position sensors provide feedback to the control unit so it knows where the various flaps are positioned. The control unit reads varying voltage signals from potentiometers which are attached to the flaps. As the potentiometer sweeps past a fixed resistor, the voltage drop across the resistor changes. The control unit matches the incoming voltage signals to values held in memory. When the voltage matches the programmed value the control head switches off the current to the flap motor.

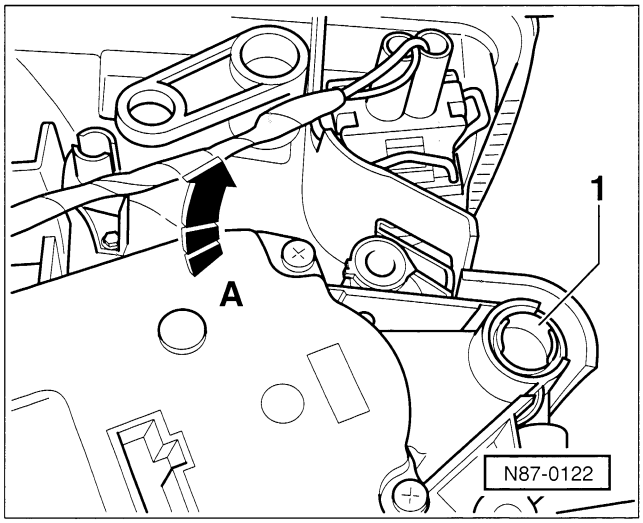
The values held in memory come from full sweep movements of the potentiometers that were retained during basic settings (function 04) using the VAG 1551/5051 scan tool, or equivalent.

NOTE —
- *Before replacing any components of the Climatronic A/C system, the system should be diagnosed using a VAG 1551/5051 scan tool, or equivalent.*
- *After replacing any of the flap motors, it will be necessary to initiate basic setting (function 04) using a VAG 1551/5051 scan tool, or equivalent.*
- *For vehicles without Climatronic, the cable operated flaps are covered in* **80 Heating and Ventilation**.
- *Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See* **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*

Air flow flap motor (V71), removing and installing







– Disconnect battery ground (GND) strap from battery negative (–) terminal. See the **Cautions** at the beginning of this repair group regarding battery disconnection.

NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.

– Remove the glove box, see **70 Trim–Interior.**

➢ Use a screwdriver to carefully unclip the air flow flap rod (**1**) from lever (**2**).

– Disconnect harness connector for flap motor and remove mounting bolt.

– Lower flap motor while pulling off from fresh air/recirculating air flap shaft.

➢ Disconnect harness connector (**1**), remove bolt (**3**) and pull motor off fresh air/recirculating flap shaft (**2**) in direction of **arrow A**.

– To install motor, connect harness connector to flap motor and switch on ignition.

– Operate button for fresh air/recirculating air.

NOTE —
Replacement flap motors from Volkswagen are supplied in the "recirculating air" position.

– When the center position has been reached by the flap, disconnect electrical harness connector from flap motor.

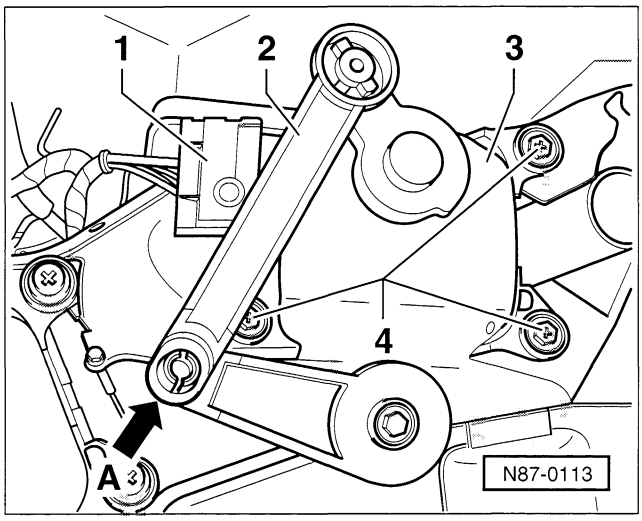
➢ Insert flap motor onto fresh air/recirculating air flap shaft (**1**), rotate motor in clockwise direction (**arrow A**) and install mounting bolts.

NOTE —
If the flap motor cannot be attached to the fresh air/recirculating air flap shaft, remove the fresh air blower and attach flap by hand.

– Attach operating rod for air flow flap.

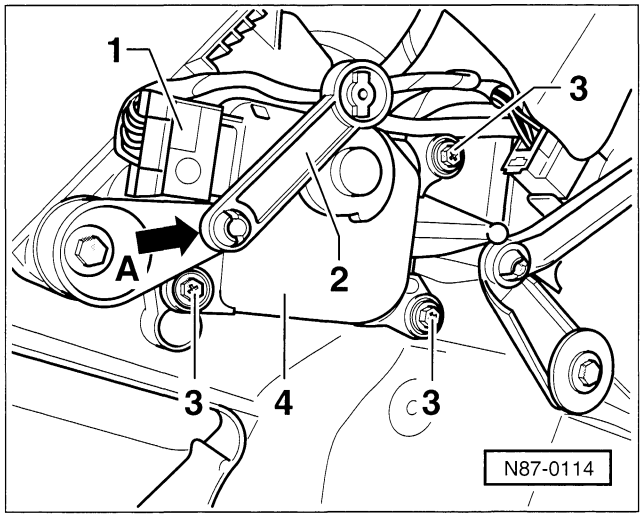
– Install harness connector and initiate basic setting (function 04) with VAG 1551/5051 scan tool, or equivalent.

Temperature flap motor (V68), removing and installing

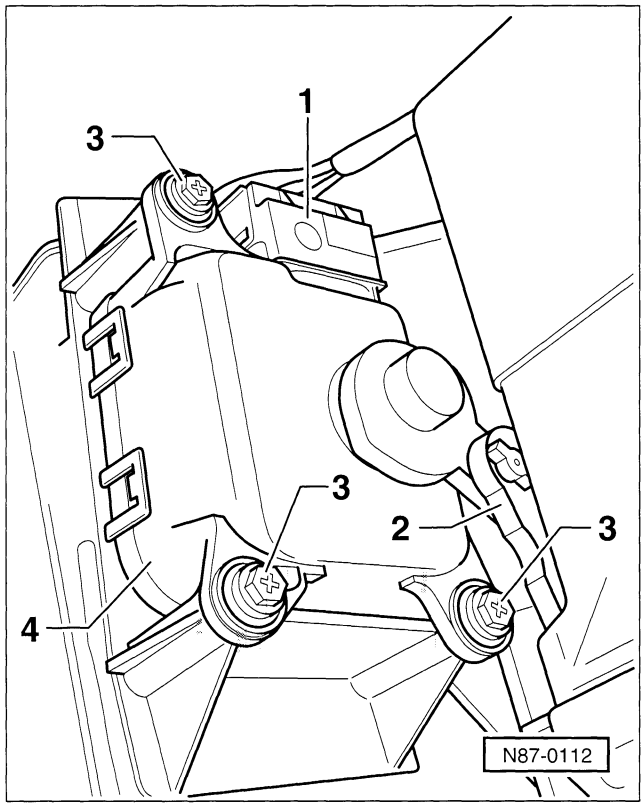


- Remove glove box, lower steering column trim and center console, see **70 Trim–Interior**.
- Remove connecting duct to rear footwell air duct, see **80 Heating and Ventilation**.
- Disconnect harness connector (**1**) and use screwdriver to carefully unclip operating rod (**2**) from flap lever (**arrow A**). Remove screws (**4**) and remove flap motor (**3**).
- Install in reverse order of removal.
- Initiate basic setting (function 04) with VAG 1551/5051 scan tool, or equivalent.

Central flap motor (V70), removing and installing



- Remove glove box, lower steering column trim and center console, see 70 Trim–Interior.
- Remove connecting duct to rear footwell air duct, see 80 Heating and Ventilation.
- Disconnect harness connector from flap motor and use a screwdriver to carefully unclip operating rod from flap lever.
- Remove mounting bolts for motor.
- Disconnect harness connector (**1**) and use screwdriver to carefully unclip operating rod (**2**) from flap lever (**arrow A**). Remove screws (**3**) and remove flap motor (**4**).
- Install in reverse order of removal.
- Initiate basic setting (function 04) with VAG 1551/5051 scan tool, or equivalent.



Footwell/defrost flap motor (V85), removing and installing

– Remove lower steering column trim, **70 Trim–Interior**.

– Disconnect harness connector from flap motor.

– Remove mounting screws for flap motor.

➤ Disconnect harness connector (**1**), remove screws (**3**), rotate motor to release from operating rod (**2**) and remove flap motor (**4**).

– Remove flap motor from housing.

– Install in reverse order of removal.

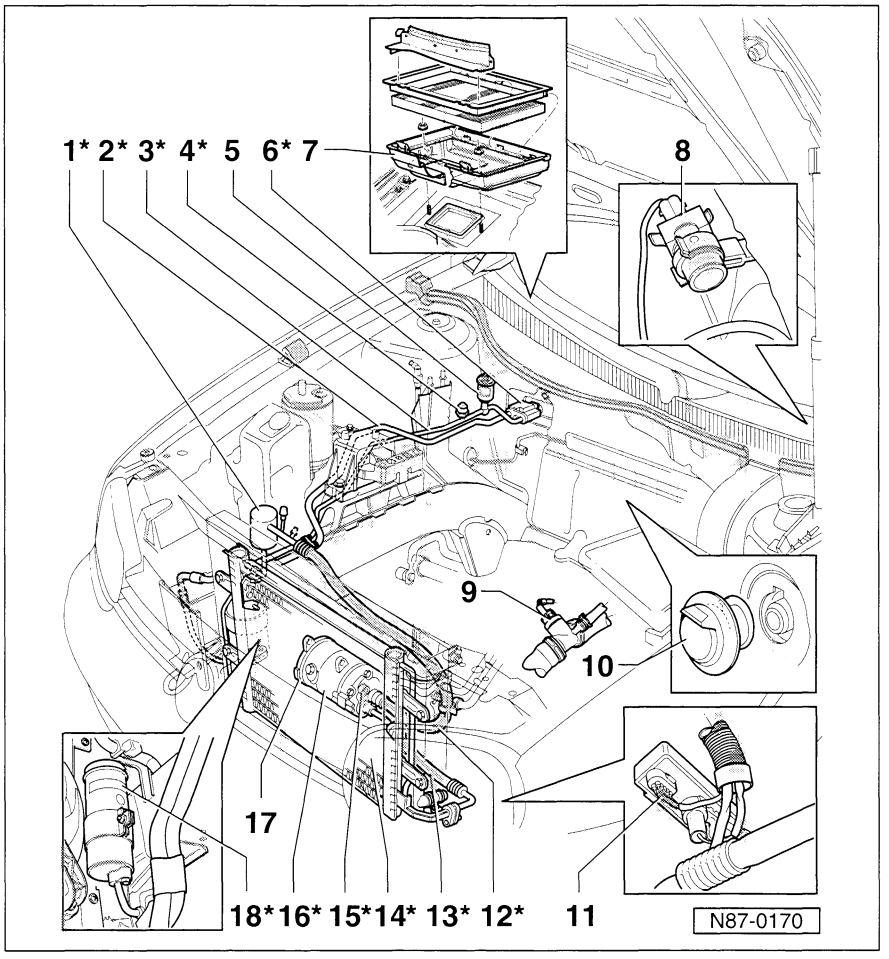
– Initiate basic setting (function 04) with VAG 1551/5051 scan tool, or equivalent.

A/C COMPONENTS, UNDERHOOD

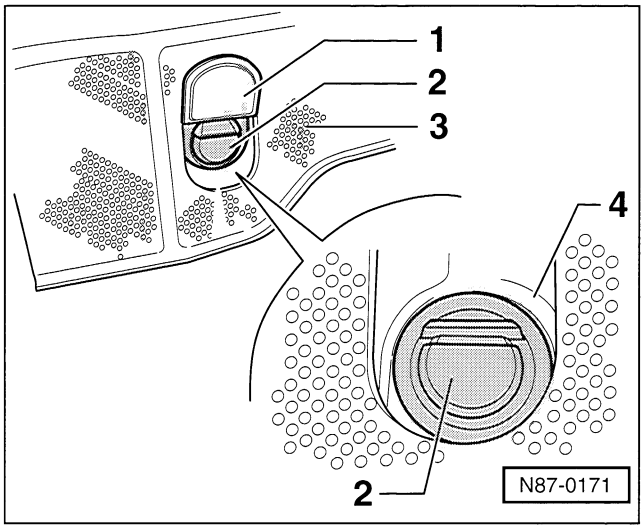
WARNING —
Observe all cautions, warnings and notes before starting repairs involving air conditioning systems.

A/C components, underhood overview

CAUTION —
Components identified with an asterisk (*) can only be removed after discharging the refrigerant.



1. **Damper***
   - In refrigerant hose (item 2).
2. **Refrigerant hose***
   - From expansion valve to compressor
3. **Refrigerant pipe***
   - From receiver dryer to expansion valve
4. **Service valve (evacuating/charging)***
   - Use Kent Moore ACR4 recovery unit, or equivalent
5. **A/C pressure switch (F129) or high pressure sensor (G65)***
   - Can be removed without discharging refrigerant
   - **Tighten to** 8 Nm (71 in-lb)
   - Always replace O-ring
   - Checking pressure switch (F129), see **A/C refrigerant system, component overview** given earlier
   - G65 supplies refrigerant system pressure signal to coolant fan control module (J239) and ECM
6. **Expansion valve***
7. **Dust and pollen filter**
   - With activated charcoal filter
   - Removing and installing, see **80 Heating and Ventilation**
8. **Ambient air temperature switch (F38) or outside temperature sensor (G17)**
   - F38 on manual A/C system only: Switches off A/C clutch (N25) at low ambient air temperatures to prevent damage
     Switches clutch off at -1°C (30°F)
     Switches back on at 7°C (45°F)
   - G17 (not shown) on Climatronic only:
     Located behind driver side headlight
   - In the event of a malfunction, fresh air intake duct sensor (G89) takes over. If both sensors are malfunctioning, operation continues by assuming a value of 10°C (50°F). Air recirculation is not possible and A/C control head will indicate "--"
9. **A/C thermal cut-out switch (F163)**
   - Switches off A/C clutch (N25) at excessively high coolant temperature
   - Switches clutch off at 119°C (246°F)
   - Switches clutch back on at 112°C (234°F)
10. **Evaporator water drain valve**
    - Location: Under insulation flap on bulkhead
    - Checking, **see Evaporator water drain valve, checking**
11. **Coolant fan control module (J293)**
    - Location: lower left side of engine compartment near radiator
    - Controls all A/C clutch functions and A/C related radiator fan functions
12. **Refrigerant hose***
13. **Refrigerant hose***
14. **Condenser***
15. **Pressure relief valve***
16. **Compressor***
17. **A/C compressor clutch (N25)**
18. **Receiver drier***



Evaporator water drain valve, checking

➢ Fold cover (**1**) in bulkhead insulation mat (**3**) upwards.

– Remove drain valve (**2**) from opening in bulkhead (**4**).

– The water drain valve flap and body must not be stuck together.

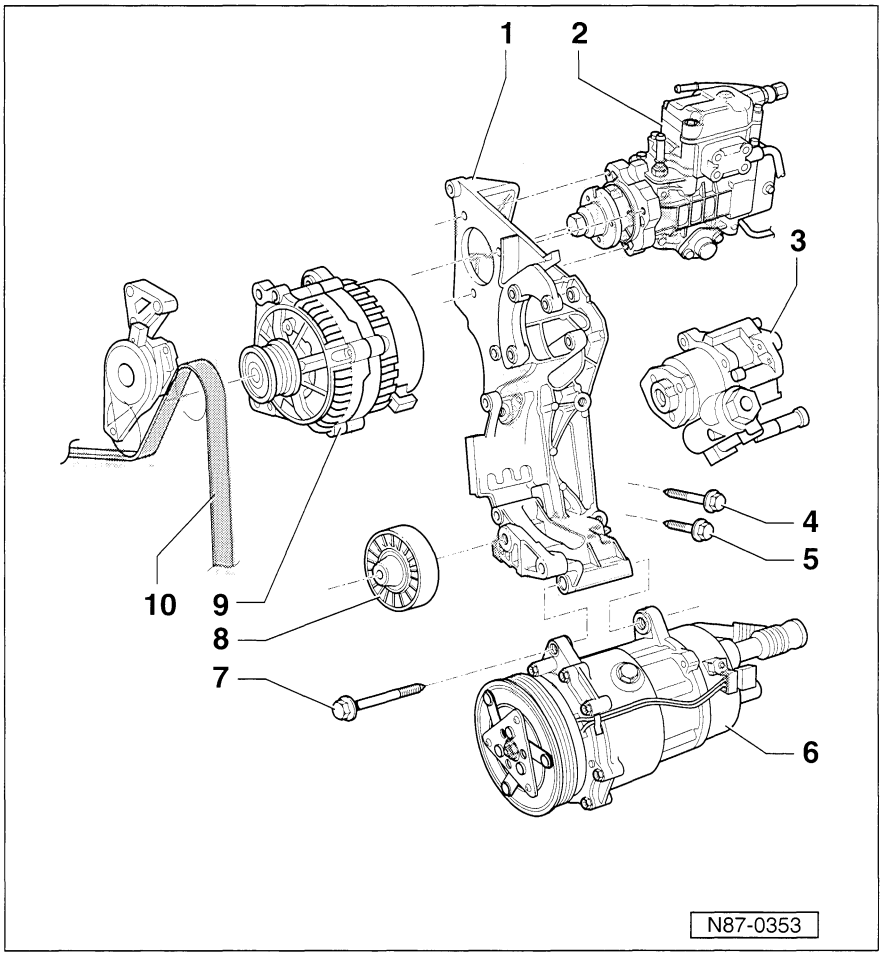
– Insulation mat must not be deformed or damaged in the area of water drain valve.

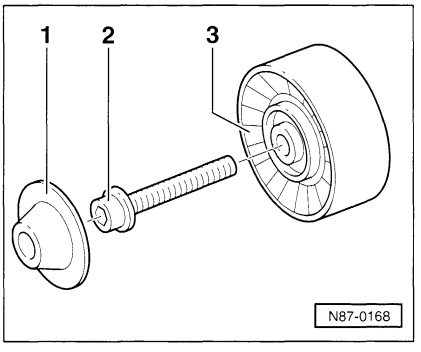
– The opening in the drain valve body must point downwards with the flap hinge at the top.

– When the insulation cover (**1**) is closed it must be flush with the insulation matting (**3**). If the insulation cover (**1**) is pushed in too far, the water drain valve flap can become jammed.

A/C compressor mounting bracket assembly (1.9L engine)

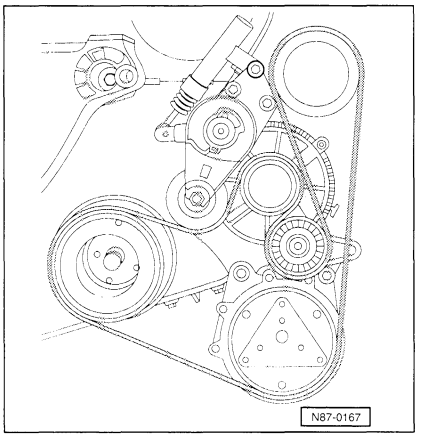
1. **Bracket**
   - The compressor bracket and related components can be removed and installed without having to open the refrigerant circuit.
   - Mounting for generator, compressor, power steering pump, diesel injection pump.
   - Remove compressor from bracket, swing away and secure in engine compartment with wire.
2. **Diesel injection pump**
3. **Power steering pump**
4. **Bolts**
   - Tighten to 45 Nm (33 ft-lb)
5. **Bolts**
   - Tighten to 45 Nm (33 ft-lb)
6. **Compressor**
   - Sanden SD7-V16 or
   - Zexel DCW-17D
7. **Bolt**
   - Tighten to 45 Nm (33 ft-lb)
8. **Idler pulley,**
   - See **Idler pulley assembly**
9. **Generator (GEN) and pulley**
10. **Ribbed V-belt**
    - See **Ribbed V-belt, routing**





Idler pulley, assembly

1. **Protective cap**
2. **Bolt**
   - Tighten to 25 Nm (18 ft-lb)
3. **Idler roller with bearings**



Ribbed belt routing (ALH only)

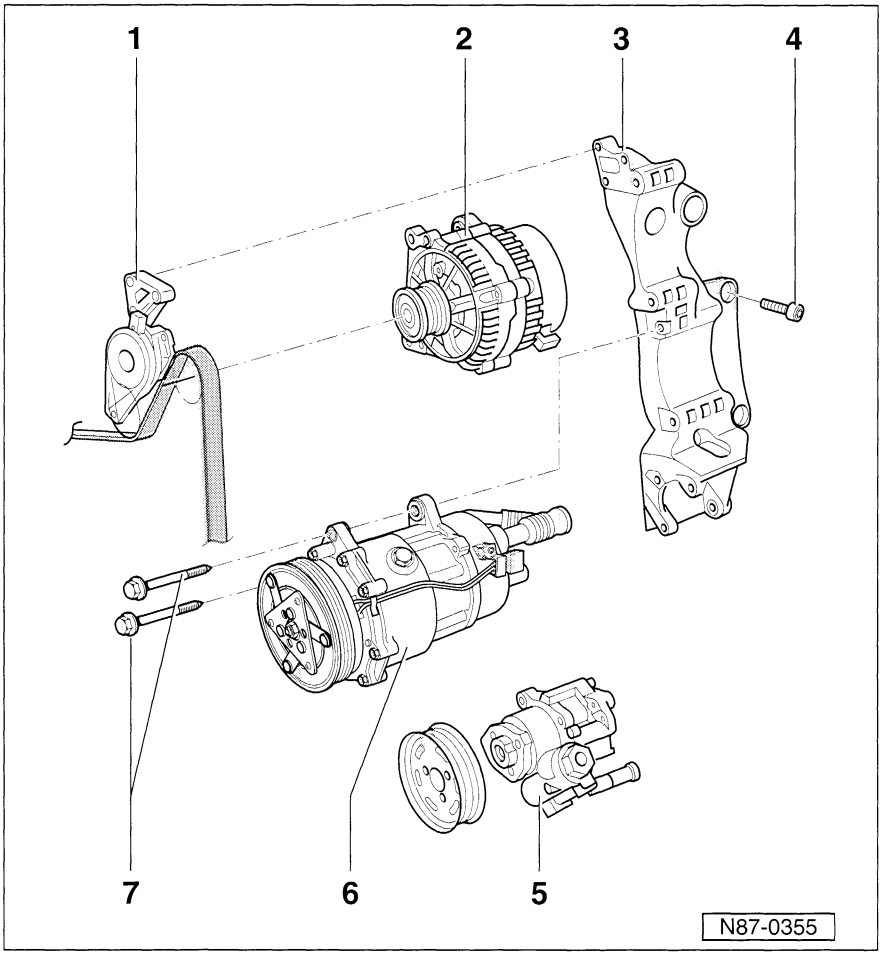
- Always mark the running direction before removing belt and install in the same direction.
- When installing the belt ensure it is correctly seated in the pulley.

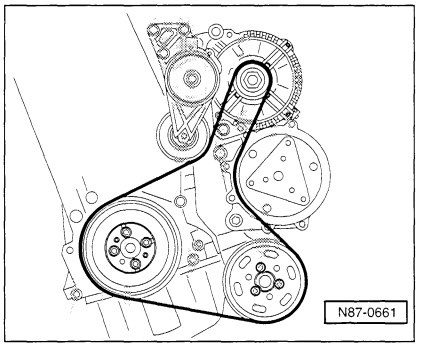
NOTE —

For 1.9L PD diesel belt routing see following page.

A/C compressor mounting bracket assembly (1.8L and 2.0L engine)

1. **Tensioning roller, ribbed V-belt**
2. **Generator (GEN) and pulley**
3. **Bracket**
   - Compressor bracket and related components can be removed and installed without having to open the refrigerant circuit
   - Mounting for generator, A/C compressor and power steering pump
   - Remove compressor from bracket, swing away and secure in engine compartment with wire
4. **Bolts**
   - Tighten to 50 Nm (37 ft-lb)
5. **Power steering pump**
6. **A/C compressor**
   - Sanden SD7-V16 or
   - Zexel DCW-17D
7. **Bolts**
   - Tighten to 45 Nm (33 ft-lb





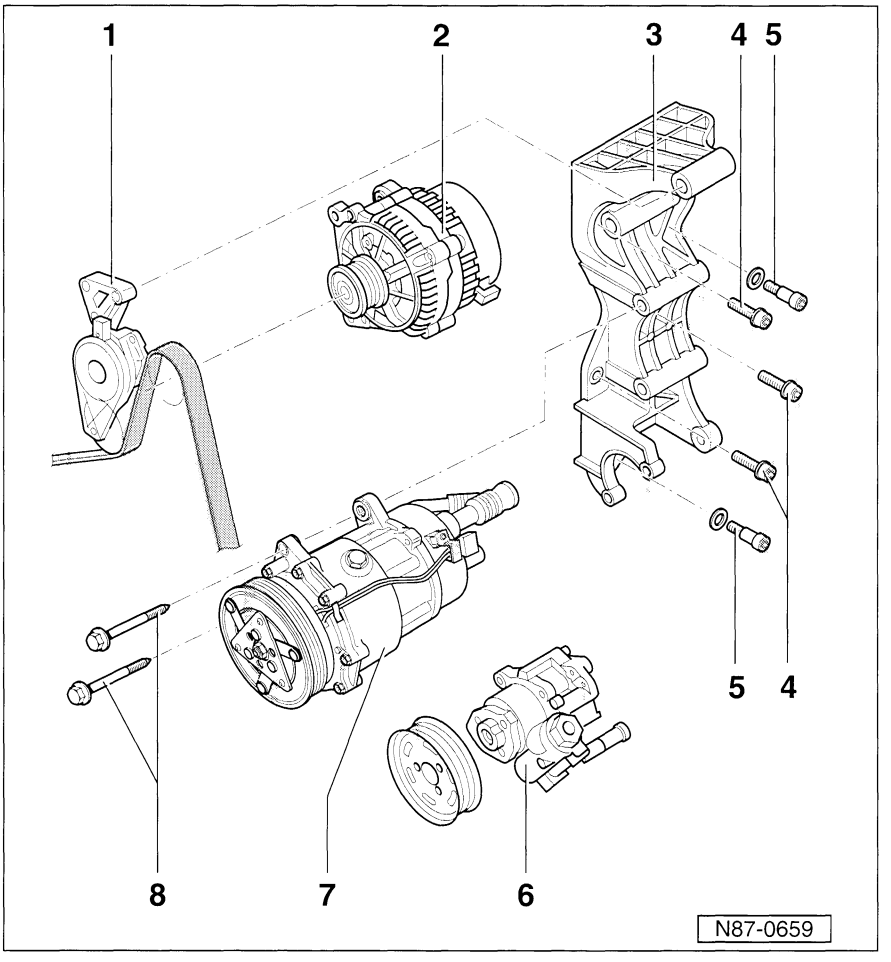
Ribbed belt routing (1.8L, 2.0L and 1.9L PD diesel)

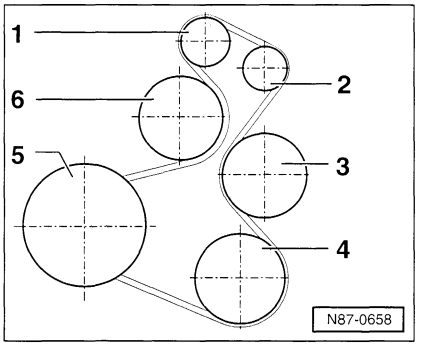
- Before removing ribbed belt mark direction of rotation.
- When installing belt make sure it is correctly seated in pulley.

A/C compressor mounting bracket assembly (2.8L engine)

NOTE —
The compressor bracket and related components can be removed and installed without having to open the refrigerant circuit.

1. **Ribbed belt tensioner**
2. **Generator**
3. **Bracket**
   - Removing:
     Position lock carrier in service position, see **50 Body-Front**
     Remove ribbed belt
     Remove generator and power steering pump
     Remove mounting bolts (**8**)
     Remove compressor from bracket, swing away and secure in engine compartment with wire or heavy duty zip tie
     Remove socket head bolts (**4** and **5**)
     Remove bracket from engine
   - When installing, first install bolts (items 3 and 11)
4. **Bolts (M8 x 30)**
   - Tighten to 25 Nm (18 ft-lb)
   - Quantity: 3
5. **Socket head bolt (M8 x 28)**
   - Tighten to 25 Nm (18 ft-lb)
   - Quantity: 2
6. **Power steering pump**
   - Removing, see **48 Steering**
7. **Compressor with A/C clutch**
   - Sanden SD7-V16 or
   - Zexel DCW-17D
8. **Bolt (M10 x 112)**
   - Tighten to 45 Nm (33 ft-lb)

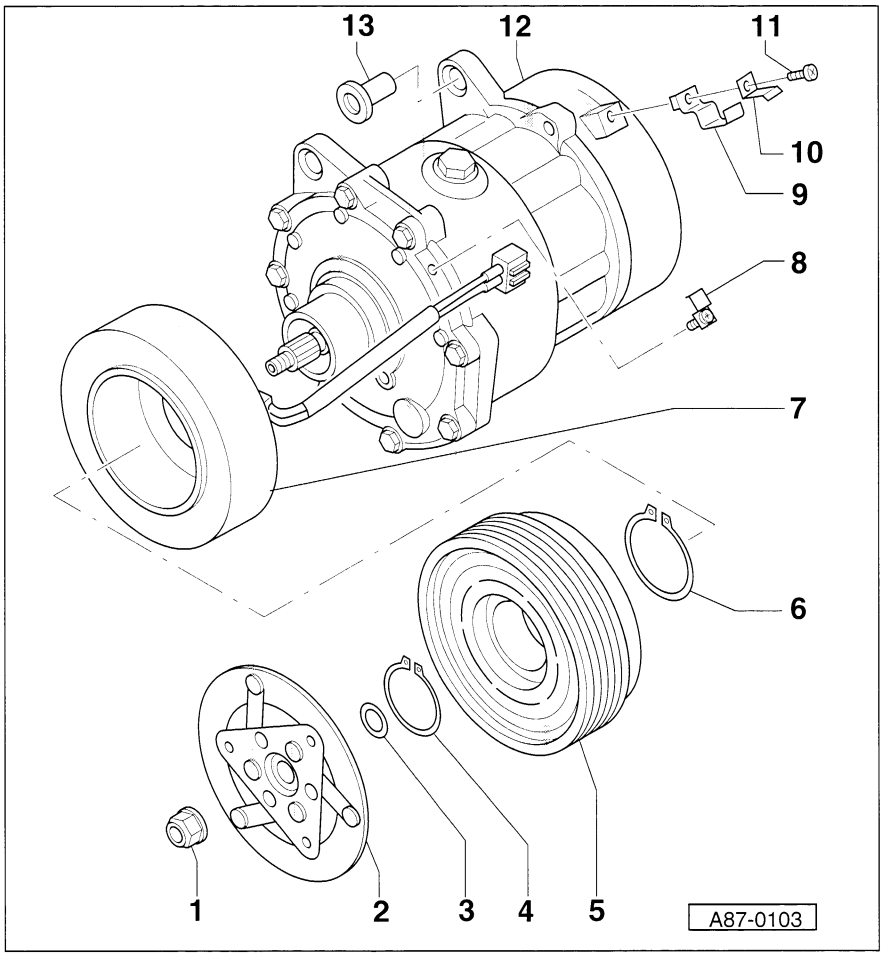




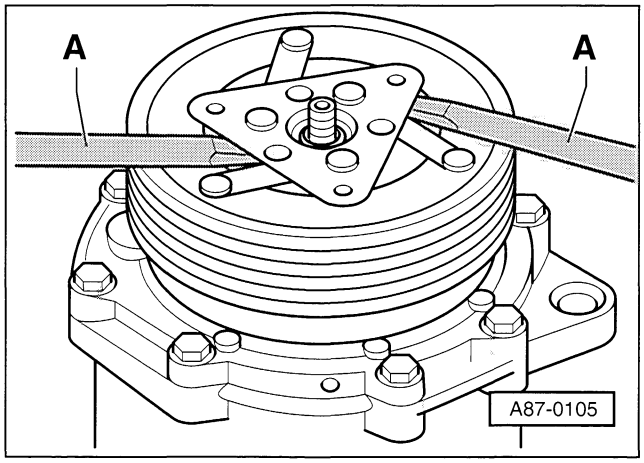
Ribbed belt routing (2.8L)

1. Ribbed belt tensioner
2. Generator pulley
3. Compressor pulley
4. Power steering pulley
5. Crankshaft pulley/vibration dampener
6. Coolant pump pulley

A/C compressor overview (Sanden)



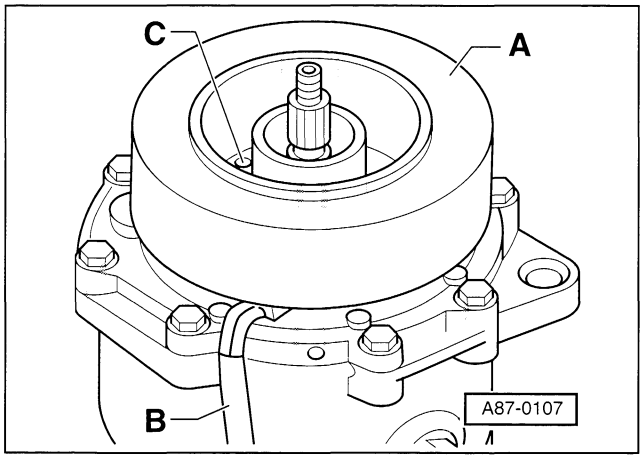
1. **Nut, self locking**
   - Always replace
   - Tighten to 40 Nm (30 ft-lb)
   - Use two pin spanner wrench (with 4mm pins) to counterhold clutch plate while loosening nut
2. **Clutch plate**
   - Removing, **see A/C clutch plate, removing**
3. **Shims**
   - Used to adjust gap between clutch plate and pulley, **see A/C clutch plate gap, checking**
4. **Circlip**
   - Always replace
   - Note installation position: flat side faces compressor
   - Ensure correct seating in groove
5. **Clutch pulley**
   - Refrigerant circuit does not need to be discharged to service A/C clutch
   - Use 2-arm puller to remove
6. **Circlip**
   - Always replace
   - Note installation position: flat side faces compressor
   - Ensure correct seating in groove
7. **Clutch coil**
   - Thermo-fuse integrated into clutch coil protects the A/C clutch in the event of overheating due to a binding compressor. The clutch coil circuit is interrupted.
   - Note installation position, **see A/C clutch coil, installed position**
8. **Retainer**
   - With screw
9. **Retainer**
10. **Retainer**
11. **Screw**
12. **Compressor**
13. **Threaded bushing**



A/C clutch plate, removing (Sanden)

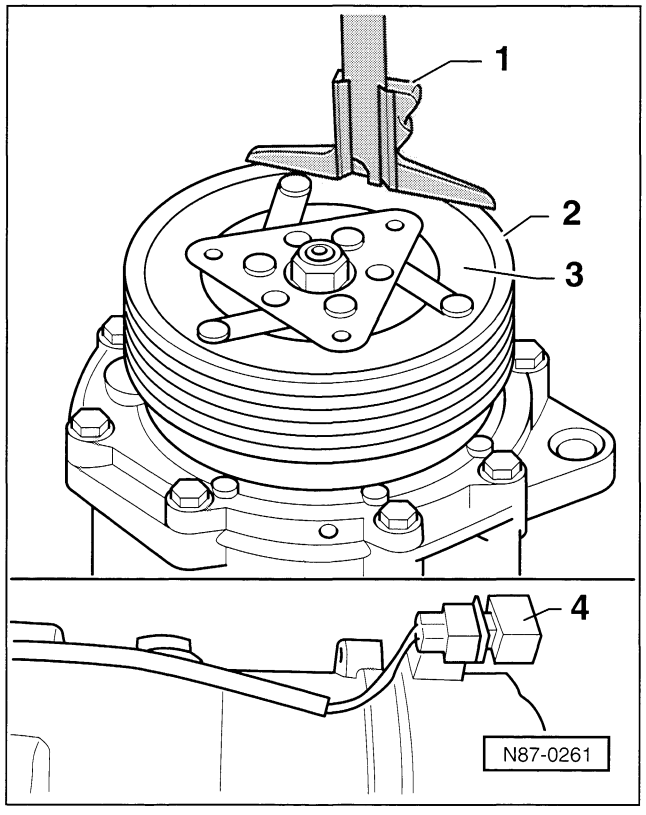
– Loosen self-locking nut that holds clutch plate while counter-holding clutch plate with two-pin spanner wrench.

➢ Carefully pry off clutch plate using two large screwdrivers (**A**).



A/C clutch coil, installed position (Sanden)

➢ Install coil (**A**) onto compressor. Locate locking tab on coil and position into recess (**C**) in face of compressor. Ensure proper routing of coil wiring harness (**B**).



A/C clutch plate gap, checking (Sanden)

➢ **Dimension 1**
Using depth gauge (**1**), measure gap between top of clutch plate (**3**) and clutch pulley (**2**) at three equally spaced locations. Measurements must not deviate from each other.

– If compressor is installed in vehicle, disconnect electrical connector (**4**) from vehicle wiring harness.

– **Dimension 2**
Using a jumper wire, energize the clutch coil by applying 12V (B+) to connector (**4**). If compressor is removed from vehicle, compressor must be grounded.

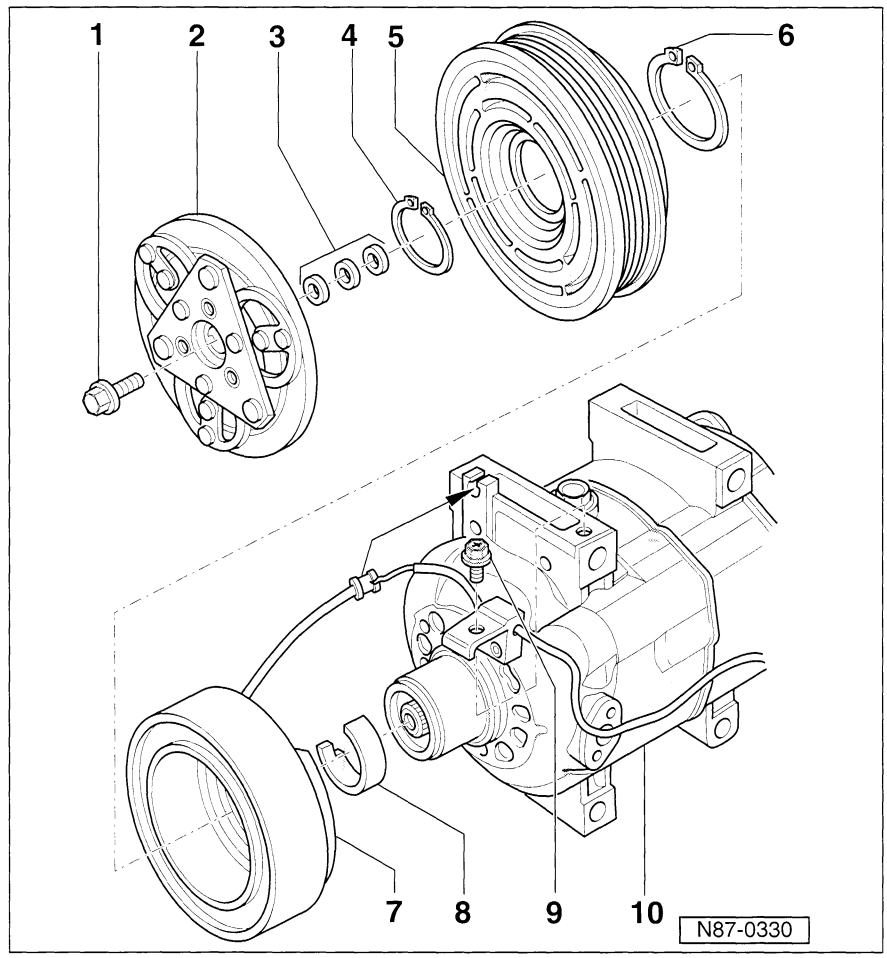
– With clutch energized, measure gap between belt pulley (**2**) and clutch plate (**3**) with depth gauge (**1**).

– The allowable gap: 0.4 - 0.6 mm (0.015 - 0.023 in) is the difference between **Dimension 1** and **Dimension 2**.

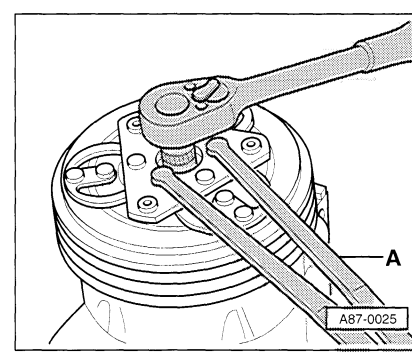
– If gap between clutch plate and clutch pulley is not within specification, remove clutch plate and add or remove shims as needed.

– When installing, ensure that wiring harness and harness connector (**4**) are secured under securing clips.

A/C compressor overview (Zexel)



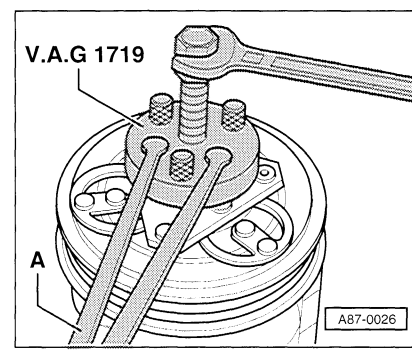
1. **Nut, self locking**
   - Always replace
   - Tighten to 15 Nm (11 ft-lb)
   - Use two pin spanner wrench (with 4mm pins) to counterhold clutch plate while loosening nut
2. **Clutch plate**
   - Removing, **see A/C clutch plate, removing**
3. **Shims**
   - Used to adjust gap between clutch plate and pulley, **see A/C clutch plate gap, checking**
4. **Circlip**
   - Always replace
   - Note installation position: flat side faces compressor
   - Ensure correct seating in groove
5. **Clutch pulley**
   - Refrigerant circuit does not need to be discharged to service A/C clutch
     To remove:
     Remove felt ring
     Use VAG 1719/1 adapter with 2-arm puller to extract pulley
   - To install, drive on pulley and VAG 1719/2 adapter with plastic head hammer
6. **Circlip**
   - Always replace
   - Note installation position: flat side faces compressor
   - Ensure correct seating in groove
7. **Clutch coil**
   - Thermo-fuse integrated into clutch coil protects the A/C clutch in the event of overheating due to a binding compressor. The clutch coil circuit is interrupted.
   - Note installation position, **see A/C clutch coil, installed position**
8. **Felt gasket**
9. **Screw**
10. **Compressor**



Clutch plate bolt removing (Zexel)

➤ When removing and installing bolt, counter-hold with two-pin wrench (**A**). Use VW special tool 3212 or equivalent with 4 mm pins.

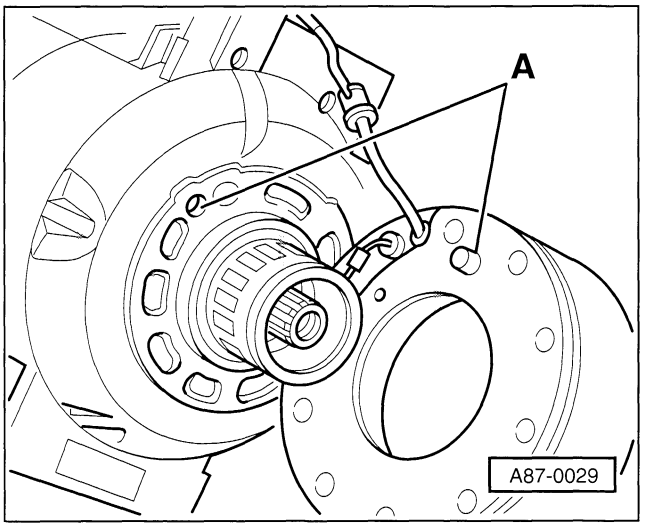
- Tighten to 15 Nm (11 ft-lb)



Clutch plate, removing (Zexel)

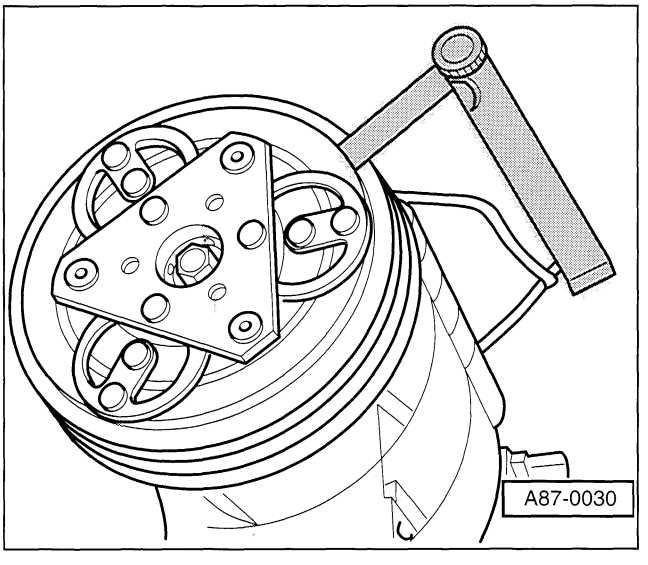
➤ Mount VAG 1719 and turn center bolt to extract clutch plate.

– When removing, counter-hold with two-pin wrench (**A**). Use VW special tool 3212 or equivalent with 4 mm pins.



A/C clutch coil, installed position (Zexel)

- Position pin (**A**) in recess.



A/C clutch plate gap, checking (Zexel)

- Check gap with feeler gauge.
  - Gap 0.3 - 0.6 mm (0.0118 - 0.0236 in).

9 Electrical System

GENERAL 9-1
Voltage and polarity 9-1
Electrical system safety precautions 9-1
Electrical test equipment 9-2
Wiring diagrams, fuses and relays 9-3

ELECTRICAL TROUBLESHOOTING 9-3
Voltage and ground, checking 9-4
Voltage, measuring 9-5
Voltage drop, testing 9-5
Continuity, checking 9-5
Short circuits, checking 9-6
Short circuit test with voltmeter 9-6

GENERAL

This group covers a brief description of the principal parts of the electrical system. Also covered here is general electrical system troubleshooting.

Voltage and polarity

Volkswagen electrical systems are 12-volt direct current (DC) negative-ground systems. A voltage regulator controls the output of the alternator to approximately 13.5 volts. All circuits are grounded by direct or indirect connection to the negative (–) terminal of the battery. A number of ground connections throughout the car connect the wiring harness to chassis ground. These circuits are completed by the battery cable or ground strap between the body and the battery negative (–) terminal.

Electrical system safety precautions

Please read the following warnings and cautions before doing any work on your electrical system.

WARNING —

- *Ignition systems operate in a dangerous voltage range that could prove to be fatal if exposed terminals or live parts are contacted. Use extreme caution when working on a vehicle with the ignition on or the engine running.*
- *On cars equipped with Airbags, special precautions apply to any electrical system testing or repair. The airbag unit is an explosive device and must be handled with extreme care. Before starting any work on an airbag equipped car, refer to the warnings and cautions in* **69 Seatbelts, Airbags**.
- *Before operating the starter without starting the engine (as when making a compression test), disable ignition system as described in* **28a Ignition System**.

WARNING —

- *Always switch the ignition off and disconnect the negative (–) battery cable before removing any electrical components.*
- *Before disconnecting battery be sure to obtain radio anti-theft code.*
- *Connect and disconnect ignition system wires, multiple connectors, and ignition test equipment leads only while the ignition is switched off.*
- *Do not disconnect battery while the engine is running. Never reverse the battery terminal connections. Even a momentary wrong connection can damage the alternator or electrical components. If the polarity markings on the battery are not visible, confirm the polarity of battery using a voltmeter.*
- *Always remove the battery cables before quick-charging the battery. Never use a quick-charger as a booster for starting the car. Do not exceed 16.5 volts at the battery.*
- *Many solid-state modules operate on very low current and can be permanently damaged if exposed to static discharge. Always handle the modules using proper static prevention equipment and techniques.*
- *Always switch a test meter to the appropriate function and range before making test connections.*
- *Disconnect the battery before doing any electric welding on the car.*
- *Do not wash the engine while it is running, or anytime the ignition is switched on.*
- *Do not try to start the engine of a car which has been heated above 176°F (80°C), (for example, in a paint drying booth) until allowing it to cool to normal temperature.*

Electrical test equipment

Many of the electrical tests described in this manual call for measuring voltage, current or resistance using a digital multimeter (DMM). DMMs are preferred for precise measurements and for electronics work because they are generally more accurate than analog meters. The DMM is also safe for most solid state components whereas an analog meter can damage some components.

An LED test light is a safe, inexpensive tool that can be used to perform many simple electrical tests that would otherwise require a multimeter. The LED indicates when voltage is present between any two test-points in a circuit.

WARNING —

- *Choose test equipment carefully. Use a meter with at least 10 megohm input impedance, or an LED test light. An analog meter (swing-needle) or a test light with a normal incandescent bulb may draw enough current to damage sensitive electronic components.*
- *An analog meter must not be used to measure resistance on solid state components such as control units or time delay relays.*
- *Always disconnect the battery before making resistance (ohm) measurements on the circuit.*

Wiring diagrams, fuses and relays

Nearly all parts of the wiring harness connect to components of the electrical system with keyed, push-on connectors that lock into place. Notable exceptions are the heavy battery cables and the alternator wiring.

With the exception of the charging system, all electrical power is routed from the ignition switch or the battery through the fuse panel, located in the passenger compartment behind the driver side left knee bar. Fuses prevent excessive current from damaging components and wiring. Fuses are color coded to indicate their different current capacities. Most relays are electro-mechanical switches that operate on low current to switch a high-current circuit on and off.

The wiring diagrams shown in **97 Wiring Diagrams, Fuses and Relays** are organized according to model year and engine type, with complete diagrams for each year.

ELECTRICAL TROUBLESHOOTING

Four things are required for current to flow in any electrical circuit: a voltage source, wires or connections to transport the voltage, a consumer or device that uses the electricity, and a connection to ground or a return to the voltage source. Most problems can be found using only a digital multimeter (volt/ohm/amp meter) to check for voltage supply, for breaks in the wiring (infinite resistance/no continuity), or for a path to ground that completes the circuit.

Electric current is logical in its flow, always moving from the voltage source toward ground. Keeping this in mind, electrical faults can be located through a process of elimination. When troubleshooting a complex circuit, separate the circuit into smaller parts. Be sure to analyze the problem. Use the wiring diagrams to determine the most likely cause of the problem. Get an understanding of how the circuit works by following the circuit from ground back to the power source.

NOTE —

When making test connections at connectors and components, use care to avoid spreading or damaging the connectors or terminals. Some electrical tests may require jumper wires to bypass components. When connecting jumper wires, use blade connectors at the wire ends that match the size of the terminal being tested. The small internal contacts are easily spread apart, and this can cause intermittent or faulty connections that can lead to more problems.

Voltage and ground, checking

Checking for the presence of voltage or ground is usually the first step in troubleshooting a problem circuit. For example, if a parking light does not work, a check for voltage at bulb socket will quickly determine if the circuit is functioning properly or if bulb itself is faulty. If voltage and ground are found at socket, then bulb is most likely faulty.

Another valuable troubleshooting technique is a voltage drop test. This is a good test to perform if current is flowing through the circuit but the circuit is not operating correctly. Sluggish wipers or dim headlights are examples of this. A voltage drop test will help to pinpoint a corroded ground strap or a faulty switch. Normally, there should be less than 1 volt drop across most wires or closed switches. A voltage drop across a connector or short cable should not exceed 0.5 volts.

A voltage drop is caused by higher than normal resistance in a circuit. This additional resistance actually decreases or stops the flow of current. Some common sources of voltage drops are faulty wires or switches, dirty or corroded connections or contacts, and loose or corroded ground wires and ground connections.

A voltage drop can be checked only when current is flowing through the circuit, such as by operating the starter motor or turning on the headlights. Making a voltage drop test requires measuring the voltage in the circuit and comparing it to what the voltage should be. Since these measurements are usually small, a digital voltmeter should be used to ensure accurate readings. If a voltage drop is suspected, turn the circuit on and measure the voltage at the circuit's load.

NOTE —

- *A voltage drop test is generally more accurate than a simple resistance check because the resistances involved are often too small to measure with most ohmmeters. For example, a resistance as small as 0.02 ohms would result in a 3 Volt drop in a typical 150 amp starter circuit (150 amps x 0.02 ohms = 3 volts).*
- *Keep in mind that voltage with the key on and voltage with the engine running are not the same. With the ignition on and the engine off (battery voltage), voltage should be approximately 12.6 volts. With the engine running (charging voltage), voltage should be approximately 14.0 volts. Measure voltage at the battery with the ignition on and then with the engine running to get exact measurements.*

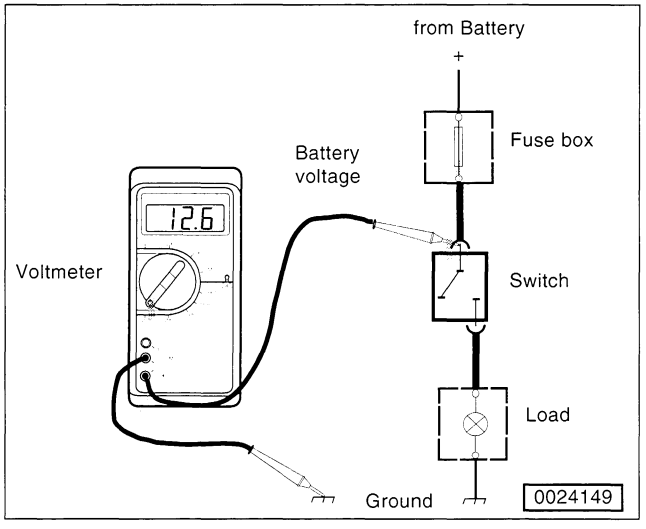
NOTE —
Do not use an analog (swing-needle) ohmmeter to check circuit resistance or continuity on any electronic (solid-state) components. The internal power source used in most analog meters can damage solid state components. Use only a high quality digital ohmmeter having high input impedance when checking electronic components.

Voltage, measuring

– Set voltage meter to 20V DC scale and connect negative lead to a reliable ground point on car.

➢ Connect voltmeter positive lead to the point in the circuit you wish to measure.

– If a reading is obtained, there is voltage at that point in the circuit. The voltage reading should not deviate more than 1 volt from voltage at battery. If the voltage is less than this, there is probably a fault in the circuit, such as a corroded connector or a loose ground wire.

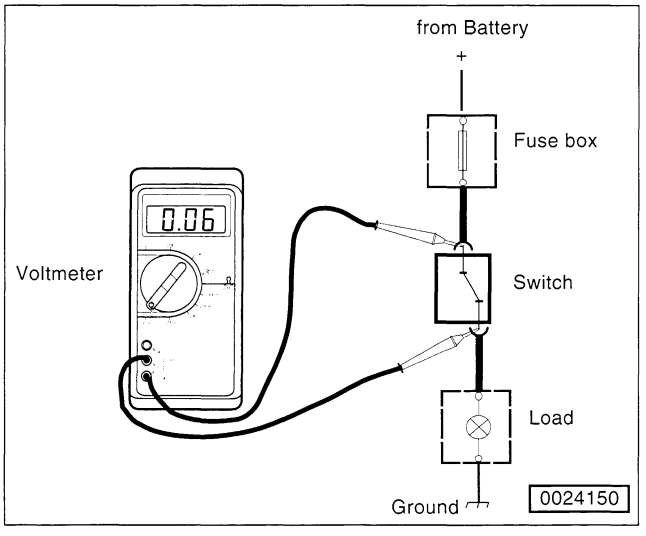


Voltage drop, testing

– Connect digital voltmeter positive lead to positive (+) connector of component to be tested.

➢ Connect voltmeter negative lead to the negative (–) connector of component being tested.

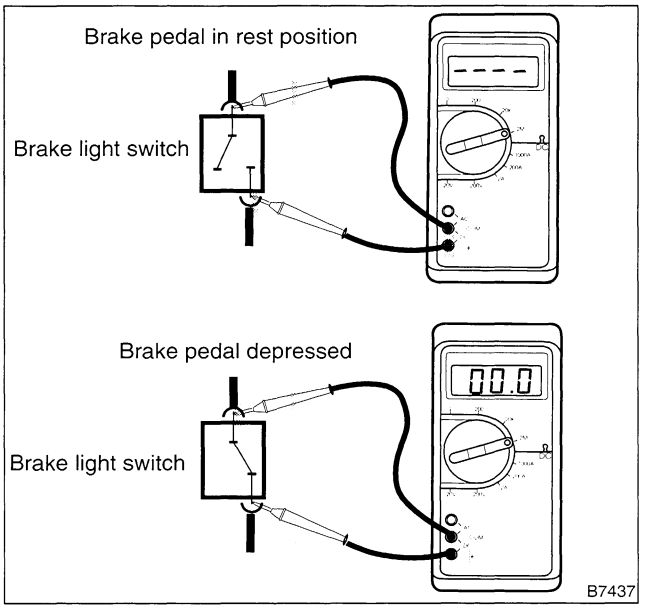
– With power on and circuit working, meter shows the voltage drop (difference between the two points). This value should not exceed 1 volt.



NOTE —
The maximum voltage drop in an automotive circuit, as recommended by the Society of Automotive Engineers (SAE), is as follows: 0 Volts for small wire connections; 0.1 Volts for high current connections; 0.2 Volts for high current cables; and 0.3 Volts for switch or solenoid contacts. On longer wires or cables, the drop may be slightly higher. In any case, a voltage drop of more than 1.0 Volt usually indicates a problem.

Continuity, checking

The continuity test can be used to check the basic integrity of a circuit or switch. Because most automotive circuits are designed to have little or no resistance, a circuit or part of a circuit can be easily checked for faults using an ohmmeter.



An open circuit or a circuit with high resistance will not allow current to flow. A circuit with little or no resistance allows current to flow easily.

When checking continuity, the ignition should be off. On circuits that are powered at all times, the battery should be disconnected. Using the appropriate wiring diagram, a circuit can be easily tested for faulty connections, wires, switches, relays, and engine sensors by checking for continuity. With brake pedal in rest position (switch open) there is no continuity (infinite ohms). With the pedal depressed (switch closed) there is continuity (zero ohms).

Short circuits, checking

A short circuit is exactly what the name implies. The circuit takes a shorter path than it was designed to take. The most common short that causes problems is a short to ground where the insulation on a positive (+) wire wears away and the metal wire is exposed. When the wire rubs against a metal part of the car or other ground source, the circuit is shorted to ground. If the exposed wire is live (positive battery voltage), the direct current flow to ground will blow a fuse or damage an unfused circuit.

WARNING —

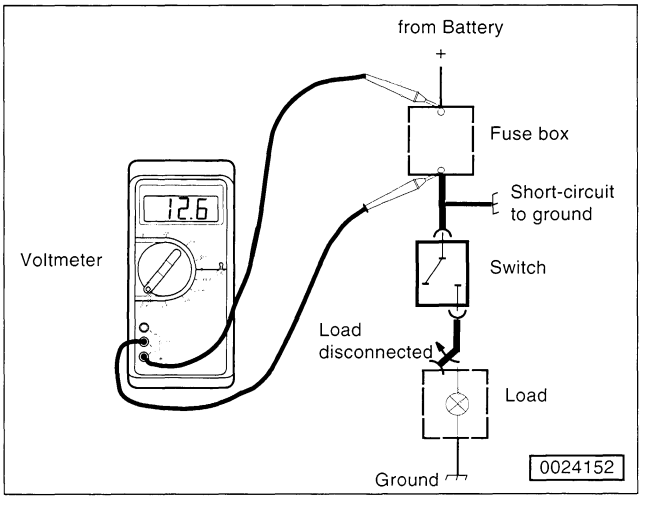
- *On circuits protected with large fuses (25 amp and greater), the wires or circuit components may be damaged before the fuse blows. Always check for damage before replacing fuses of this rating.*
- *When replacing blown fuses, use only fuses having the correct rating. Always confirm the correct fuse rating printed on the fuse panel cover.*

Short circuit test with voltmeter

- Remove blown fuse from circuit.
- Disconnect harness connector from circuit load or consumer.

Using a voltmeter, connect test leads across fuse terminals. Make sure power is present in circuit. If necessary, turn key on.

- If voltage is indicated at voltmeter, there is a short to ground somewhere in the circuit.
- If voltage is not indicated, work from wire harness nearest to fuse panel and move or wiggle wires while observing meter. Continue to move down harness until meter displays a reading. This is the location of the short to ground.
- Inspect wire harness at this point for any faults. If no faults are visible, carefully slice open harness cover or wire insulation for further inspection. Repair any faults found.



90 Instruments

GENERAL 90-1

INSTRUMENT CLUSTER 90-1
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TABLES
a. Instrument cluster 32-pin connector (T32a green) terminal identification 90-6
b. Instrument cluster 32-pin connector (T32 blue) terminal identification 90-7

GENERAL

The instrument cluster contains an electronic speedometer and tachometer with an LCD digital odometer/trip odometer and clock display. Vehicles with automatic transmission also have a gear selector display. Some vehicles also have an optional multi-function indicator (MFI) incorporated into the clock display window which will indicate outside temperature, momentary fuel consumption, average fuel consumption, distance driven, average driving speed and time driven.

The speedometer receives an electronic signal from a Hall sender on the transmission. Mileage is permanently held in memory and will be retained if power to the instrument cluster is interrupted.

Individual components for the instrument cluster are not available from Volkswagen and therefore disassembly of the cluster is not recommended. The illumination for the instrument cluster is provided by several blue light emitting diodes (LEDs) that are not serviceable. Remanufactured instrument cluster assemblies are available through the Volkswagen parts department.

NOTE —
Some versions of the instrument cluster may use a miniature light bulb to provide illumination for certain displays. These bulbs are replaceable separately.

WARNING —
Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using a VAG 1551/1552 or equivalent scan tool.

INSTRUMENT CLUSTER

If the instrument cluster is to be replaced it will be necessary to use a VAG 1551/1552 or 5051 scan tool, or equivalent. The scan tool is used to code the instrument cluster and diagnostic interface for the data bus as well as adapting the odometer display, service interval data, vehicle immobilizer (if equipped) and reactivate the radio anti-theft system (if equipped). If you do not have a proper scan tool and/or experience then it is recommended that the vehicle be taken to an authorized Volkswagen dealer or properly equipped independent repair shop for instrument cluster replacement.

Malfunction recognition and display

The instrument cluster has On-Board Diagnostic (OBD) capability, which is an aid to troubleshooting.

If the instrument cluster control module detects a malfunction with the odometer or speedometer that is non-repairable, then "dEF" will appear in the trip recorder display. Replacement of the instrument cluster will be necessary.

If the instrument cluster control module detects a malfunction and nothing is displayed on the trip recorder display, carry out the following work before removing the instrument cluster:

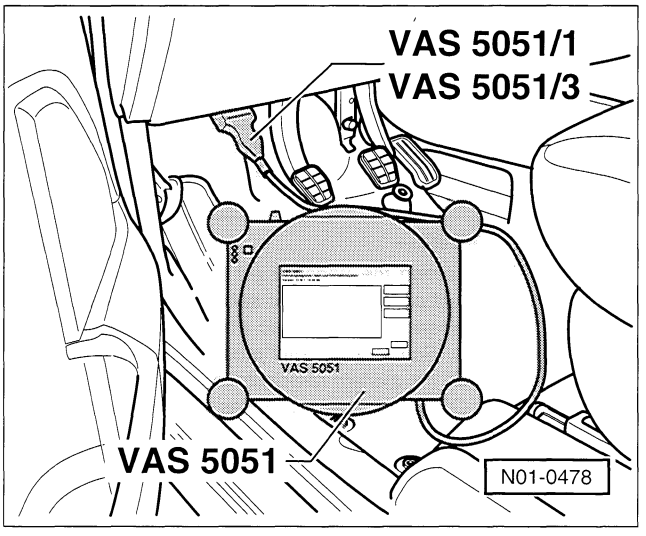
- Check DTC memory with VAG1551/1552 or equivalent scan tool .
- Read service interval display values and odometer reading with VAG1551/1552 or equivalent scan tool and note the values.

If the malfunction indicates that the instrument cluster requires replacement, the recorded values can be entered in the new instrument cluster.

Instrument cluster, removing and installing

> ***WARNING —***
> - *Special safety precautions apply to vehicles equipped with airbags.*
> - *Refer to airbag **CAUTIONS** and **WARNINGS** in* **69 Seatbelts, Airbags**.

Replacement of instrument cluster **from 2000 m.y.** must be accomplished by properly coding with the VAS 5051 Vehicle Diagnostic Testing and Information system.



INSTRUMENT CLUSTER

WARNING —

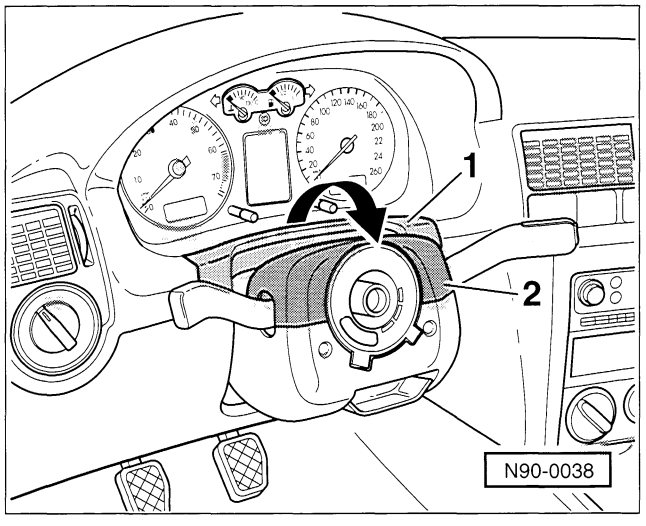
- *Disconnect battery ground (GND) strap from battery negative (–) terminal.*
- *Be sure to have the anti-theft radio code on hand before disconnecting the battery.*
- *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using a VAG 1551/1552 or equivalent scan tool.*
- *See* **Malfunction recognition and display** *given earlier before removing instrument cluster.*

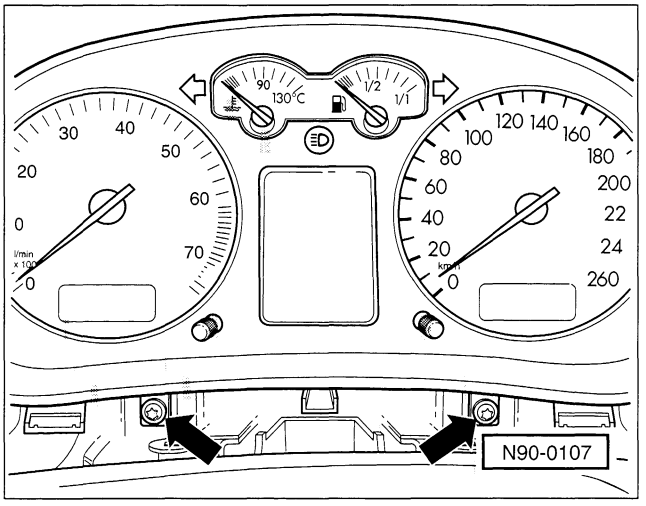
NOTE —

- *If replacing the instrument cluster, be sure to note the mileage indicated in the old cluster before removal.*
- *For ease of illustration the steering wheel is not shown in the following illustrations. It is not necessary to remove the steering wheel to remove the instrument cluster.*

– Release steering wheel position lock, pull steering wheel out completely and lock again in lowest position.

➤ Pull trim piece (**1**) above steering column out from instrument panel and place on steering column switch cover.





➤ Remove instrument cluster mounting screws (**arrows**).

– Tilt instrument cluster slightly toward passenger compartment.

– Disconnect harness connectors at rear of instrument cluster.

– Remove instrument cluster.

– Installation is reverse of removal. After completing installation check function of instrument cluster.

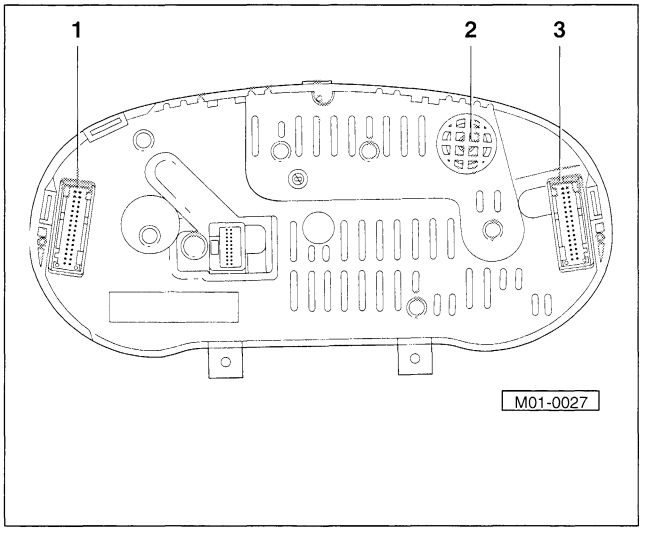
NOTE —

- *Due to the large number of instrument cluster variations it always advisable to order a replacement cluster using the part number on the back of the cluster.*
- *Replacement clusters can have the odometer mileage adjusted to match the mileage of the original cluster. Because of the specialized nature of these repairs, servicing should be referred to an authorized Volkswagen dealer or qualified independent repair shop.*
- *If the instrument cluster has been replaced because it was faulty, and a functional check does not display a malfunction the instrument cluster will need to be coded with VAG 1551/1552 scan tool or equivalent, see* **Scan Tool** *section at the back of this manual.*

Multi-pin connector terminal assignment

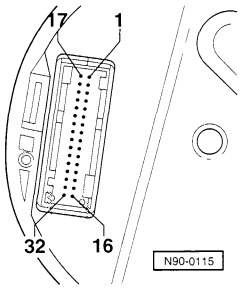
NOTE —

- *The instrument cluster must not be disassembled.*
- *For troubleshooting specific systems and circuits see* **Wiring Diagrams, Fuses and Relays**.



➤ The back of the instrument cluster has a blue (**3**) and a green (**1**) 32-pin connector and warning buzzer (**2**). **Table a** and **Table b** identify the various terminals for these connectors.

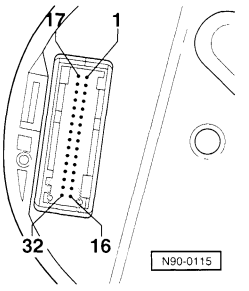
Table a. Instrument cluster 32-pin connector (T32a green) terminal identification



Terminal	Circuit
1	Open
2	Open Reading coil for immobilizer 1 (from 05.99 prod.)
3	Open Indicator lamp for parking light (from 05.99 prod.)*
4	Open Data bus (CAN), shielding for input (from 05.99 prod.)
5	W-wire (where applicable)
6	Low level washer fluid
7	Brake pad wear indicator
8	External buzzer Open from 05.99 production Data bus (CAN), high input signal (from 01.01 prod.)
9	Open Data bus (CAN), low input signal (from 01.01 prod.)
10	Fuel level warning
11	Signal for vehicle stationary
12	Air conditioning system cut-off - ECT signal
13	Parking brake indicator light (K14)
14	Warning light for traction control/vehicle stability
15	Open
16	Open

* - where applicable

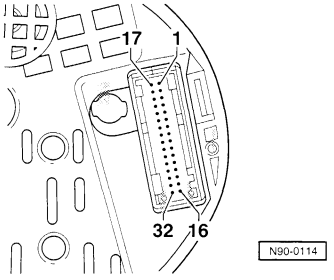
Table a. Instrument cluster 32-pin connector (T32a green) terminal identification



Terminal	Circuit
17	Open Reading coil for immobilizer 2 (from 05.99 prod.)
18	Open Oil temperature and oil level warning signals (from 05.99 prod.)*
19	Open Data bus (CAN), high input signal (from 05.99 prod.)
20	Open Data bus (CAN), low input signal (from 05.99 prod.)
21	Open
22	Open Input signal from hood alarm switch (from 05.99 prod)
23	MFI call up button - top (display switches forward)
24	MFI call up button - bottom (display switches backward)
25	MFI memory switch - reset
26	MFI ambient temperature display
27	Open Data bus (CAN), high output signal (from 05.99 prod.)
28	Open Data bus (CAN), low output signal (from 05.99 prod.)
29	Open
30	Output signal 2 from electronic speedometer Open (from 05.99 prod.)
31	Automatic transmission selector lever display* Open (from 05.99 prod.)
32	Fuel consumption signal Open (from 05.99 production)

* - where applicable

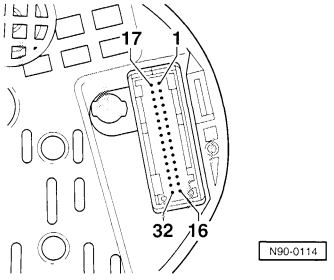
Table b. Instrument cluster 32-pin connector (T32 blue) terminal identification



Terminal	Circuit
1	Terminal 15, positive
2	Right turn signal indicator light (K94)
3	Output signal 1 from electronic speedometer
4	Open
5	Fuel gauge (G1)
6	Airbag malfunction indicator light
7	Terminal 31, sender Ground (GND)
8	Engine coolant temperature gauge (G3)
9	Terminal 31, Ground (GND)
10	Oil pressure switch (F1)
11	Engine speed (RPM) signal Open from 05.99 production
12	Generator warning light (K2), terminal 61
13	Glow plug indicator light (K29) (Diesel only)* Control light for rear seat backrest lock (from 05.99 production)*
14	Open Rear fog light indicator*
15	Open
16	Warning light for rear lid open

* - where applicable

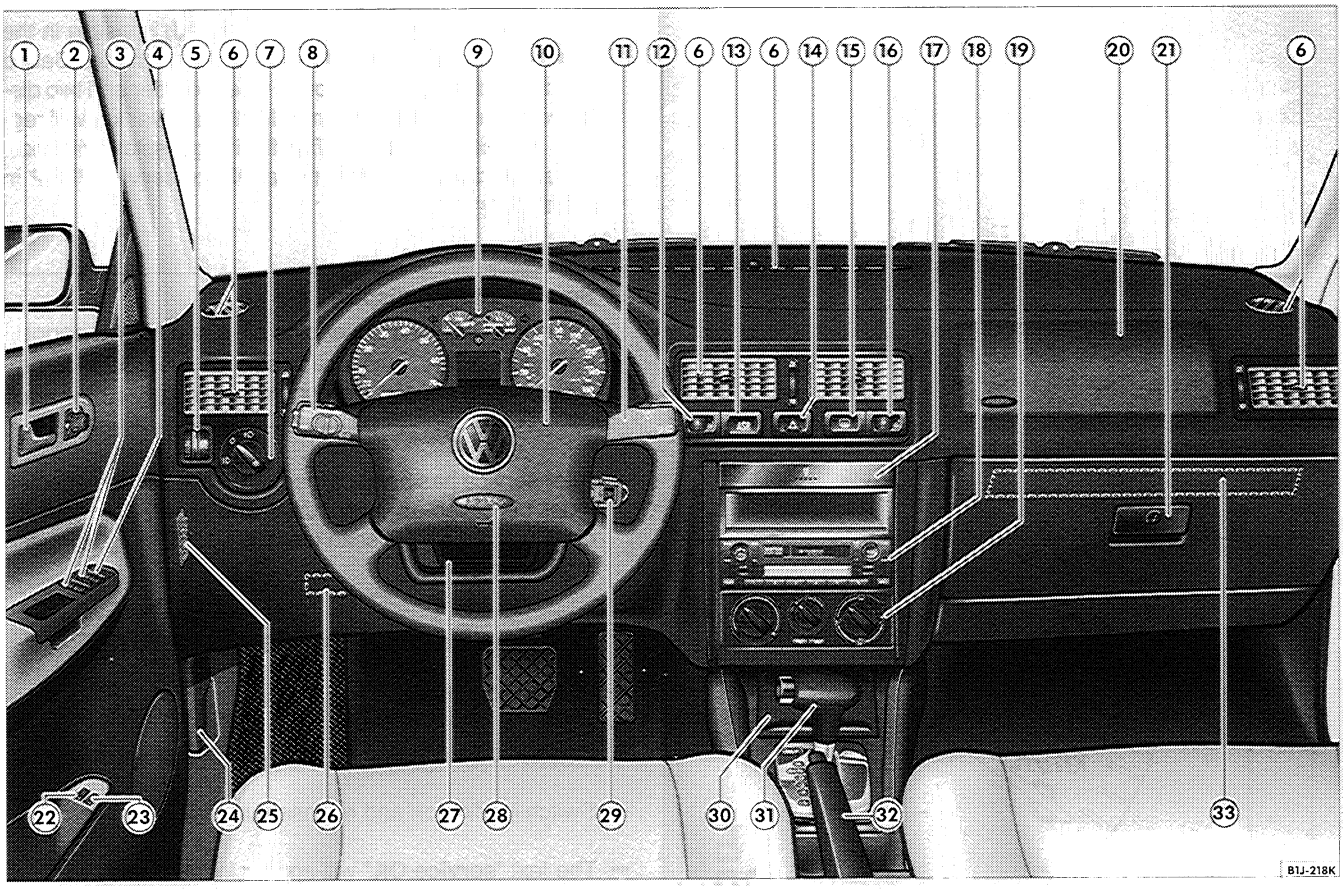
Table b. Instrument cluster 32-pin connector (T32 blue) terminal identification



Terminal	Circuit
17	Headlight high beam indicator light (K1), terminal 56a
18	Left turn signal indicator light (K65)
19	ABS warning light (K47)
20	Instrument cluster illumination, terminal 58b
21	Driver's door open warning buzzer
22	Engine Coolant Level (ECL) sensor (G32)
23	Terminal 30, (B+)
24	Terminal 31, Ground (GND)
25	On-Board Diagnostic (K-wire)
26	Parking light right, signal for "lights on" warning buzzer
27	Parking light left, signal for "lights on" warning buzzer
28	Speedometer Vehicle Speed Sensor (VSS) (G22)
29	Warning light for brake system fluid level
30	Ignition key warning buzzer, terminal 86s
31	Seat belt warning system
32	Malfunction Indicator Lamp (MIL)* Open from 05.99 production

* - where applicable

Instrument panel overview



1. **Door release handle**
2. **Outside mirrors adjuster**
3. **Power window switches**
4. **Power lock switch**
5. **Instrument cluster illumination**
6. **Air vents**
7. **Light switch**
8. **Turn signal/high beam lever**
   - With cruise control switch
9. **Instrument cluster**
10. **Horn**
11. **Windshield wiper/washer lever**
    - With multi-function indicator switch
12. **Heated driver's seat switch**
13. **Anti-slip regulation switch**
14. **Emergency flasher switch**
15. **Rear window defogger switch**
16. **Heated passenger's seat switch**
17. **Cup holder**
18. **Radio**
19. **Climate controls**
20. **Front passenger airbag**
21. **Glove compartment**
22. **Fuel filler flap release switch**
23. **Rear lid release switch**
24. **Hood release lever**
25. **Fuse panel**
26. **Data Link Connector (DLC) for On Board Diagnostics (OBD)**
27. **Steering wheel adjustment lever**
28. **Driver airbag**
29. **Steering lock/ignition/starter switch**
30. **Ashtray**
31. **Gear selector lever**
32. **Parking brake lever**
33. **Storage compartment for owner's manual**
    - In glove compartment

NOTE —

Features and equipment may vary from the illustration shown. Variants are based on model and option packages. Switch and indicator light arrangements may also vary.

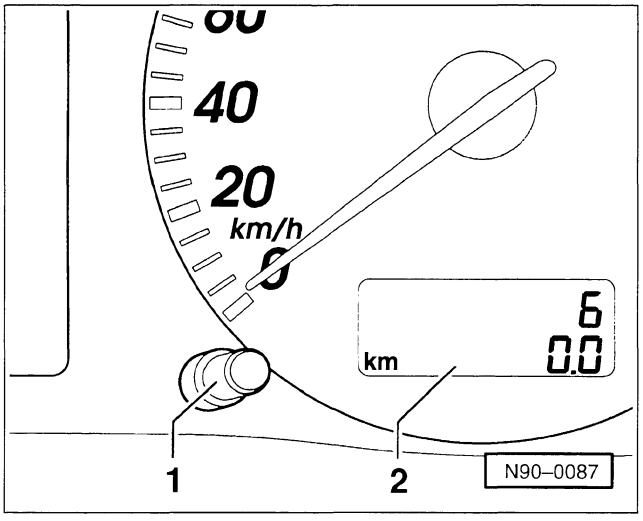
SERVICE INTERVAL DISPLAY

The service interval display (if equipped) is visible in the display window at the bottom of the speedometer. Based on information obtained from a time recorder and two distance recorders this system will let the driver know if regular service is required. The flashing display will show distance travelled and **service OIL** or **service INSP** in the display window.

Service interval display

- **service OIL** change engine oil, see **0 Maintenance**
- **service INSP** . . .inspection service every 12 months or every 30,000 km (20,000 miles), see **0 Maintenance**

After service has been carried out, each service affected must be called-up individually and reset. This can be done using the VAG scan tool 1551/1552 or by using the procedure below.



Service interval display, resetting

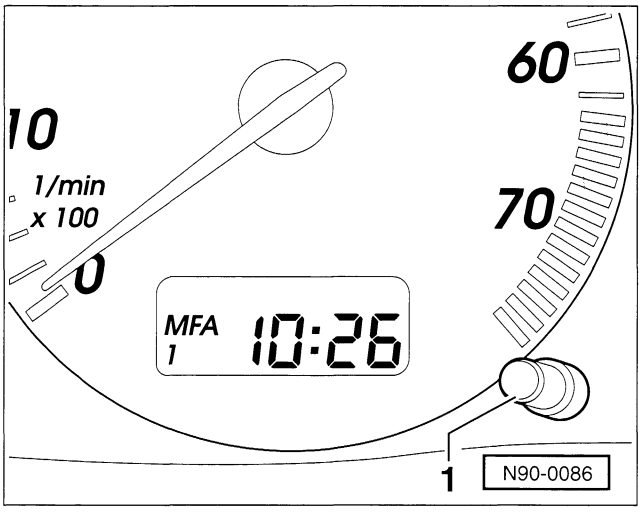
– Switch off ignition.

➢ Press and hold button (**1**) at bottom left of speedometer.

– Switch ignition on and release button.

– The text "**service OIL**" will appear in the display window. On 2000 m.y. cars, the message "SERVICE NOW" will appear in the instrument clusters with center display.

- To reset oil service display continue with next step.
- To change display to "**service INSP**" press the button (**1**) again.



➢ To reset either function (**service OIL or service INSP**) turn adjusting knob (**1**) at lower right side of tachometer to the right.

– The service display shown in the display window is now reset and "service _ _ _" will appear in display window.

– Switch off ignition. Service display is now reset until next scheduled service interval is reached.

91 Radio and Communication

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c. CD player terminal assignment 91-15
d. Multi-function steering wheel control module terminal assignment 91-19

GENERAL

This section covers the Volkswagen factory installed stereo radio sound systems. For specific circuit tracing, it is necessary to see **97 Wiring Diagrams, Fuses and Relays**.

WARNING —

- *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using a VAG 1551/1552 or equivalent scan tool.*
- *Be sure to have the anti-theft radio code on hand before disconnecting the battery.*
- *Before working on any part of electrical system, always disconnect the battery ground strap first.*

WARNING —

- *The radio is wired to the vehicle alarm system. If the alarm system is armed, removing the radio will activate the alarm even if the proper tools are used. Do not attempt to remove the radio without disarming the alarm.*
- *The factory installed connectors are designed for genuine Volkswagen radios. If installing a different radio, remember that the radio may not fit properly into the space provided, the electrical connections may not be compatible and different terminals may be needed.*
- *Keep in mind that factory installed radios are electronically linked to the ignition, alarm and data link circuits.*

Radio reception

Radio stations send out electromagnetic signals from transmitting towers. When these signals move past an automobile, a small electrical impulse is induced in the antenna and sent to the radio for detection and amplification. The radio takes these small electrical impulses and converts them to a level sufficient to operate a speaker.

AM (amplitude modulation) radio signals travel in two ways; ground waves and sky waves. Ground waves travel through the air and follow the curve of the earth. Sky waves spread up into the sky until they reach the ionosphere where they are reflected back to earth. Depending on the power of the transmitting station, this reflection or "skip", enables AM radio waves to travel great distances. FM (frequency modulation) radio waves are not reflected by the atmosphere and travel in what is known as "line of sight". Therefore, FM broadcasts do not travel as far as AM broadcasts.

Several impediments can prevent optimum radio reception in any vehicle and can include:

Fading

- Signal fading is typical on AM when driving through an underpass or near large buildings or objects. FM does not tend to fade as much as AM. In the same location where AM fades, FM may come in strong and clear because the shorter radio waves are reflected by metal objects such as buildings and bridges.

Flutter-fence effect

- In weak FM reception areas you may hear short pops of hissing background noise with otherwise good reception of the radio program. This "flutter" noise is like the sound burst that occurs when passing poles or posts close to the side of the road. This flutter effect may cause the stereo indicator to flicker because the signal has fallen below the minimum level to operate the stereo decoder. In even more remote areas such as in the desert or in hilly or mountain areas, it may not be possible to receive some AM or FM radio stations at all.

Multi-Path Cancellation

- Flutter and distortion is also caused by a mixing of several signals coming from different directions as a result of reflection from various objects. Mixing or cancellation effects often happen in cities even when close to the radio station transmitting towers and when transmitting towers are in close proximity to each other.

Interference

- Ignition or accessory interference, flutter, distortion and background noise can be caused by the ignition system or electrical accessories in the vehicle. In addition to internal sources, noise can also be caused by outside sources such as electrical power lines, other radio wave transmitters and other vehicles.

Interference suppression

The majority of the electrical consumers in the vehicle have radio suppression built in. All vehicles also include additional suppression measures in the following areas and components:

- Coolant fans (V7)
- Windshield wiper motor (V)
- Rear window wiper motor (V12), as applicable

NOTE —

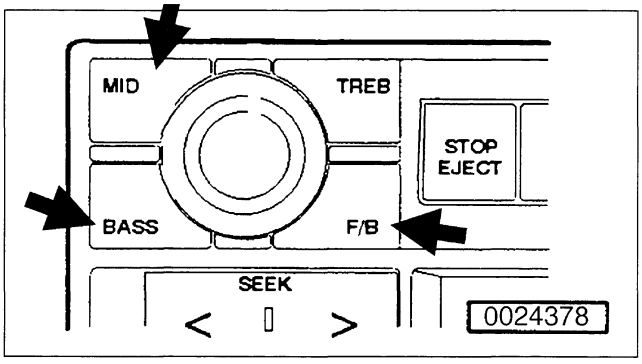
- *Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See* **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*
- *Only factory approved accessory radios and radio equipment (available from VWoA) should be installed. This ensures proper installation and minimizes risk of damaging vehicle electrical system and On-Board Diagnostic functions.*

RADIO SYSTEM

Radio system, description

The radio system consists of a radio head unit and cassette tape player with bass loudspeakers (woofers) in the front doors and rear side panels. Domed treble loudspeakers (tweeters) are installed in each front door exterior mirror triangular cover as well as the in the rear trim/door panels. The system also includes an amplified roof mounted antenna.

A 6-Disc CD changer is available as optional equipment, and (if equipped) is located in left side of the luggage compartment behind the rear seat. All vehicles are prewired from the factory for this unit only. In addition, some vehicles may be equipped with an in-dash single CD-player.



Some vehicles are equipped with an optional Monsoon radio system. The radio head unit is very similar to the standard Premium unit and all service procedures in this section apply to all factory installed components of either type of system. The factory supplied glovebox owner's manual provides the most up-to-date information for operation of the radio. The Premium V with Monsoon is shown with it's unique "mid" button for midrange control.

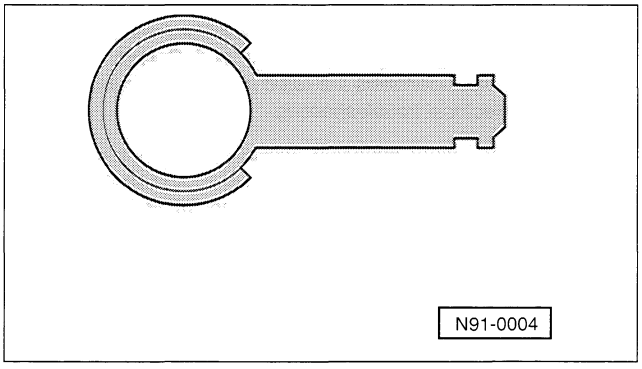
Radio allocation (model year)

- Premium IV 1999-2000
- Premium V (incl. Monsoon) 2001-2002
- Premium VI (incl. Monsoon). . . . . 2002 on

Volkswagen radios are capable of communicating with scan tool VAG 1551/1552 through the Data Link Connector (DLC). Radios can store Diagnostic Trouble Codes, (DTCs), and must be coded via the scan tool in order to function properly. The correct code varies depending on the type of vehicle, the type of antenna and the CD changer, if applicable. See **Radio head unit, coding**, given later.

Radio head unit (Premium IV and V, including Monsoon), removing and installing

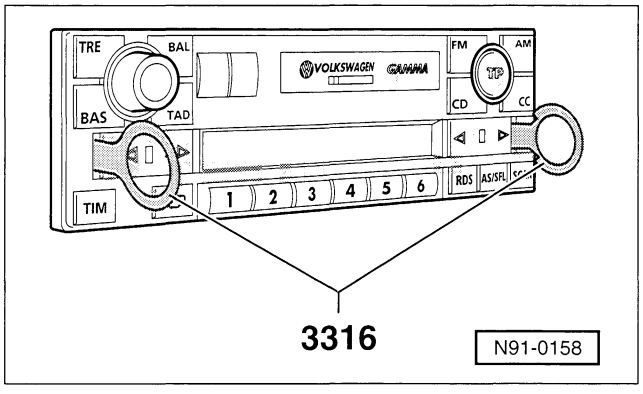
WARNING —
Observe all warnings in **9 Electrical System** *before starting repairs involving the electrical system.*



NOTE —
Always remove ignition key from ignition before removing radio.

The radio release tool 3316 consists of two identical parts used to remove the factory radio unit.

– Slide Volkswagen radio release tools 3316 into radio release slots until they engage the release mechanism.



Pull radio out of instrument panel using grip rings of release tools.

NOTE —

- *The radio release tool 3316 must not be pushed to the side or tilted. Pull straight out.*
- *Remove release tools before reinstalling radio.*
- *To remove the release tools from the radio the locating lugs on the side of the radio must be pressed inward.*

– Remove antenna connector and harness connectors on back of radio head unit.

– To install radio head unit, remove release tools.

– Connect harness and antenna connectors to radio head unit.

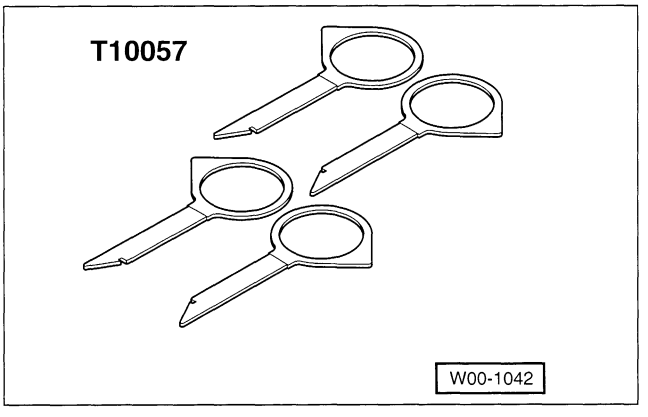
– Carefully slide radio head unit straight into instrument panel until it engages properly in assembly frame.

– If new (or exchange) radio head unit has been installed, be sure to safely store new radio code card.

Radio head unit (Premium VI, including Monsoon), removing and installing

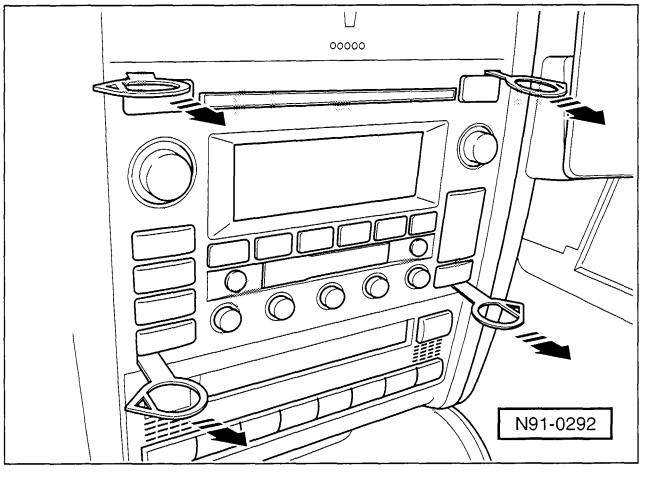
WARNING —
Observe all warnings in **9 Electrical System** *before starting repairs involving the electrical system.*

NOTE —
Always remove ignition key from ignition before removing radio.



➢ Slide Volkswagen radio release tools T10057 into radio release slots marked until they engage the release mechanism.

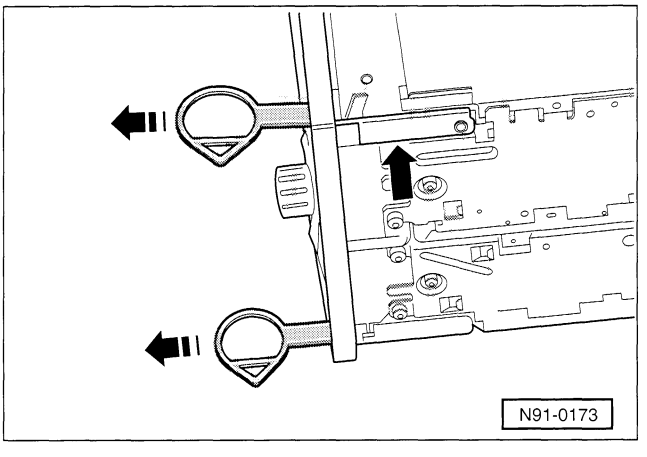
NOTE —
Individual radio release tools are marked "Top L" for both left upper and lower openings and "Top R" for both right upper and lower openings.



➢ Pull radio straight out of instrument panel using grip rings of release tools.

• Do not twist or tilt tools while removing radio.

– Remove antenna connector and harness connectors on back of radio head unit.



➢ Release removal tools from radio by pressing locking tabs (**arrow**) on the side of radio once it is removed.

– To install radio, connect harness and antenna connectors to radio head unit.

– Carefully slide radio head unit straight into instrument panel until it engages properly in assembly frame.

CAUTION —
When installing radio do not press on display or control buttons to engage locking tabs. Doing this could damage the radio.

– If new (or exchange) radio head unit has been installed, be sure to safely store new radio code card.

– Input anti-theft security code.

– Confirm radio coding for sound system functions using diagnostic scan tool if necessary.

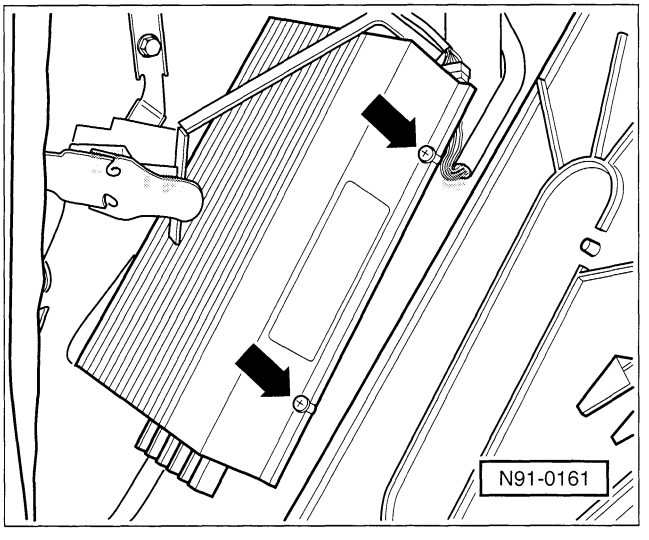
Amplifier (Monsoon), removing and installing

> ***WARNING —***
> *Observe all warnings in* **9 Electrical System** *before starting repairs involving the electrical system.*

– Open left side luggage compartment trim panel.

– Disconnect electrical connectors at amplifier.

Golf/GTI, Jetta wagon models



➤ Remove mounting screws (**arrows**) and amplifier.

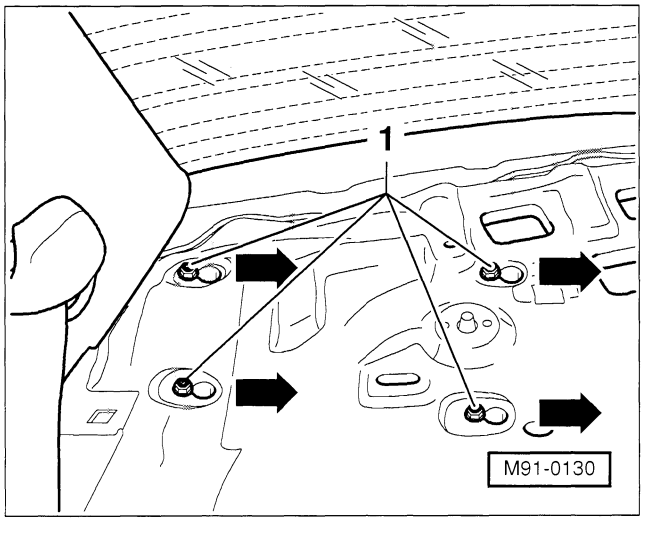
– Install in reverse order of removal.

– Ensure that radio is coded accordingly for Monsoon system using diagnostic scan tool.

> ***NOTE —***
> *Radio sound system coding must be checked/performed in order to account for presence of CD changer (if applicable), Monsoon system (if applicable) and interior sound field difference between models. See* **ST Scan Tool** *at the back of this repair manual.*

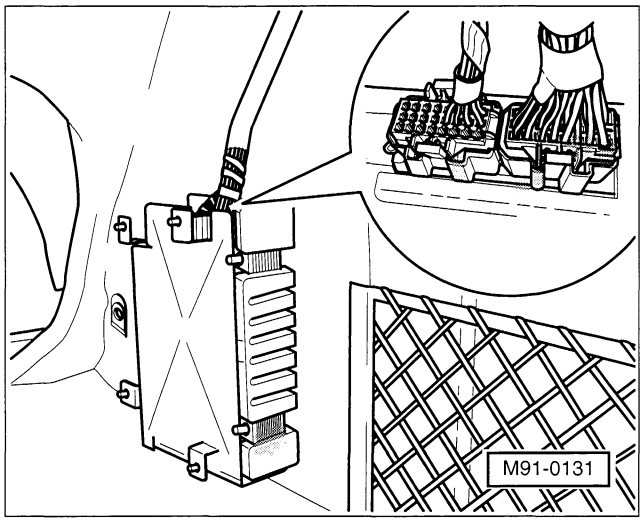
Jetta sedan models

– Remove parcel shelf trim, see **70 Trim–Interior**.



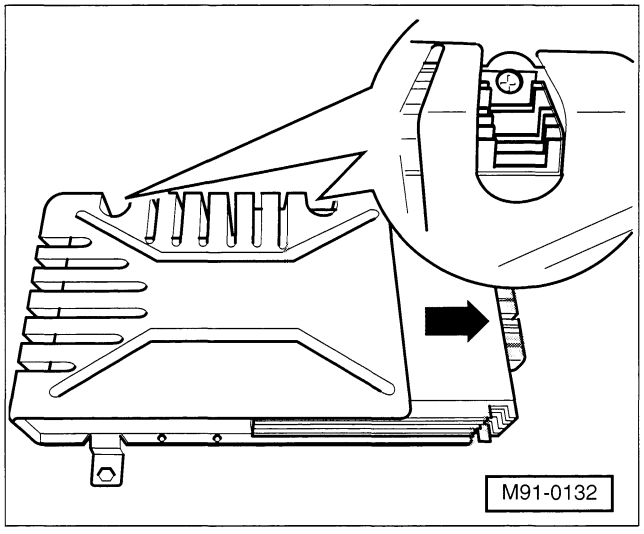
➤ Loosen but do not remove screws (**1**).

– Release amplifier assembly from mounting position by sliding towards the perforations in the rear shelf sheet metal (**arrow**).



➤ Disconnect electrical connections at amplifier by depressing both securing lugs on each plug.

NOTE —
Always disconnect the green plug last in order to better support the weight of the amplifier assembly when it hangs on the wiring harnesses.



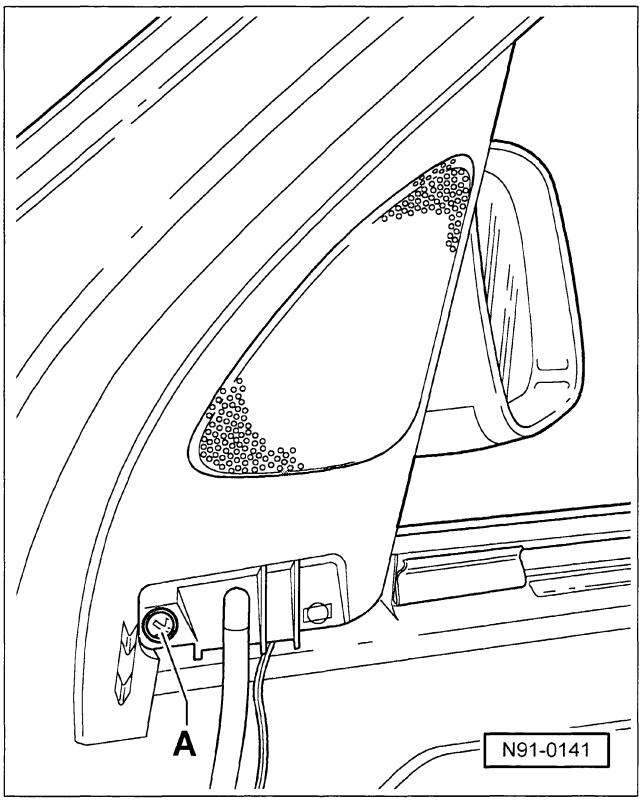
➤ Remove amplifier mounting screws as illustrated in detail.

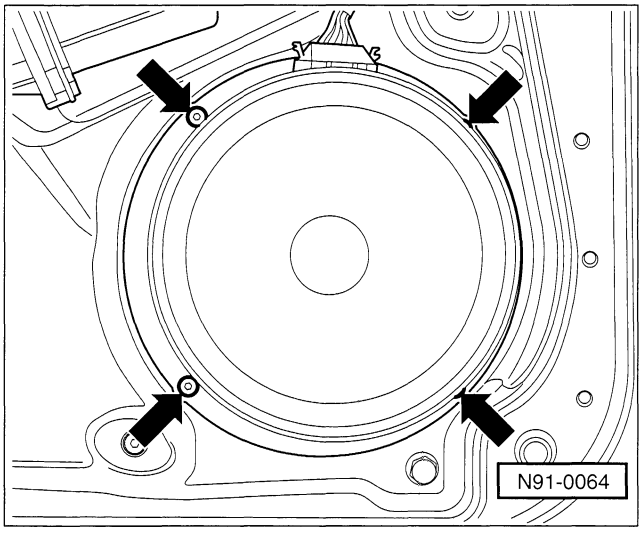
– Slide amplifier from mounting frame in direction of (**arrow**).

– Install in reverse order of removal.

– Ensure that radio is coded accordingly for Monsoon system using diagnostic scan tool.

NOTE —
Radio sound system coding must be checked/performed in order to account for presence of CD changer (if applicable), Monsoon system (if applicable) and interior sound field difference between models. See **ST Scan Tool** *at the back of this repair manual.*





Speakers, removing and installing

– To remove domed treble speaker in front door, remove door trim panel first, see **70 Trim–Interior**.

– Disconnect harness connector for speaker and remove mounting screw.

➤ Remove mounting screw (**A**). Carefully slide triangular mirror cover upwards and remove speaker

– Install domed treble front door speaker in reverse order of removal.

– The rear treble (tweeter) speakers are integrated into the rear trim panel, or rear door panel on 4-door models. The panel must be removed first to remove the rear tweeter, see **70 Trim–Interior**.

NOTE —
On 4-door models, the rear tweeter speakers cannot be removed from the interior rear door handle trim. The interior door handle and the speaker are replaced as one unit.

– The rear bass speakers (woofers) are also attached to the rear trim/door panel which must first be removed, see **70 Trim–Interior**.

– Disconnect harness connector from rear door speaker.

➤ Carefully drill out rivets (**arrows**) that hold speaker to trim panel.

NOTE —
- *To prevent corrosion, make sure that all metal particles from drilling are removed from inside the door.*
- *If the paint on door frame is damaged during drilling, touch-up immediately.*

– Install rubber gasket between speaker and trim panel. Use new rivets of proper length and diameter to install speaker.

Radio anti-theft system, description

All factory installed and supplied radios are equipped with an electronic anti-theft system. The anti-theft system is activated and electronically de-activates (locks) the radio as soon as any of the following occur:

- Voltage supply (terminal 30) drops below a predetermined minimum voltage value.
- The radio unit is disconnected from voltage supply (terminal 30) such as when removing radio head unit or if the fuse blows.
- Vehicle battery has been disconnected.

A radio which is locked by the electronic anti-theft system will show the word "SAFE" in the display window when the radio is switched on. After 3 seconds, the word "SAFE" will be replaced by the number "1000" indicating readiness to unlock.

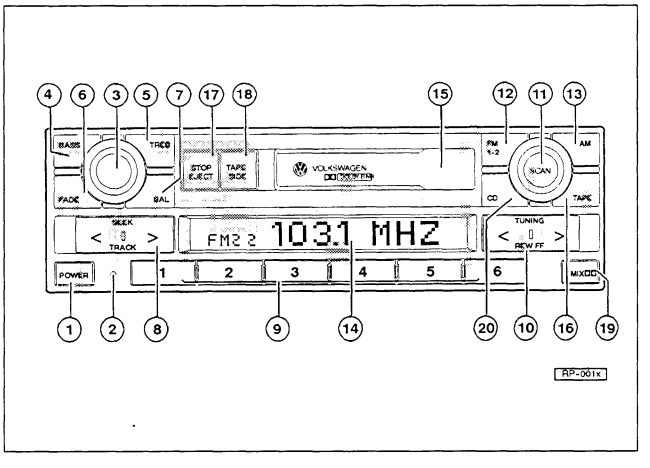
In addition to electronic anti-theft locking, the radio is linked to the alarm system. The alarm horn will sound if the alarm has been set and the radio is removed.

Radio anti-theft system, unlocking

If the radio has been electronically locked as described above, it can be unlocked using the following procedure. The radio will only work if the correct code number for the anti-theft system is entered. The anti-theft code can be found along with the radio number on the radio card provided with the vehicle.

NOTE —

For security reasons, the radio card should not be left in the vehicle. Ask the customer for the code before starting repairs. Never leave the radio card in the car.



Standard Sound System radio head unit showing controls. Factory supplied glovebox owners manual with radio instructions will provide more specific detail and button descriptions.

To unlock the radio anti-theft feature, perform the following steps:

- Obtain correct anti-theft code number from radio card.
- Switch radio on.
- "SAFE" will appear in the display window. After 3 seconds, the number "1000" will appear in the display window.
- Use station preset buttons to enter radio security code.
  - Press preset button 1 to enter first digit in code number, preset button 2 for second digit and so on.
  - To enter code number, press applicable button repeatedly until desired number appears on display.
  - The value range for each of the 4 digits is between 0 and 9.
  - If a button is pressed beyond desired number, sequence will start over at 0 after 9 is pressed.
- Once entire code is entered:
  - For Premium IV and V, press right side of "Seek" button for longer than 2 seconds, until audible signal is heard.
  - For Premium VI, press the upper portion of the "Seek" button(s) or the "Scan" button for longer than 2 seconds until an audible signal is heard.

The anti-theft code is entered properly when the display indicates a radio frequency, or "LSM" (ready for use). When the radio is switched off and the ignition key removed, a flashing LED on the radio faceplate confirms the radio is security protected.

NOTE —

- *If wrong code was accidentally entered, display window will show "SAFE"; flashing at first and then remaining on.*
- *Coding procedure may be repeated a second time (the number of coding attempts will be shown on display window). If wrong code is entered again, radio will be disabled for an hour. If this happens, leave radio ON and key in ignition for one hour. After the hour has elapsed, you will have two more attempts to unlock system. Unsuccessful attempts will cause the cycle to be repeated.*
- *The cycle is: 2 attempts, 1 hour locked.*

Radio anti-theft system, first activation

On new radios the anti-theft coding is not active. The electronic anti-theft system only becomes active after entering the correct code number factory assigned to that particular unit. If the radio is disconnected from the voltage supply before the anti-theft system is activated, it will not electronically lock. Radio head units that have not had the anti-theft system activation done initially will not have the blinking LED when the key is removed. Note the following points:

- Each radio is assigned a unique code.
- If the radio has been replaced, the new code must be used.
- The customer must be informed that the code number has changed.

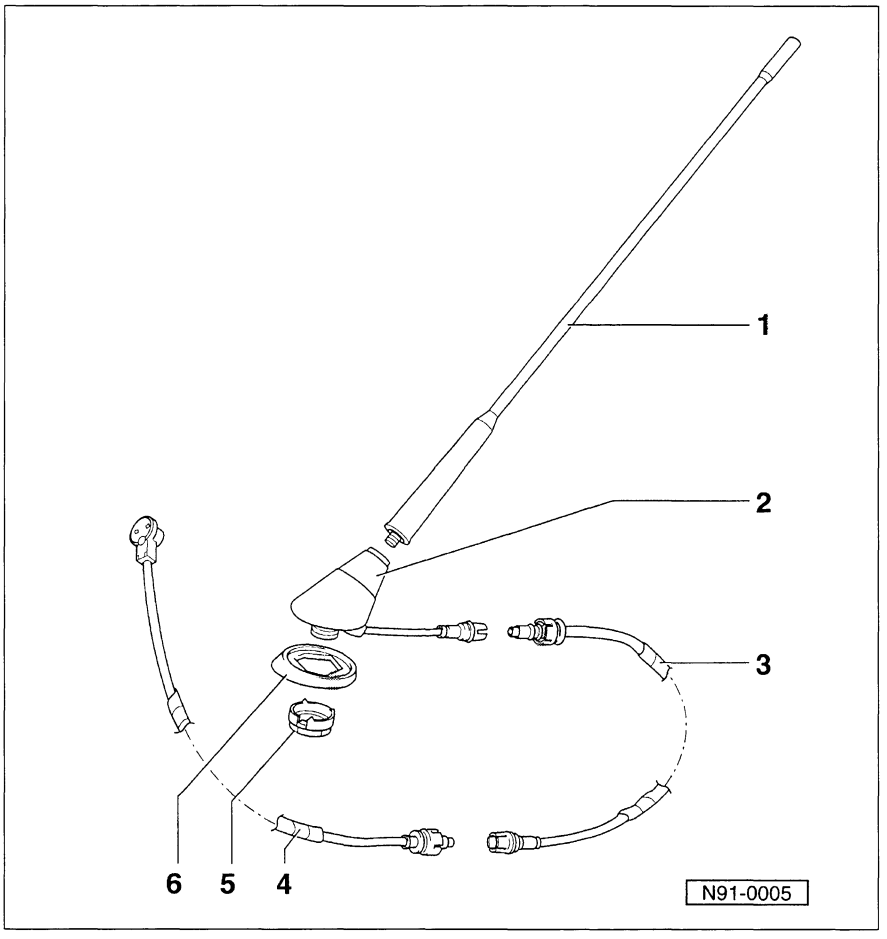
Follow the Radio anti-theft system, unlocking procedure above to input the anti-theft code in a new radio.

Radio head unit, coding

The radio is controlled by a microprocessor which has extensive On-Board Diagnostic (OBD) capability. To take full advantage of the OBD capabilities, the head unit must be coded to match the equipment level of the vehicle. Failure to code the radio head upon the addition of a CD changer will prevent it from being included in the On-Board Diagnostics, however, it will operate properly. A list of radio head unit codes have been provided at the back of this manual, see **ST Scan Tool**.

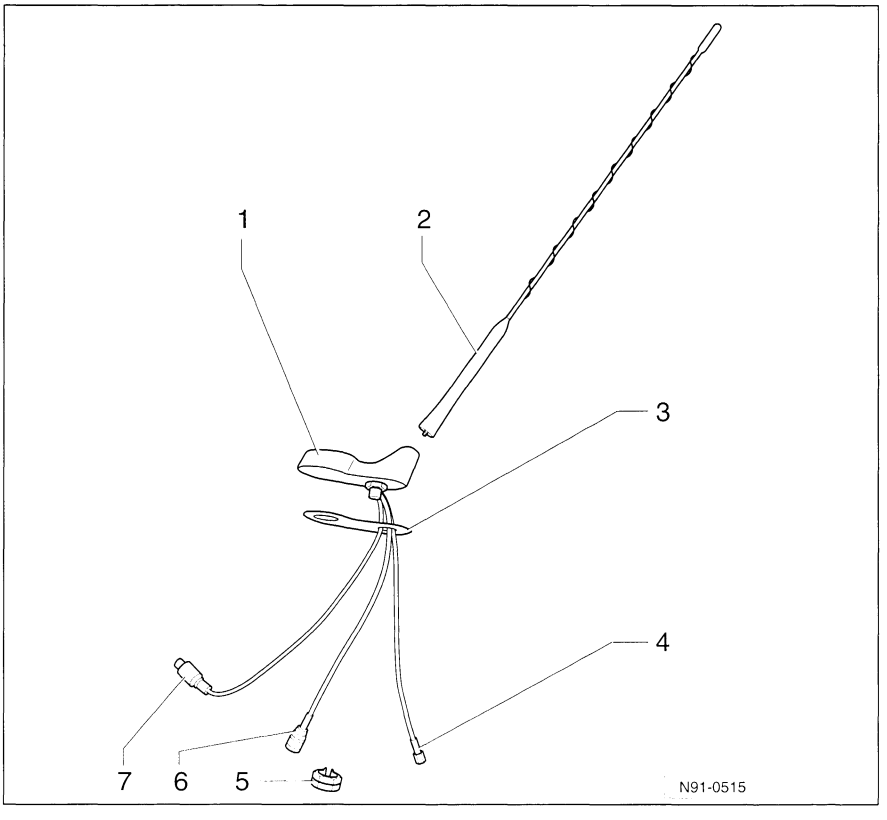
Amplified antenna

1. **Antenna mast**
2. **Antenna base**
   - With amplifier
   - Lower molded headliner at rear to access base
3. **Antenna cable**
   - From roof antenna to front of center console
   - Current to operate amplifier is supplied from radio head unit through center coaxial conductor. No separate 12 volt power lead is used.
4. **Antenna cable**
   - From front of center console to radio head unit
5. **Nut with serrated washer**
   - Special M14 nut with attached serrated grounding washer
   - Serrated washer is attached to nut with plastic ring
   - Apply contact grease to inside of roof in area of serrated washer to ensure good electrical grounding
   - Tighten to: 7 Nm (62 in lb)
6. **Gasket**
   - Ensure correct positioning to provide water tight seal.



GPS/Telematics antenna

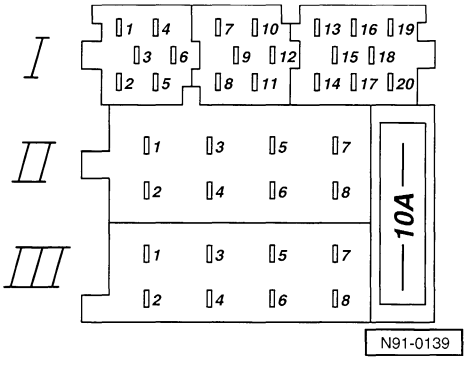
1. **Antenna base**
2. **Antenna mast**
3. **Gasket**
4. **Antenna connection -GPS**
   - Threaded
5. **Hex nut**
6. **Antenna connection - Radio**
   - Black
7. **Antenna connection - Telematics**
   - Grey



Radio head unit terminal assignment

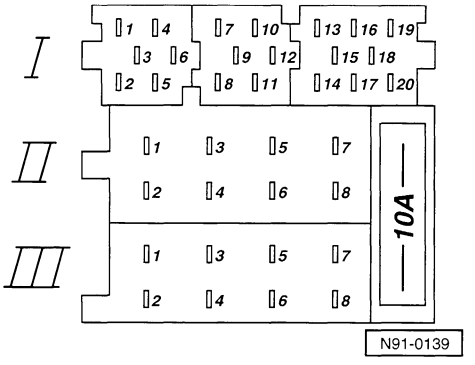
Tables a and b list the terminal assignments for the multi-pin connectors on the back of the various radios.

Table a. Radio head unit terminal assignments (Premium IV and V, incl. "Monsoon")



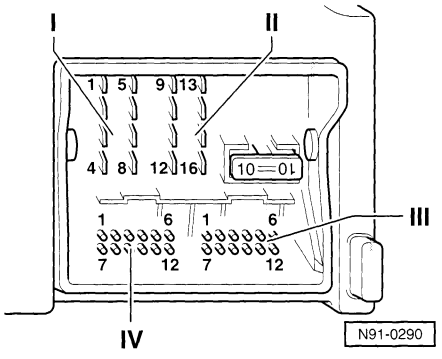
Terminal	Circuit
	Harness connector I, T20, part 1, yellow
1	Line out, L/R
2	Line out, R/R
3	Ground (GND)
4	Line out, L/F
5	Line out, R/F
6	Switched positive (B+ out) for sound amplifier
	Harness connector I, T20, part 2, green
7	Open
8	Second display, CLOCK
9	Second display, DATA
10	Second display, ENA
11	Remote control, REM
12	Telephone input signal, TEL-
	Harness connector I, T20, part 3, blue
13	CD changer - DATA IN
14	CD changer - DATA OUT
15	CD changer - CLOCK
16	CD changer - Positive (B+ in), terminal 30
17	CD changer - Control signal, turn-on
18	CD changer - Ground (GND) and shield
19	CD changer - Line out, left (CD/L)
20	CD changer - Line out, right (CD/R)

Table a. Radio head unit terminal assignments (Premium IV and V, incl. "Monsoon")



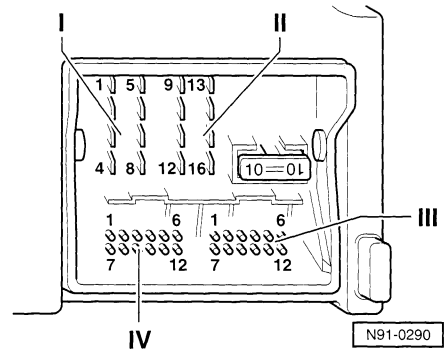
Terminal	Circuit
	Harness connector II, T8a, brown
1	R/R speaker +
2	R/R speaker -
3	R/F speaker +
4	R/F speaker -
5	L/F speaker +
6	L/F speaker -
7	L/R speaker +
8	L/R speaker -
	Harness connector III, T8, black
1	Signal for anti-theft alarm system
2	Open
3	Data Link Connector (DLC), K wire
4	Ignition switch (S contact)
5	Anti-theft system control signal, SAFE (terminal 30)
6	Illumination (terminal 58b)
7	Battery positive (B+) (terminal 30)
8	Battery ground, (GND) (terminal 31)

Table b. Radio head unit terminal assignments (Premium VI, incl. "Monsoon")



Terminal	Circuit
	Harness connector I, 8-pin
1	R/R speaker +
2	R/F speaker -
3	L/F speaker +
4	L/R speaker +
5	R/R speaker -
6	R/F speaker -
7	L/F speaker -
8	L/R speaker -
	Harness connector II, 8-pin
9	CAN-Bus plus
10	CAN-Bus minus
11	Mute
12	Ground
13	Radio, Control signal
14	Contact alarm
15	Battery positive (B+)
16	Signal for anti-theft alarm

Table b. Radio head unit terminal assignments (Premium VI, incl. "Monsoon")



Terminal	Circuit
	Harness connector III, 12-pin
1	Open
2	Open
3	Open
4	Open
5	Open
6	Signal for telephone minus (-)
7	Open
8	Open
9	Open
10	Open
11	Open
12	Signal for telephone plus (+)
	Harness connector IV, 12-pin
1	Open
2	CD changer - left and right channel ground
3	Open
4	CD changer - positive supply
5	Open
6	CD changer - DATA OUT
7	Open
8	CD changer - left channel
9	CD changer - right channel
10	CD changer - control signal
11	CD changer - DATA IN
12	CD changer - CLOCK

CD PLAYER/CHANGER

> ***WARNING —***
> *Observe all warnings in* **9 Electrical System** *before starting repairs involving the electrical system.*

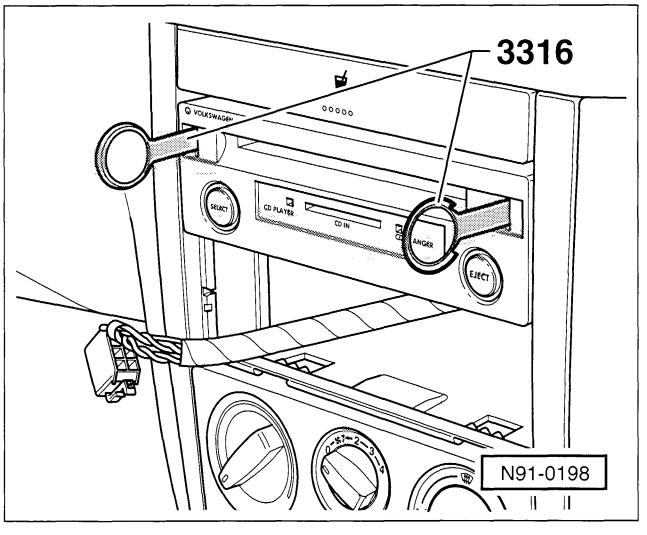
Volkswagens are factory wired for an optional 6 disc CD changer. Only genuine Volkswagen supplied changers are compatible with the radio head unit and the additional wiring. Installed location is in the left rear area of the luggage compartment just behind the rear seat.

CD player, removing and installing

> ***NOTE —***
> *Some vehicles are equipped with a single disc CD player in the dashboard. For vehicles with a multiple disc CD changer, see* **CD changer, removing and installing**, *given later.*

– Remove radio head unit as described above.

– Slide Volkswagen radio release tools 3316 into radio release slots until they engage the release mechanism.



➤ Pull CD player out of the dashboard panel using the grip rings of the release tools.

– Disconnect harness connectors from back of CD player and radio. Remove CD player.

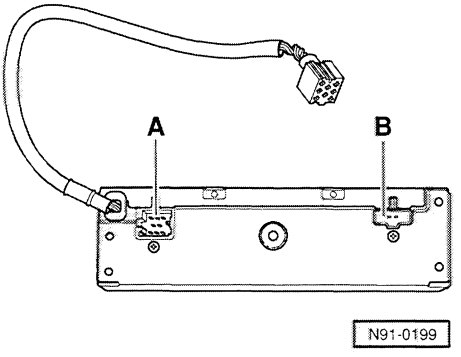
– To install CD player, remove release tools, connect harness connector and slide player into slot until it clicks into place.

CD player terminal assignment

The multi-pin connections on the back of the CD player are listed in **Table c**.

NOTE —
The multi-pin connector "A" shown below is identical to the multi-pin connection I, part 3, blue on "Premium IV and "Premium V" radios.

Table c. CD player terminal assignment



Terminal	Circuit
	Multi-pin connector "A"
13	CD changer - DATA IN
14	CD changer - DATA OUT
15	CD changer - CLOCK
16	CD changer - Positive (B+ in) (terminal 30)
17	CD changer - Control signal, turn-on
18	CD changer - Ground (GND) (terminal 31) and shield
19	CD changer - Line out, left (CD/L)
20	CD changer - Line out, right (CD/R)
	Multi-pin connector "B"
1	CD changer ground (terminal 31)
2	Illumination for CD changer (terminal 58d)

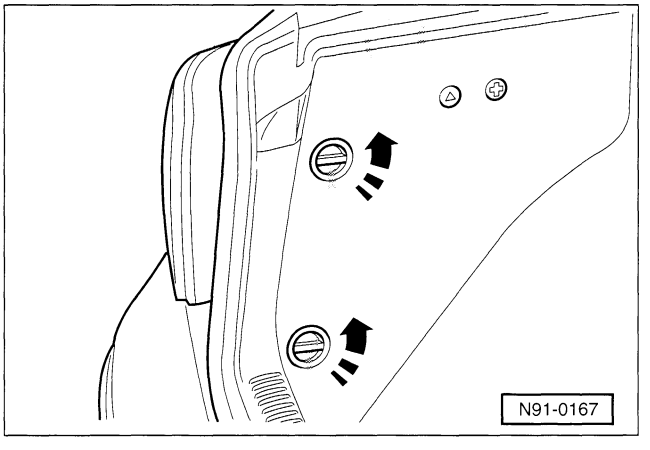
CD changer, removing and installing

The factory supplied CD changer is located in the left side of the luggage compartment, behind a protective flap.

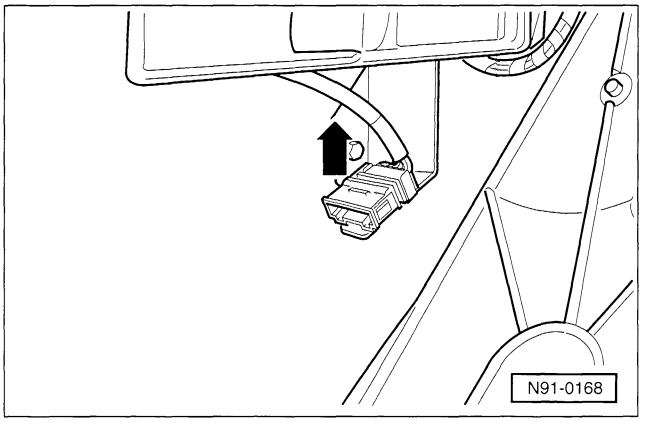
NOTE —

- *Always confirm CD changer and radio compatibility with your Volkswagen parts department or aftermarket parts specialist.*
- *The CD changer is installed horizontally in Golf, GTI, Jetta Wagon models and vertically in Jetta sedan models.*
- *If installing a new CD changer, ensure that the changer position switch (V/H) is set correctly for vertical (V) or horizontal (H) operation.*
- *It may be necessary to loosen and re-tighten a retaining screw to set the postion of the V/H switch on the back of the CD changer.*
- *The CD playback will skip if the V/H switch is not set correctly.*

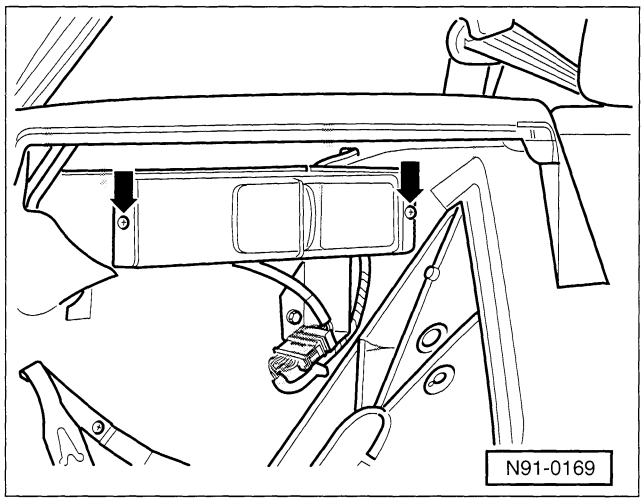
> ***WARNING —***
> *Observe all warnings in* **9 Electrical System** *before starting repairs involving the electrical system.*



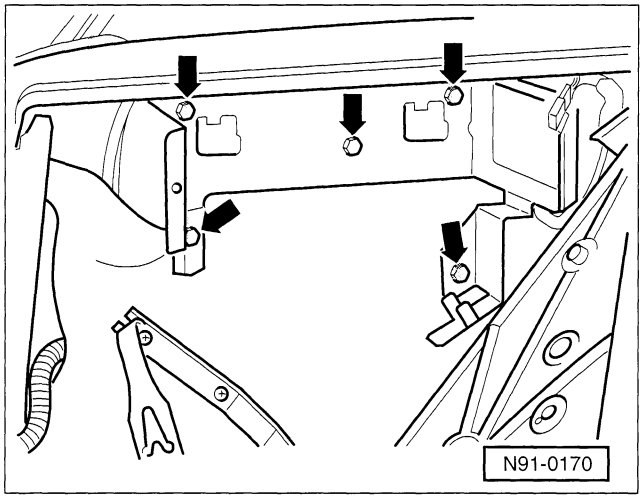
➤ Remove protective flap at left side of luggage compartment by turning retaining knobs counterclockwise (**arrows**).



➤ Disconnect harness connector below CD changer and unclip from retaining bracket in direction of **arrow**.



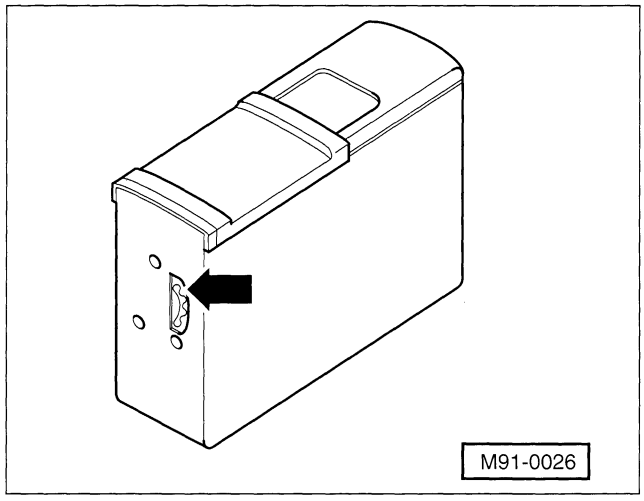
➤ Remove CD changer mounting bolts (**arrows**) and remove changer from mounting bracket.



➤ To remove CD changer mounting bracket, remove securing bolts (**arrows**) and bracket.

– Install components in reverse order of removal.

– If installing new (first time) CD changer, code radio head unit for addition of CD changer with VAG 1551/1552 scan tool or equivalent.



➤ If installing a new CD changer, ensure that the changer position switch (**arrow**) is set correctly for vertical (V) or horizontal (H) operation.

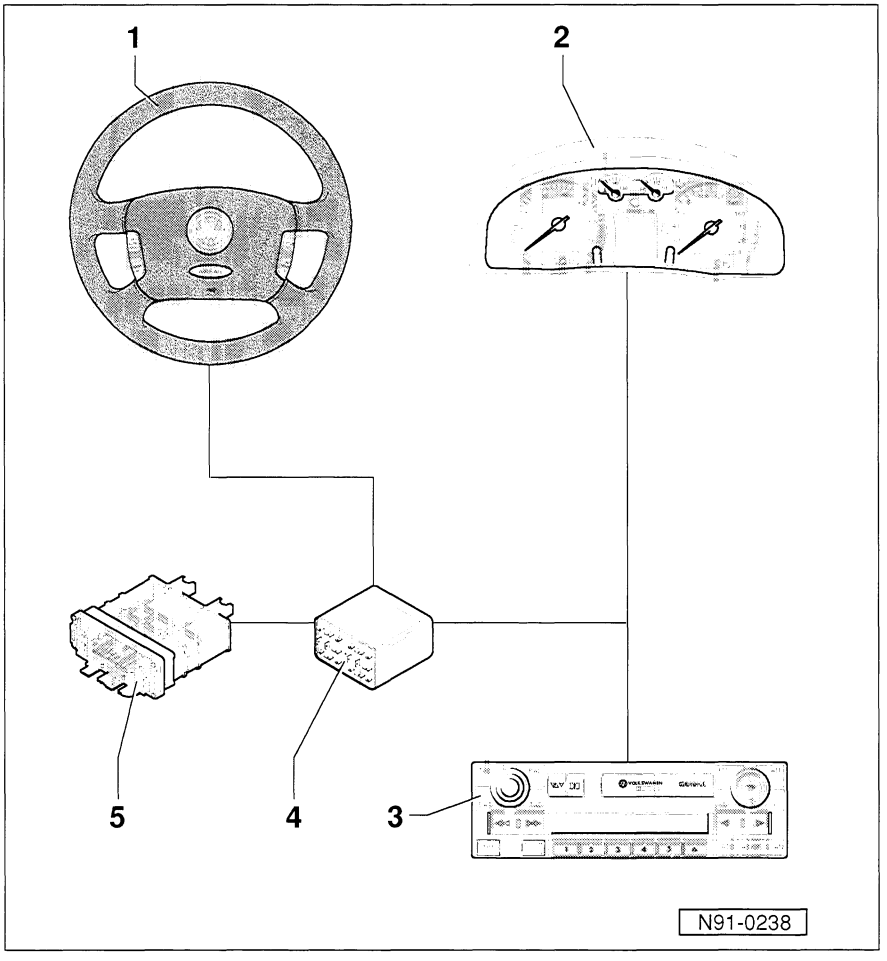
– It may be necessary to loosen and re-tighten a retaining screw to set the position of the V/H switch on the back of the CD changer.

NOTE —
The CD playback will skip if the V/H switch is not set correctly.

MULTI-FUNCTION STEERING WHEEL

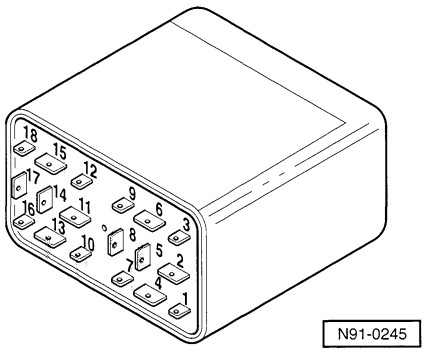
The multi-function steering wheel available as an option from May 2000 allows the various functions of the radio and cruise control system to be selected from the steering wheel. The system includes an operating unit in the steering wheel with two sets of buttons on the left and right sides of the wheel and a control module. Additionally on cars with diesel engines there is a balance weight installed in the multi-function steering wheel to prevent transmission of vibrations from the engine

Multi-function steering wheel system



1. **Multi-function steering wheel**
   - With integrated operating unit (E221)
2. **Instrument cluster**
   - Control module with display unit in instrument cluster (J285)
3. **Radio or radio/navigation system**
4. **Multi-function steering wheel control module (J453)**
   - Installed on relay carrier, see **97 Wiring Diagrams, Fuses and Relays**
   - Connector assignment, see **table d**
5. **Engine control module**

Table d. Multi-function steering wheel control module terminal assignment

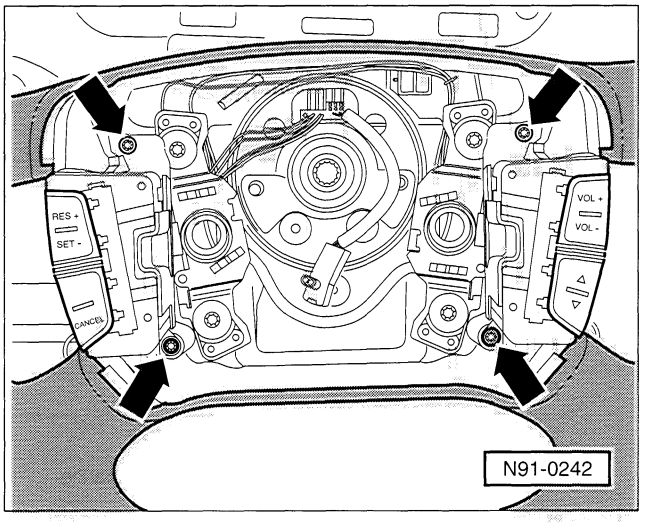


Terminal	Circuit
1	Comfort CAN Bus - Low
2	Open
3	Comfort CAN Bus - High
4	Open
5	Radio, serial data
6	Data Link Connector K-wire, diagnosis
7	Cruise Control System - resume, accelerating
8	CAN Bus Ground
9	Open
10	Ground (-) (terminal 31)
11	Double tone horn relay
12	Battery (+) with ignition on (terminal 15)
13	Battery (+) (terminal 30)
14	Open
15	Terminal 58d
16	Cruise Control System + (SET/delay)
17	Heating inlet "ON"
18	CAN Bus to control module in steering wheel -E221-

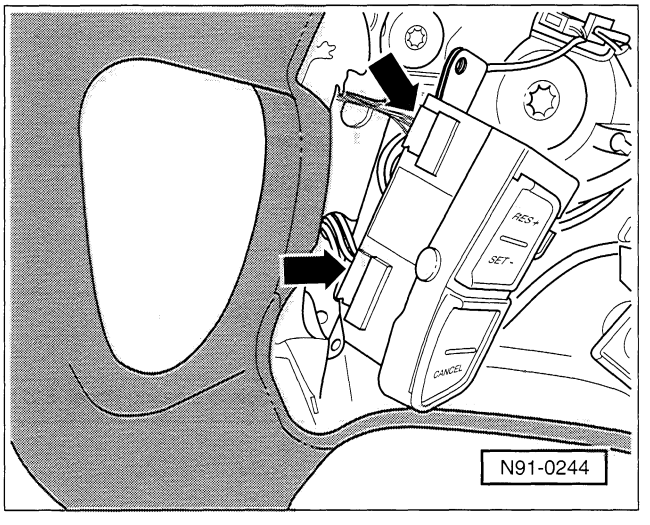
Multi-function steering wheel operating unit, removing and installing

– Disconnect battery ground (GND) strap from battery negative (–) terminal. See the **Cautions** at the beginning of this repair group regarding battery disconnection.

– Remove airbag from steering wheel, see **69 Seatbelts, Airbags**.



➤ Remove mounting bolts (**arrows**) for multi-function operating unit.



➤ Disconnect harness connectors (**arrows**) on operating unit and remove unit.

– Install in reverse order of removal.

TELEMATICS

General information

Telematics is an in-vehicle communication system that uses cellular and Global Positioning System (GPS) technologies to provide the customer with safety, security and convenience services.

GPS is a "constellation" of 24 satellites that orbit the earth and constantly broadcast radio signals. The Telematics Control Module receives GPS data, decodes it, and transmits the vehicle's location to the service provider's call center via the national cellular network.

Telematics services for Volkswagen customers are provided by OnStar via a dedicated call center. Service plans may provide route directions and concierge services as well as emergency or vehicle repair services. For details see Volkswagen Telematics by OnStar Owner's Manual.

Utilization of available Telematics services/features take place via customer's voice control. Upon customer request, the Volkswagen Telematics by OnStar call center can remotely perform the following vehicle functions:

- Lock vehicle
- Unlock vehicle
- Activate Hazard Lights
- Activate horn

During events where the Airbag Control Module processes a crash signal, the vehicle hazard lights are activated and the doors are unlocked via the respective door control modules. In addition, the telematics system automatically places an emergency call to the OnStar call center.

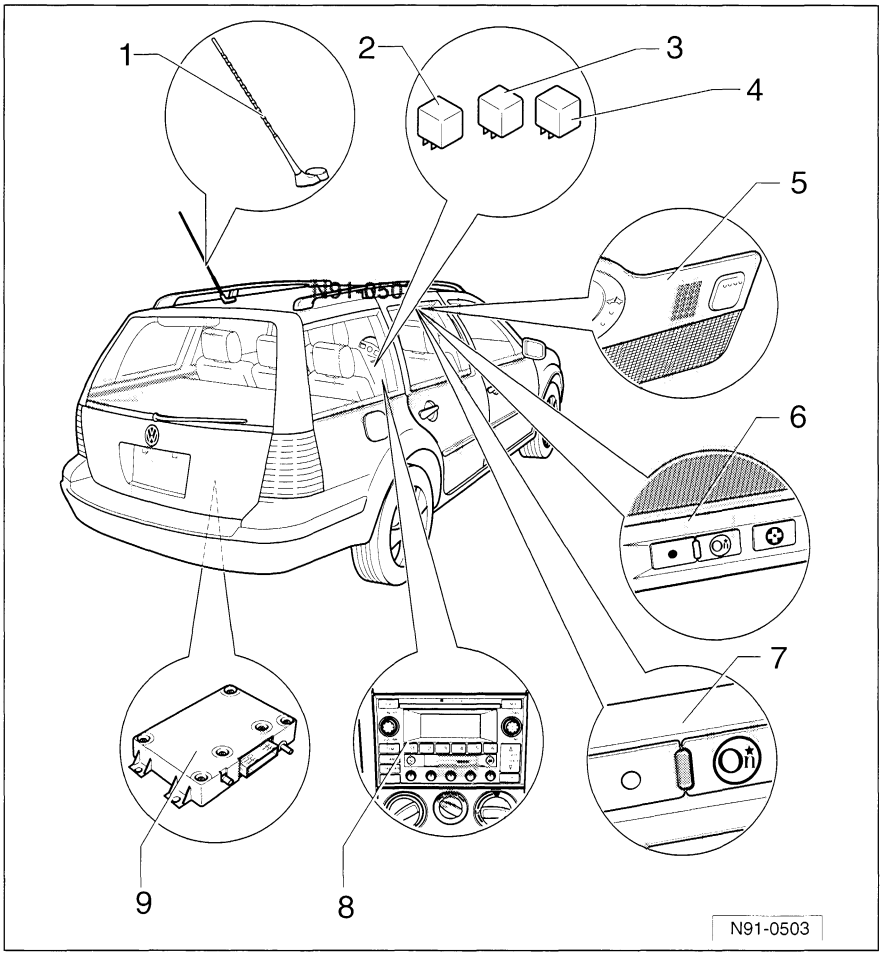
Telematics hardware includes the driver operated telematics control head (which contains the OnStar control buttons and telematics indicator lamp), microphone, roof mounted GPS/Cellular antenna and Telematics Control Module (with supporting software) and related wiring. All telematics components are factory installed/integrated into the vehicle electrical system.

Before troubleshooting or servicing, technicians must be familiar with all telematics functions, operating specifics and the particular service plan which the customer subscribes to. Refer to "Volkswagen Telematics by OnStar" Self Study Program (SSP) and "Volkswagen Telematics by OnStar Owner's Manual and/or OnStar "Quick Reference Guide" to become familiar with applicable features and functions.

The Telematics system has extensive OnBoard Diagnostic capabilities. Access can be obtained with VAS 5051 vehicle diagnostic tool in "Guided Fault Finding" mode or with the VAG 1551/1552 diagnostic scan tool using address word 75 "Telematics".

Telematics system, component overview

1. **Antenna (R11), Antenna Amplifier (R24) and Antenna for GPS Navigation System (R50)**
   - On roof, rear
2. **Dual Horn Auxiliary Relay (J733)**
   - On 13-position auxiliary relay panel, above relay panel.
3. **Auxiliary Emergency Flasher Relay (J517)**
   - On 13-position auxiliary relay panel, above relay panel
4. **Warning Lamp Auxiliary Relay (J734)**
   - On 13-position auxiliary relay panel, above relay panel.
5. **Telephone Microphone (R38)**
   - Integrated with front interior light module.
6. **Telematics Control Head (E264)**
   - In front headliner ahead of front interior light module.
   - Includes telematics indicator lamp.
7. **Telematics Indicator Lamp (K186)**
   - In Telematics Control Head.
   - LED indicates telematics system operational status
   - Green: indicates system has passed self-test and is ready for operation. Light remains on even in areas without cellular coverage
   - Blinking green: indicates a call has been initiated or is in progress
   - Red: indicates system has not passed self-test or other malfunction
8. **Radio (R)**
   - In center console
9. **Telematics Control Module (J499)**
   - Jetta Wagon, Golf & GTI - installed in luggage compartment in spare tire well
   - Jetta sedan - installed in luggage compartment under parcel shelf



Telematics Control Head - OnStar control buttons, description

The telematics control head is in the front headliner ahead of the front interior light module. The control head contains three separate buttons as well as a system telematics indicator lamp (LED).

The OnStar ("On") button is used to contact the OnStar call center to request various convenience services. It is also used to initialize or activate the owner's subscription to OnStar services and/or update the customer's account in the event that the Telephone or Telematics Control Module requires replacement.

The Emergency button is used to contact the OnStar call center to request emergency services such as fire department, police etc.

The Communication ("DOT" button is used to end a call to the OnStar call center, place or answer personal calls or cancel a call if one of the other buttons is accidentally pressed.

NOTE —

Use of certain OnStar services requires a subscriber's Personal Identification Number(s) (PIN).

92 Wipers and Washers

GENERAL 92-1

WIPERS AND WASHERS 92-1
Rubber wiper inserts, replacing 92-2
"Aero-wiper" blades, removing and installing . . 92-2
Wiper arm, front, removing and installing 92-3
Wiper motor, front, removing and installing . . . 92-4
Rear wiper assembly 92-6
Rear window washer jet, replacing 92-7
Windshield washer system overview 92-7
Windshield washer jets, removing 92-8
Windshield washer system jets, adjusting 92-8
Windshield washer reservoir, removing 92-9

GENERAL

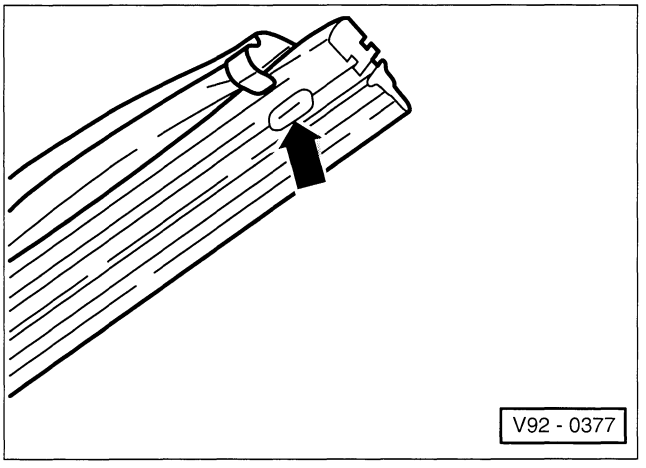
The front windshield wipers are operated by the wiper switch on the steering column. There is a small lever on the top of the wiper switch which adjusts the interval when the wipers are in delay mode. Pulling the wiper switch back toward the passenger compartment operates the washer and the wipers automatically.

Some vehicles are equipped with heated washer nozzles which do not have a separate switch and are automatically activated (with ignition switched on) depending on outside temperature.

WIPERS AND WASHERS

CAUTION —

- *Worn or dirty wiper blades will reduce visibility, making driving hazardous. Clean blades regularly to remove road film and car wash wax build-up. Use an alcohol based cleaning solution and a lint free cloth to wipe along the rubber blade.*
- *Clean all inside and outside glass regularly. Use an alcohol based cleaning solution and wipe dry with a lint free cloth.*
- *Do not use the wiper/washer in freezing weather without first warming the windshield with the defroster. Otherwise the washer solution may freeze on the windshield and obscure your vision.*
- *To prevent scratching the glass avoid running the wiper blades over a dry windshield. A scratched windshield will reduce visibility and increase glare.*



Rubber wiper inserts, replacing

– Free end of wiper insert from retaining hooks by squeezing metal strip in insert with pliers.

– Slide rubber insert from retaining hooks.

– Slide rubber insert into lower retaining hooks of wiper blade.

NOTE —

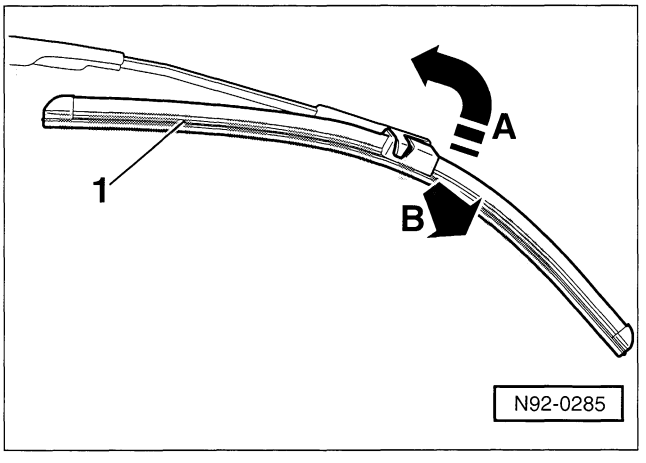
If necessary, transfer metal strips from old insert to new insert. Notches in metal strips must face rubber and engage rubber lugs in groove.

➢ Squeeze metal strips at open end of rubber insert using pliers and install insert into hooks so that hook engages rubber retaining slot (**arrow**) on insert.

"Aero-wiper" blades, removing and installing

NOTE —

- *"Aero-wiper" system installed as a running change during m.y. 2002.*
- *To ensure proper wiper performance, only grab/lift Aero-wiper blades at the mounting pivot on wiper arm when removing and installing.*
- *Driver and passenger wiper blades are different lengths. Damage will result if wiper blades are interchanged.*



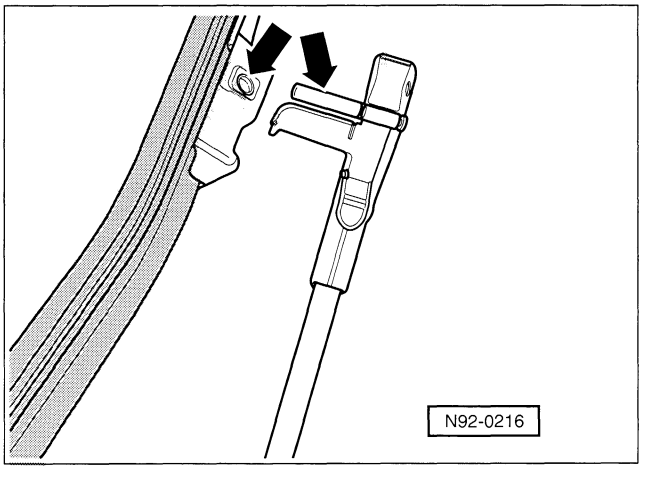
– Bring wiper arm to park position.

– Switch off all electrical consumers, switch off ignition and remove ignition key.

– Lift Aero-wiper blade/arm assembly from windshield. See **Notes** above.

➢ Tilt wiper blade (**1**) on mounting pivot in direction of **arrow A** until it reaches stop.

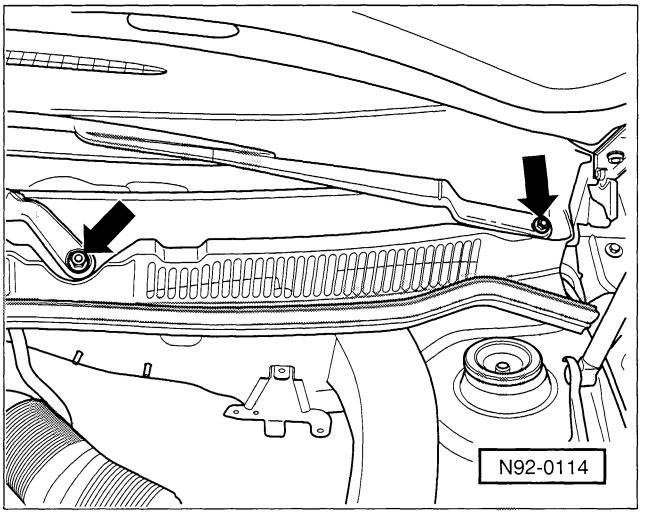
– Detach wiper blade from mounting pivot in direction of **arrow B**.



➢ To install insert wiper blade onto wiper arm mounting pivot (**arrows**).

– Engage blade by tilting on pivot until blade is parallel with arm.

– Return arm/blade assembly to windshield. See **Notes** above.

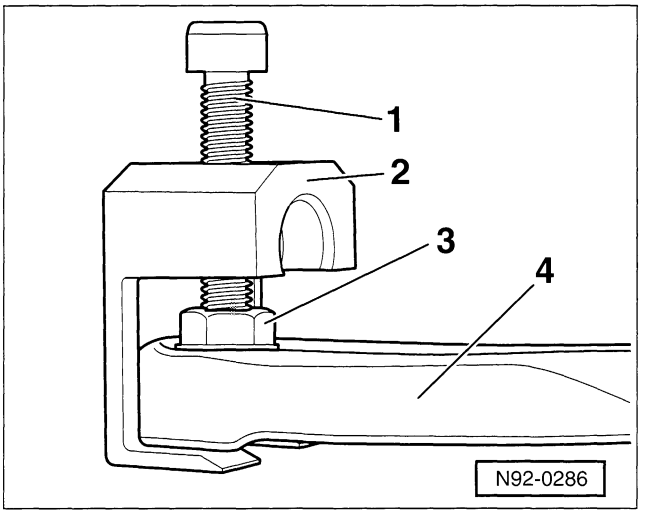


Wiper arm, front, removing and installing

– Be sure wipers are set at park position.

➢ Pry off protective cap and loosen wiper arm mounting nuts (**arrows**), but do not remove completely.

– Move wiper arm slightly to release from tapered mounting shaft.



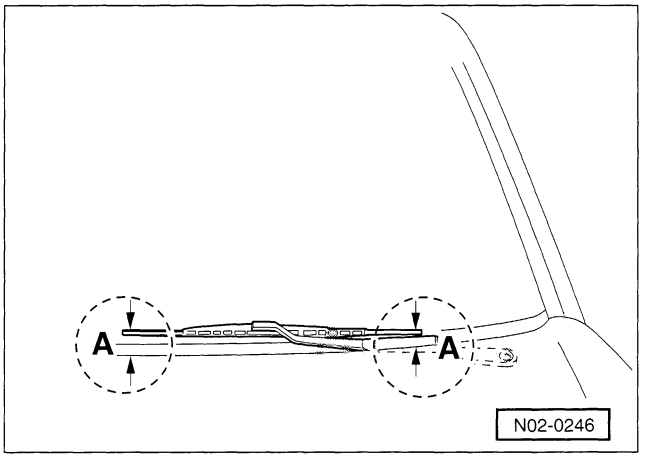
➢ If wiper arm does not come off tapered mounting shaft it may be necessary to use a small puller, such as VW special tool T10130, or equivalent.

– Position puller as shown at left. Turn spindle screw (**1**) clockwise until it engages the wiper shaft and previously loosened mounting nut (**3**). The nut serves as a centering guide for puller spindle.

– Continue to turn spindle screw (**1**) until wiper arm (**4**) releases from shaft. Remove puller.

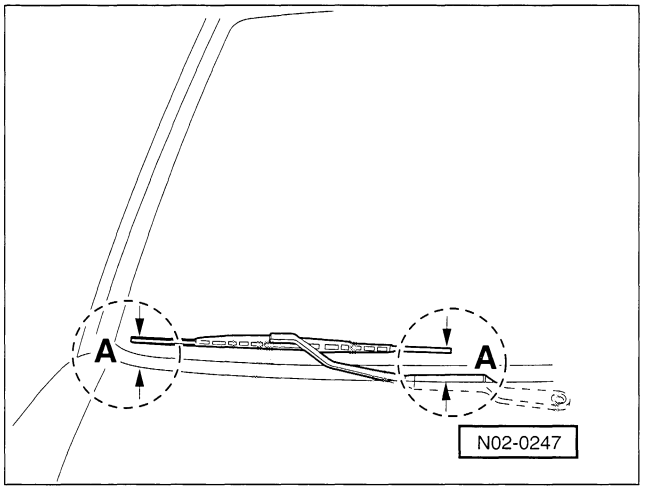
– Remove mounting nut and take off wiper arm.

– When installing wiper arm, be sure to carefully align end of arm onto tapered shaft before tightening mounting bolt.



➢ Install driver's side wiper arm.

- Driver's side wiper arm position: dimension A = 25 ± 5mm measured at ends of wiper blades



Install passenger side wiper arm.

- Passenger side wiper arm position; dimension A = 25 ± 5mm measured at ends of wiper blades.

Tightening torque

- Wiper arm to shaft . . . . . 20 Nm (15 ft-lb)

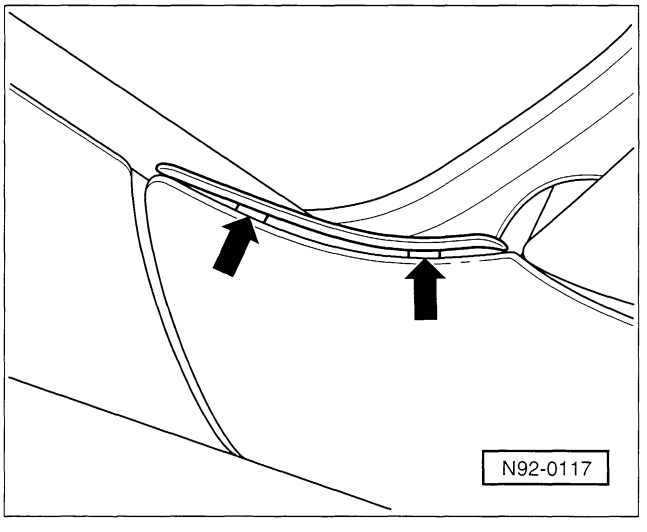
Wiper motor, front, removing and installing

– Make sure the wiper arms are in park position. Only then can wiper arm end position be correctly set when reinstalling.

– Disconnect battery ground (GND) strap from battery negative (–) terminal.

NOTE —
Be sure to have the anti-theft radio code on hand before disconnecting the battery.

CAUTION —
Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using a VAG 1551/1552 or equivalent scan tool.



– Remove wiper arms as described above.

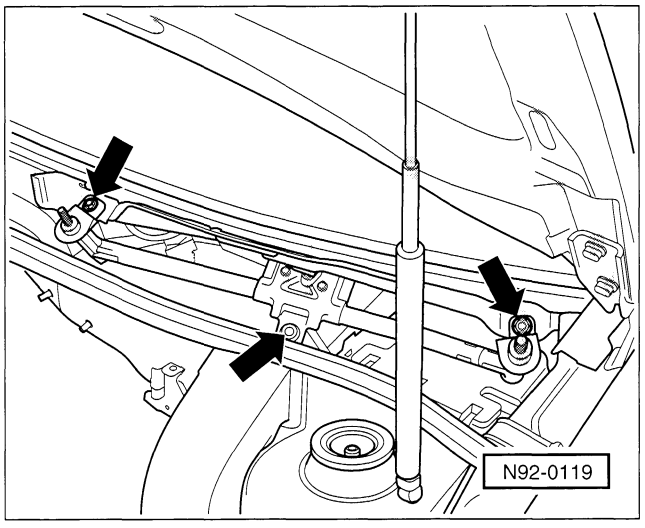
– Pull up plenum panel rubber gasket and remove.

– Remove dust and pollen filter cover.

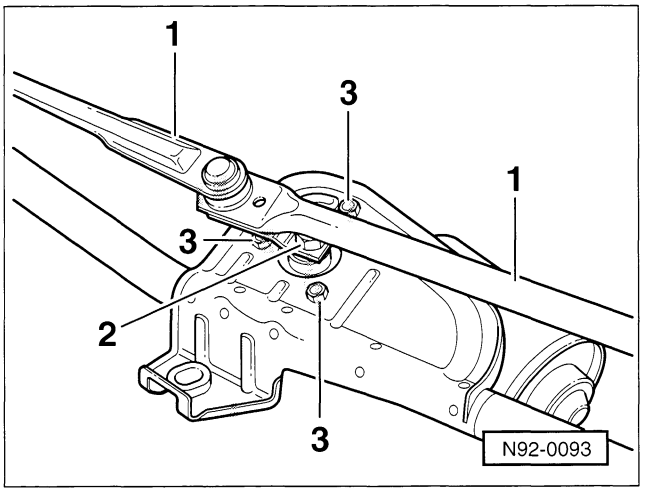
Unclip trim on inner fender at both sides (**arrows**).

– Carefully pry cowl panel upward and off.

NOTE —
The cowl panel is attached to a window guide underneath the windshield.



- Disconnect wiper motor harness connector and remove wiper motor assembly mounting nuts and washers (**arrows**).
- Remove complete wiper motor assembly from cowl.
- Pry connecting rods off wiper motor crank using large screwdriver.
- Remove M8 hex nut for crank arm from wiper motor drive shaft.



- Pry off connecting rods (**1**), remove nut for crank arm (**2**) and motor-to-frame mounting bolts (**3**).
- Remove wiper motor from wiper frame.
- Begin installation by connecting harness connector to wiper motor and operating wiper switch briefly to ensure that motor is in park position.
- Disconnect harness connector again and install wiper motor-to-frame mounting bolts.

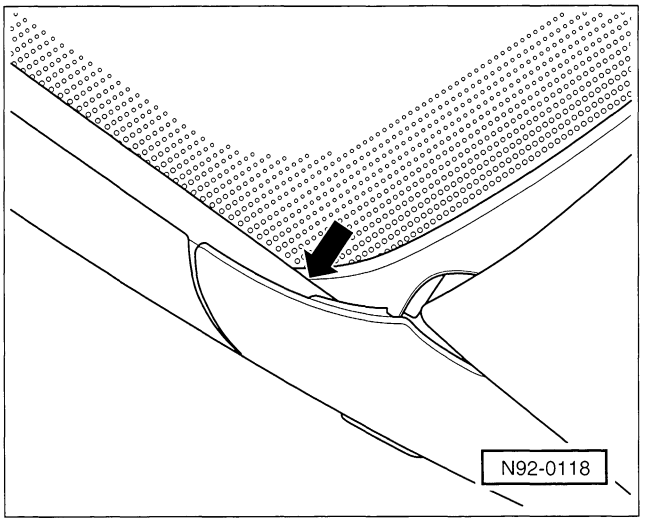
Tightening torque

- Wiper motor to frame . . . . . 8 Nm (71 in-lb)

- Install wiper motor crank and align both connecting rods (**1**) in a straight line.
- Tighten crank arm nut and press rods back onto crank.

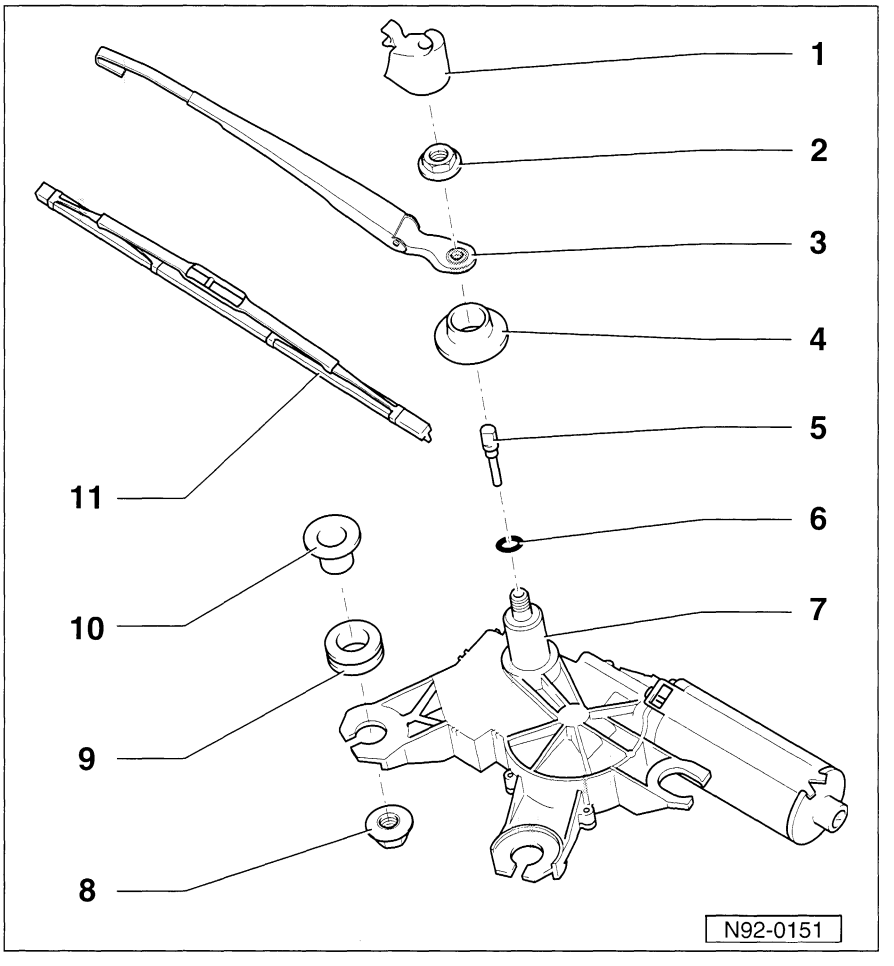
Tightening torque

- Wiper motor crank arm nut. . . . . 20 Nm (15 ft-lb)

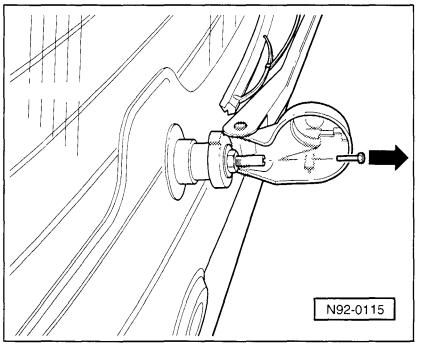


- Install wiper motor assembly into cowl and connect harness connector for motor.
- Install wiper arms as described previously.
- Install ends of cowl panel under rubber strip (**arrow**) at bottom of A-pillar.
- Install rubber gasket for cowl and check operation of wipers.

Rear wiper assembly



1. **Cover cap**
2. **Nut (13mm)**
   - Tighten to 15 Nm (11 ft-lb)
3. **Wiper arm**
   - Adjust gap between wiper rubber and lower edge of window:
     Golf/GTI: 25 mm
     Jetta wagon: 20 mm
4. **Seal**
5. **Washer jet**
   - Use VW special tool T10127 or 3125A window washer adjusting tool, or equivalent to adjust spray pattern
   - Do not use a needle or similar object to adjust jet as the passages in the spray jets will be damaged
6. **Seal**
7. **Wiper motor**
   - Removing:
     Remove rear wiper arm, rear trim panel, harness connector, washer fluid line and three mounting nuts (item 8) for motor
8. **Mounting nuts**
9. **Rubber grommet**
   - Ensure grommet seats properly in rear hatch when installing wiper motor assembly
10. **Spacer**
11. **Wiper blade**



Rear window washer jet, replacing

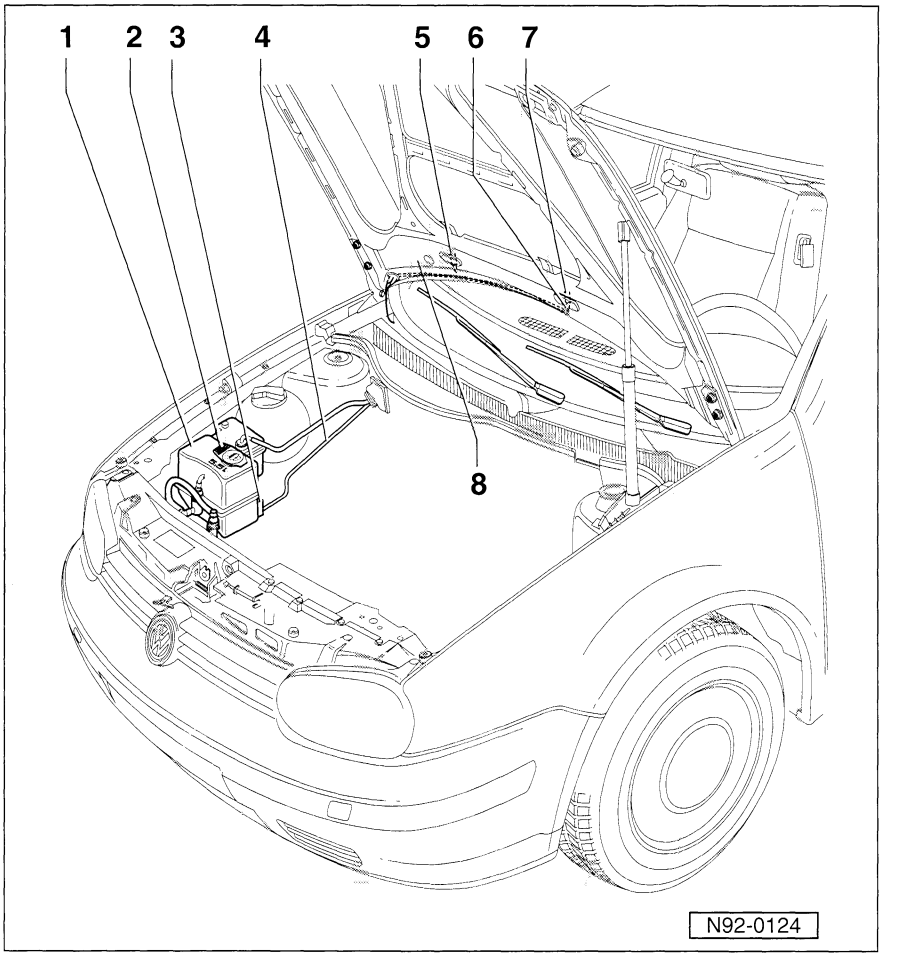
➢ To replace spray jet, fold wiper arm mounting nut cap open and pull out jet with needle nose pliers.

– To install, slide spray jet into wiper arm shaft onto stop with spray jet opening facing horizontally upward.

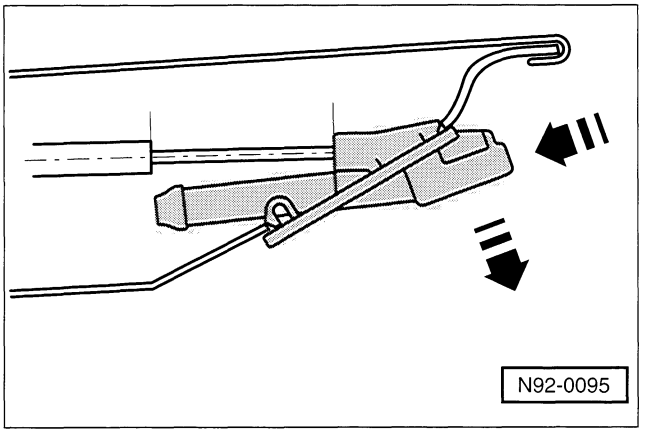
– Check and adjust spray pattern if necessary. Replace cover cap.

Windshield washer system overview

1. **Windshield washer system reservoir**
   - Capacity 5.5 liters
   - For windshield and headlights, as applicable
2. **Container cap**
3. **Windshield washer system pump**
4. **Hose**
5. **Spray jet**
   - Removing, see **Windshield washer jets, removing**
   - Adjusting, see **Windshield washer system jets, adjusting**
6. **Spray jet**
   - Removing, see **Windshield washer jets, removing**
   - Adjusting, see **Windshield washer system jets, adjusting**
7. **Cover**
8. **Junction**
   - Behind cover cap



Windshield washer jets, removing

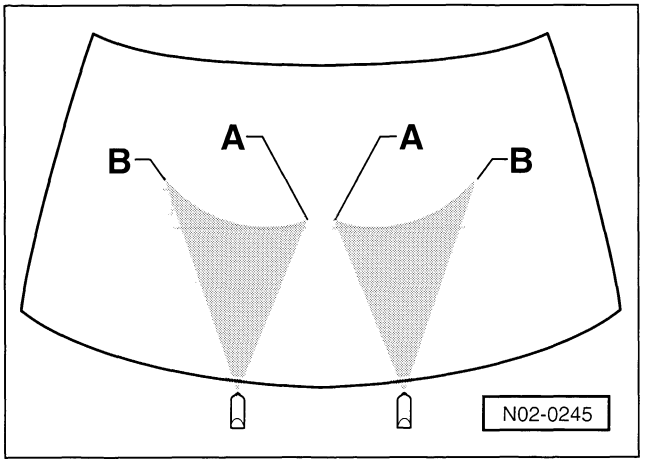


➢ Press jet forward (**arrow**) and remove downward (**arrow**).

– Pull hose off jet and disconnect harness connector.

Windshield washer system jets, adjusting

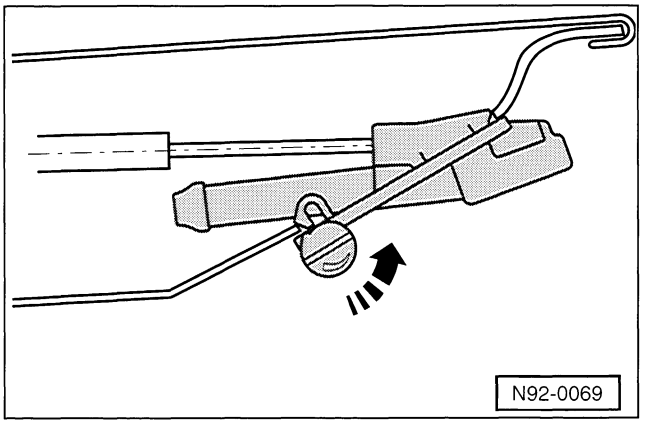
The washer jets are preset but small height adjustments can be made.



➢ Recommended spray fields. Points **A** and **B** are measured from the top of the windshield using a straight line

- Point **A** = 480 mm (18.8 in.)
- Point **B** = 400 mm (15.7 in.)

1999 m.y.

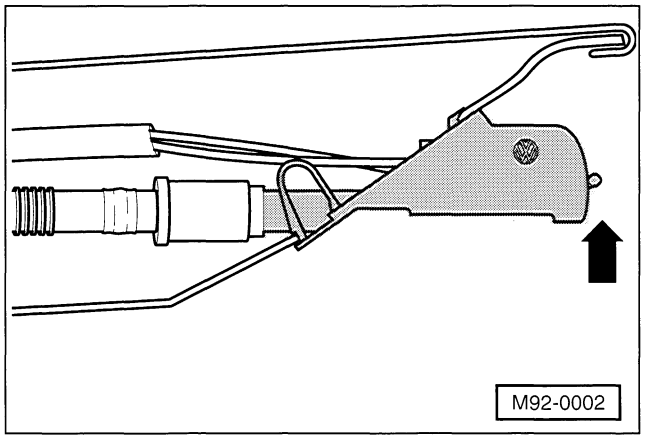


➢ Using screwdriver, turn eccentric on spray jet in direction of **arrow** to move spray field on windshield upward.

– The spray jets must not be cleaned opposite to direction of spray, e.g. blown through from front.

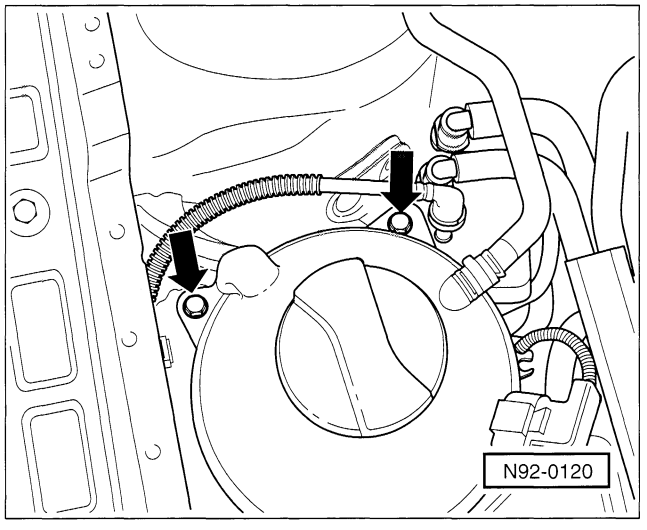
From 2000 m.y. - on

New wiper jets are installed from 2000 m.y. (model year). The washer jets are preset but small height adjustments can be made.

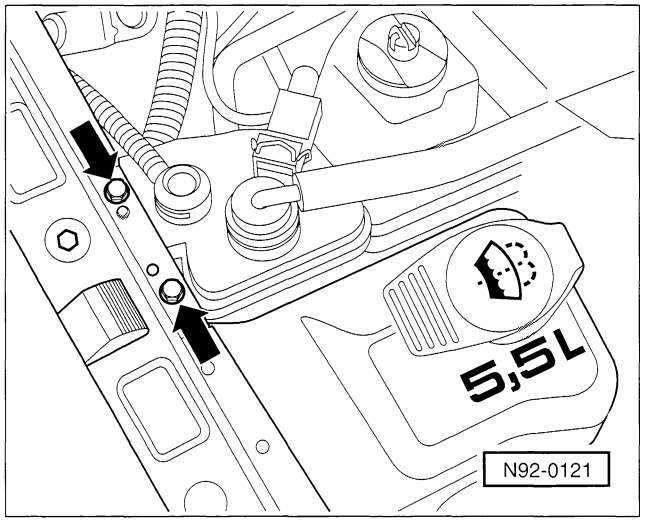


➢ Move spray jet in direction of **arrow** with finger.

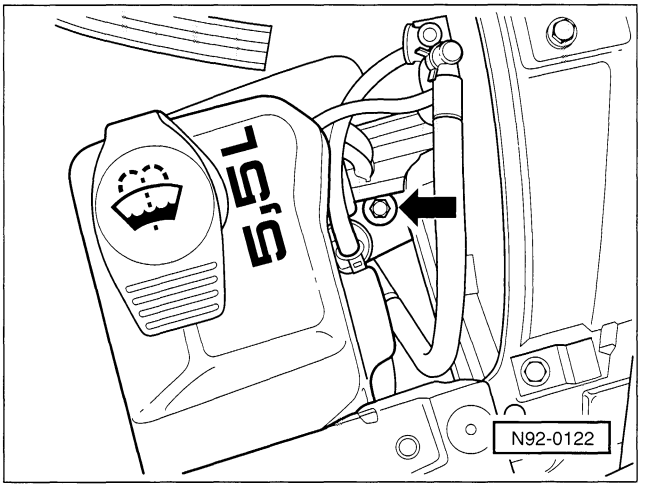
Windshield washer reservoir, removing



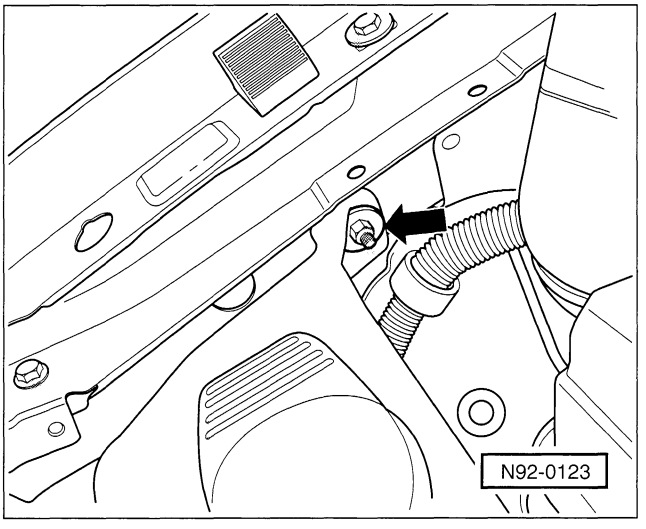
➢ Remove mounting bolts (**arrows**) for coolant expansion tank and position tank out of way with coolant hoses still connected.



➢ Remove mounting bolts (**arrow**) for activated charcoal filter housing and place to side with hoses still attached.

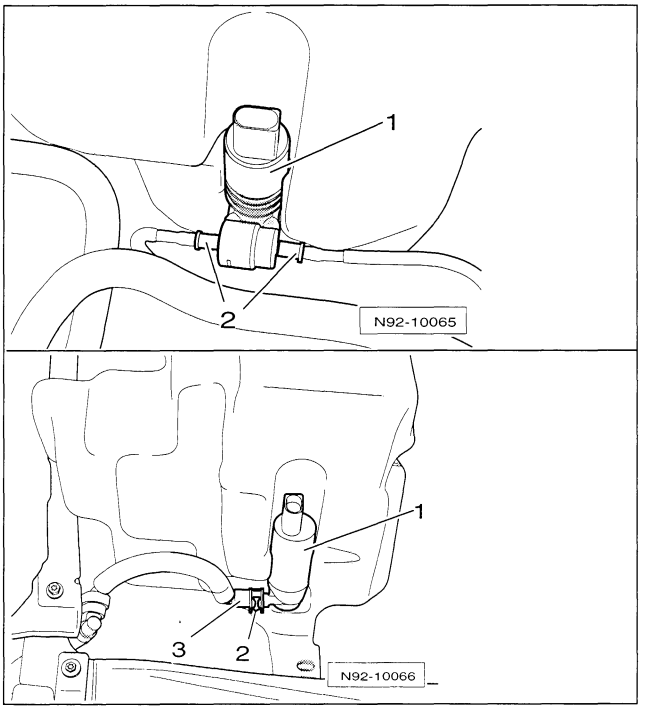


➢ Remove lower plastic mounting nut (**arrow**) from bottom of washer fluid tank.



➢ Remove upper plastic mounting nut (**arrow**) from top of washer fluid reservoir.

–



➢ Remove hose (**2**) and electrical connections from windshield washer pump (**1**).

– Remove washer reservoir.

94 Lights, Accessories–Exterior

GENERAL 94-1

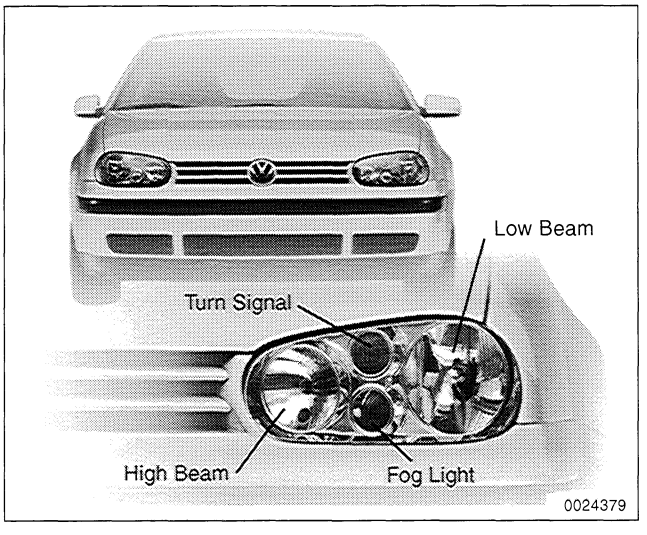
GOLF/GTI EXTERIOR LIGHTS 94-2
- Headlight assembly (Golf/GTI) 94-3
- Headlight aim, adjusting 94-4
- Headlights, removing and installing 94-4
- Headlight bulbs, replacing. 94-5
- Taillight assembly (Golf/GTI) 94-7
- Taillight bulb holder, removing and installing . . 94-8
- Taillight housing, removing and installing 94-8
- High-mount brake light (Golf, GTI, Jetta wagon) removing and installing 94-9

JETTA EXTERIOR LIGHTS 94-10
- Headlight assembly (Jetta sedan and wagon) 94-10
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- Taillight assembly (Jetta) 94-15
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GENERAL

The Jetta and Golf/GTI headlights are styled differently but function the same. The headlight housings enclose the high and low beam lights as well as turn signal and parking lights. The headlights are projector beam lamps for improved lighting and the assemblies are covered with a plastic chip resistant lens.



Fog lights are standard on all GLX models and the GLS version of the GTI. These are also housed in the headlight assembly. Models without fog lights have the fog light openings blocked off.

Jetta wagon models have the same headlight assembly as the Jetta sedan. The wagons have unique taillights which are covered in this section. For the Jetta wagon high mount (3rd) brake light, see **Golf/GTI Exterior Lights**.

This repair group covers removal, installation and replacing of the exterior lights and bulbs.

WARNING —

- *Before working on the electrical system disconnect battery ground (GND) strap from battery negative (–) terminal.*
- *Be sure to have the anti-theft radio code on hand before disconnecting the battery.*
- *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using a VAG 1551/1552 or equivalent scan tool.*

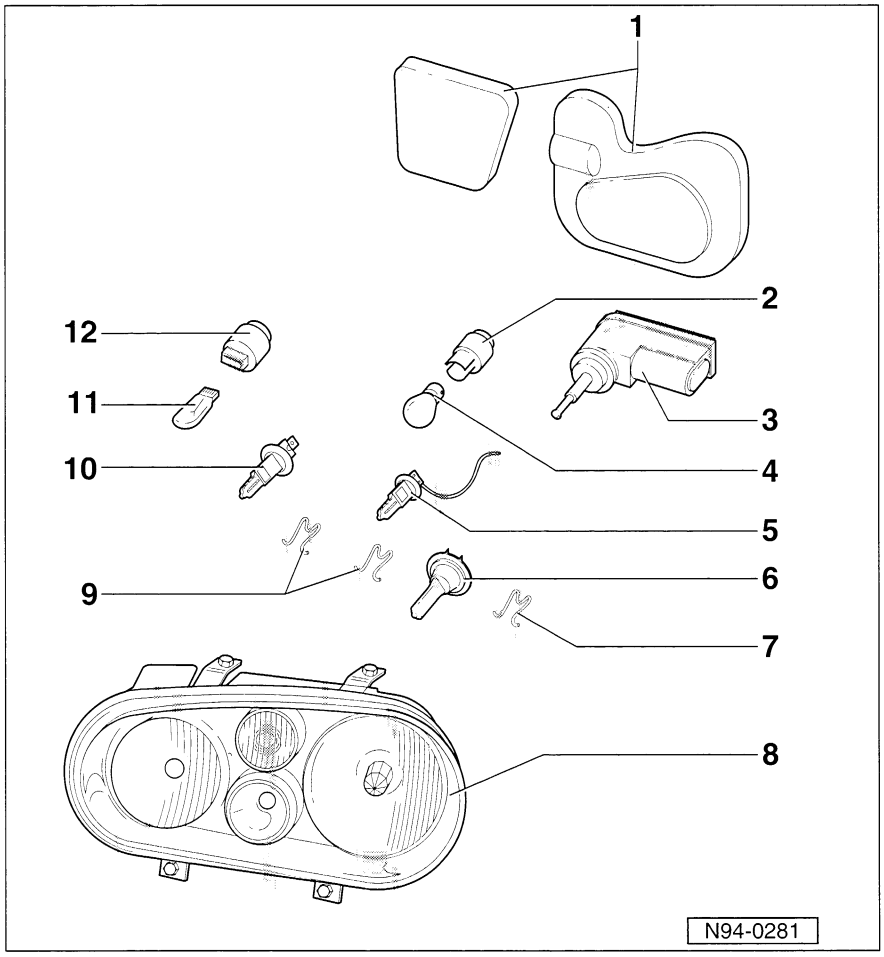
GOLF/GTI EXTERIOR LIGHTS

NOTE —

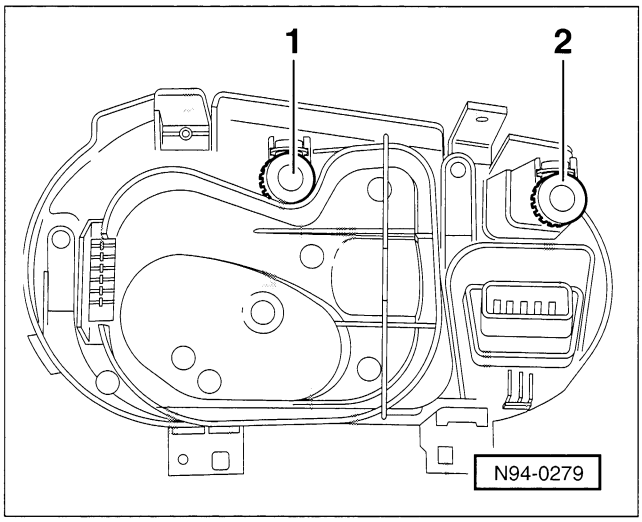
After working on any component of the headlight system that could affect the headlight level setting be sure to adjust the headlights as described later.

Headlight assembly (Golf/GTI)

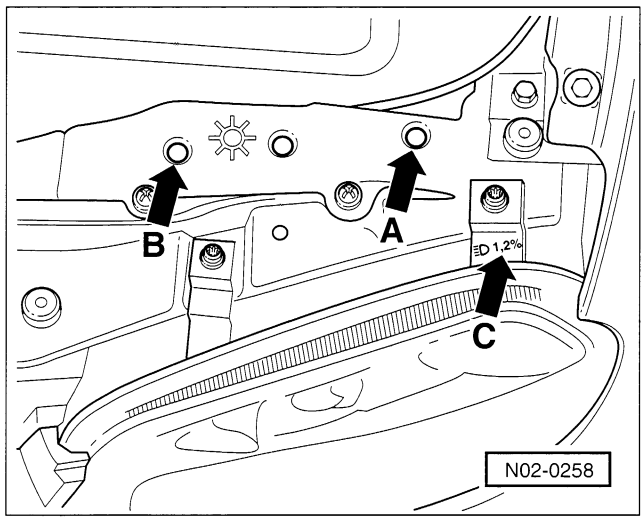
1. **Sealing caps**
2. **Turn signal bulb holder**
3. **Headlight beam range control positioning motor**
   - Adjusts headlight beam based on vehicle load
   - Not currently available on U.S. models
4. **Turn signal bulb**
   - 12V, 21W
5. **Fog light bulb**
   - As applicable
   - 12V, 55W
6. **Low beam bulb**
   - 12V, 55W
7. **Spring clip**
8. **Headlight housing**
9. **Spring clip**
10. **High beam bulb**
    - 12V, 55W
11. **Parking light bulb**
    - 12V, 5W



Headlight aim, adjusting



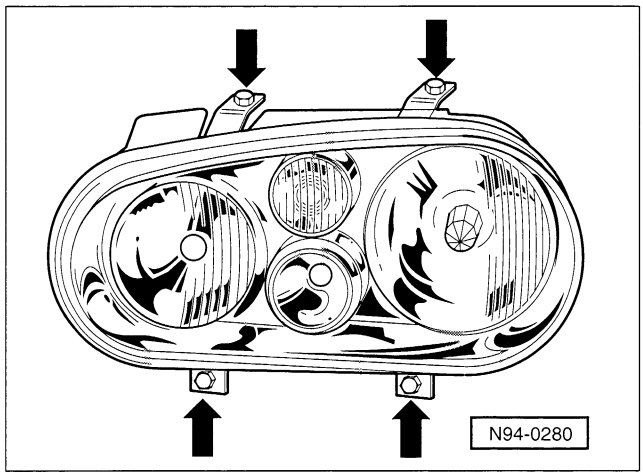
Adjusting the headlights is best accomplished with a commercial headlight adjusting unit using vertical (**2**) and horizontal (**1**) adjustment wheels.



Where applicable, headlight adjusters are accessed through trim on radiator support (left headlight shown, adjusters for right headlight are mirror image).

- A - Lateral adjustment
- B - Height adjustment

Headlights, removing and installing



– Remove bumper cover, see **63 Bumpers**.

Remove headlight mounting screws (**arrows**).

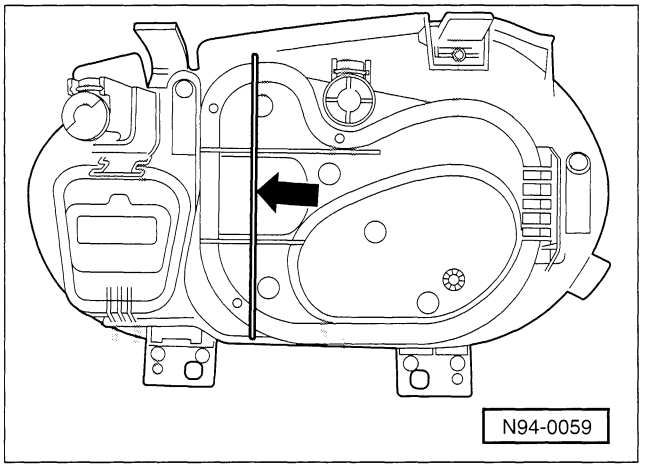
– Pull headlight slightly forward and disconnect harness connector from back. Remove headlight.

– Install headlight in reverse order of removal.

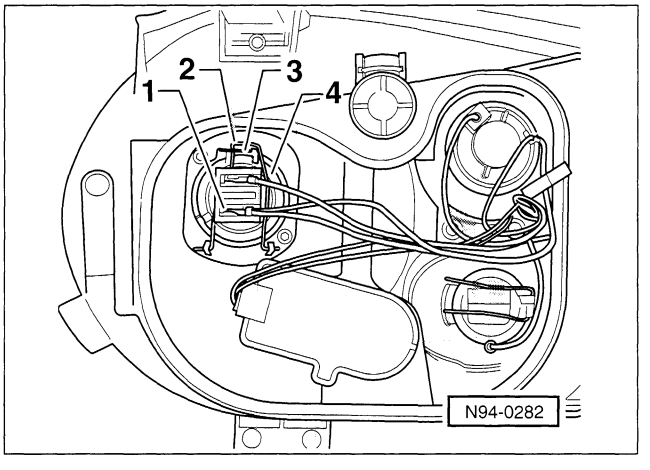
Headlight bulbs, replacing

NOTE —

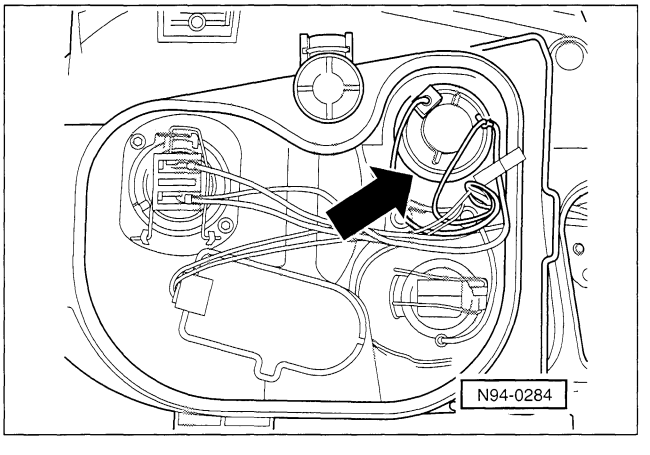
- *Do not touch bulb glass with bare skin when replacing bulb. Fingers leave traces of grease on glass which can cause bulb to cloud over or burn out prematurely.*
- *On vehicles with headlight washer system, move hoses to one side if necessary.*



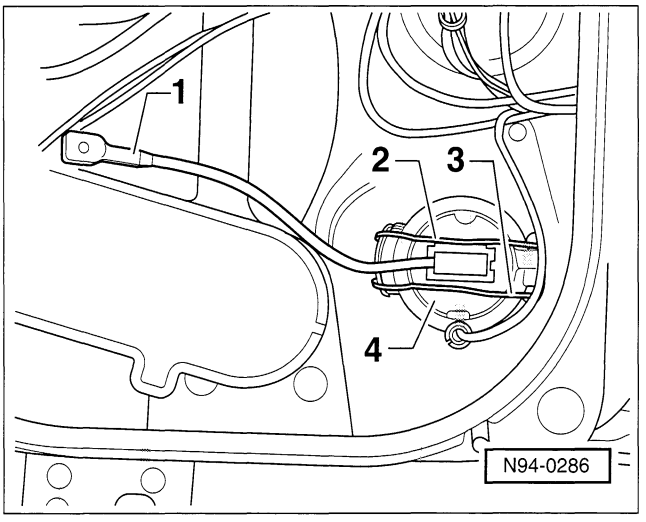
If replacing low beam, turn signal, or fog light bulb, release spring clip (**arrow**) on back of headlight and remove larger sealing cover for those bulbs.



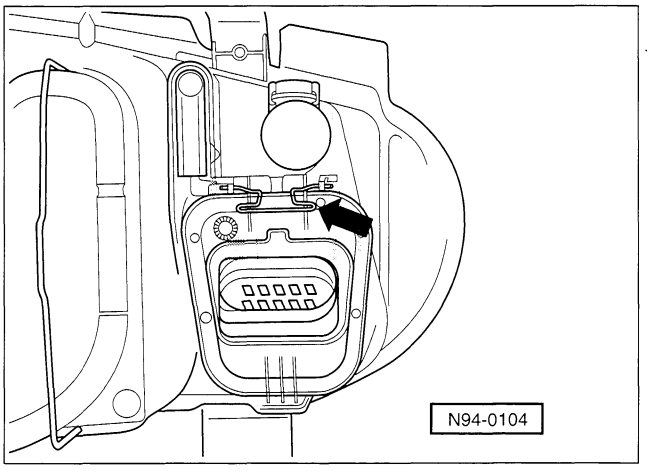
To replace low beam bulb, pull harness connector (**1**) off back of bulb and push retaining clip (**2**) over retaining lugs (**3**) and release clip. Pull bulb (**4**) out of reflector.



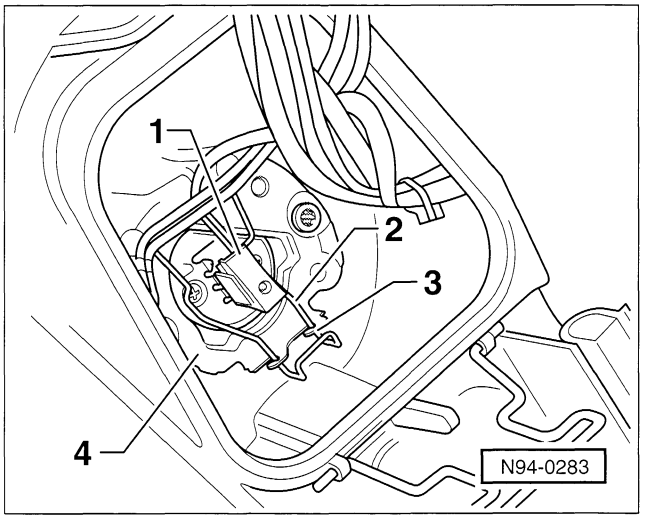
To replace turn signal bulb, turn bulb holder (**arrow**) to left and pull out of housing. Remove bulb from holder.



➤ To replace fog light bulb, pull harness connector (**1**) off bulb and push retaining clip (**2**) over retaining lugs (**3**) and release clip. Pull bulb (**4**) out of reflector.



➤ If replacing high beam bulb only, release spring clip (**arrow**) on back of headlight and remove sealing cover for high beam bulb.



➤ Pull harness connector (**1**) off bulb and push retaining clip (**2**) over retaining lugs (**3**) and release clip. Pull bulb (**4**) out of reflector.

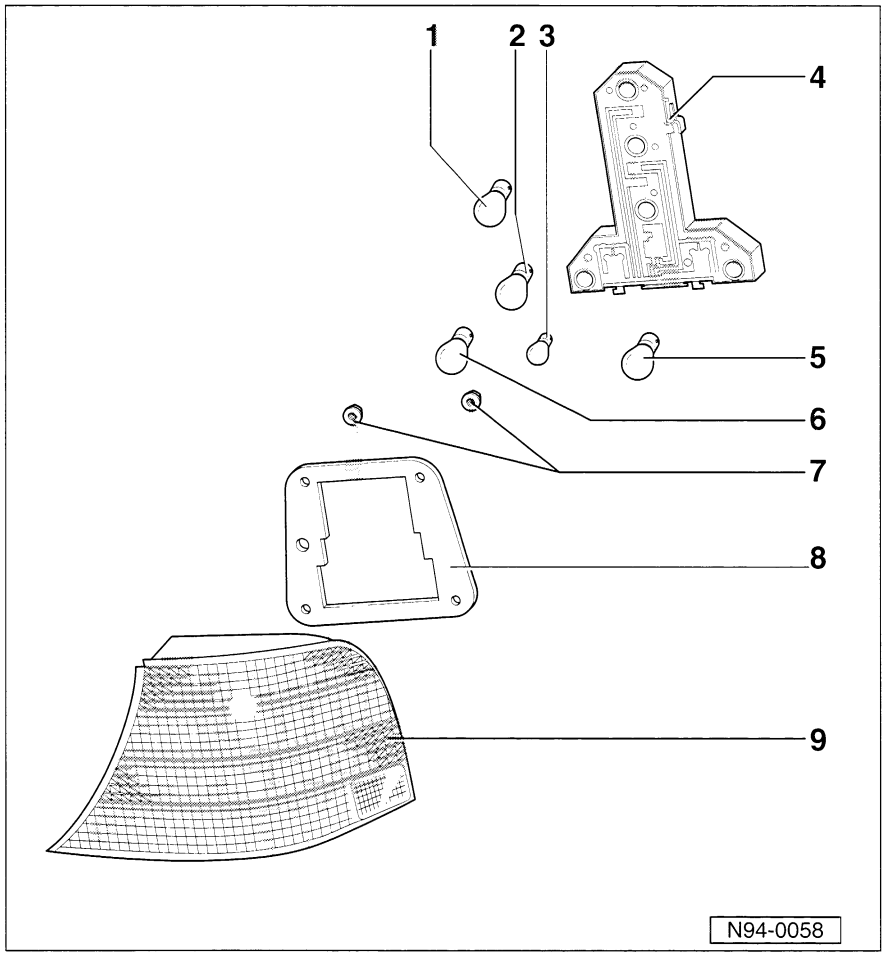
– When installing new bulbs be sure lugs on the bulb plate align with the cut-outs in the reflector, or for turn signal bulb ensure bulb holder engages in housing.

– Secure bulb retaining clip (as applicable), push harness connector back onto bulb and replace sealing cap and spring clip.

– Check headlight aim and operation of all bulbs

Taillight assembly (Golf/GTI)

1. **Brake light bulb**
   - 12V, 21W
2. **Turn signal bulb**
   - 12V, 21W
3. **Taillight bulb**
   - 12V, 10W
4. **Bulb holder**
   - Removing and installing, see **Taillight bulb holder, removing and installing**
5. **Reverse light bulb**
   - 12V, 21W
6. **Rear fog light bulb**
   - 12V, 21W
   - Where applicable, left side only
7. **Hex nuts**
8. **Gasket**
9. **Taillight housing**
   - Removing and installing, see **Taillight housing, removing and installing**

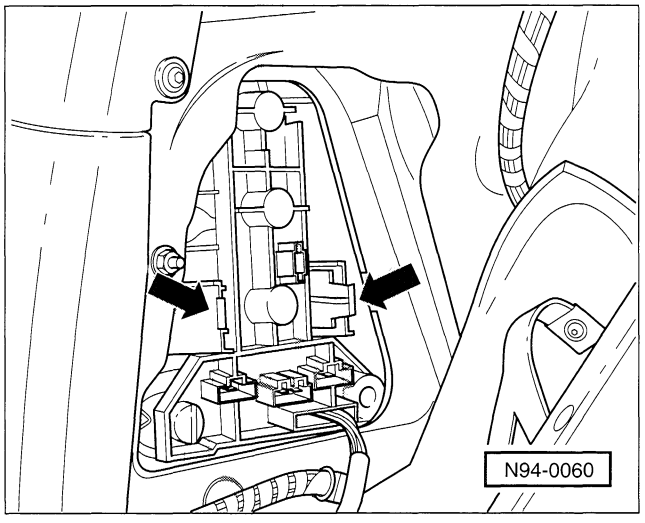


Taillight bulb holder, removing and installing

– Remove trunk liner and rear luggage compartment trim for appropriate side, see **70 Trim–Interior**.

– Pull off harness connector.

NOTE —
It is not necessary to pull off harness connector if only replacing bulbs.



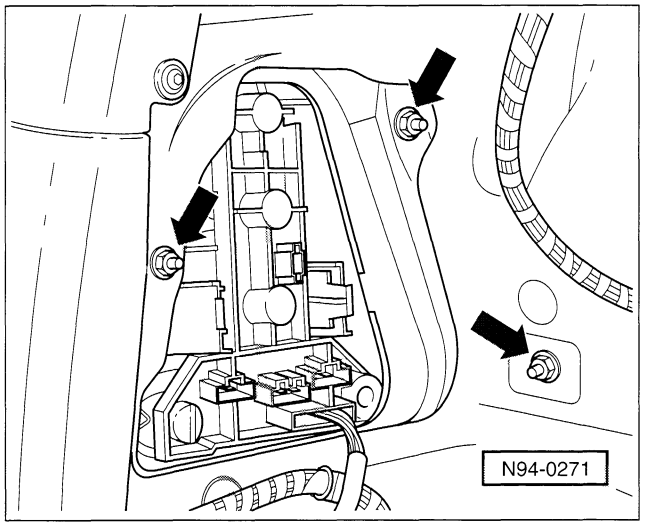
➢ Release retainer clips (**arrows**) and pull bulb holder out.

– Install in reverse order of removal.

Taillight housing, removing and installing

– Remove trunk liner and rear luggage compartment trim for appropriate side, see **70 Trim–Interior**.

– Remove bulb holder as shown above.

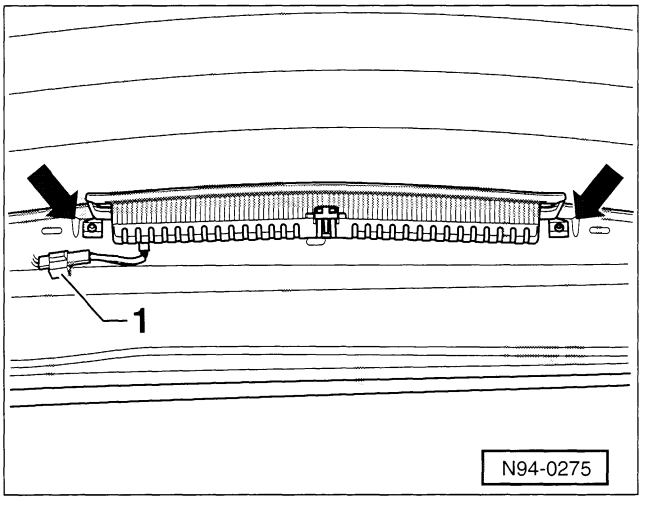


➢ Remove securing nuts (**arrows**) and pull off tail light assembly.

– When installing, tighten securing nuts to 3 Nm (27 in-lb).

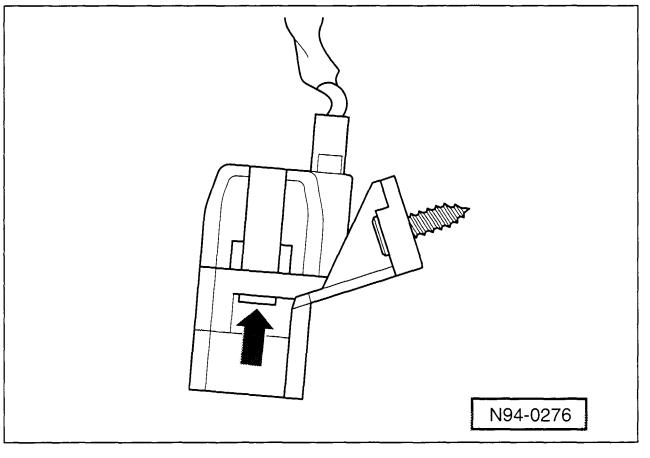
High-mount brake light (Golf, GTI, Jetta wagon), removing and installing

– Remove upper and lower rear lid trim, see **70 Trim–Interior**.

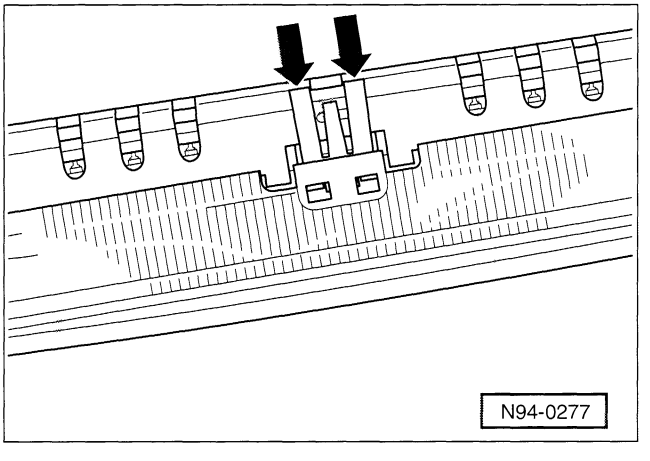


➢ Remove mounting screws (**arrows**) for high-mount brake light and pull off harness connector (**1**).

– Unclip retaining clips from short sides of bulb housing.



➢ Unclip bulb housing at both short sides (**arrow**).



➢ Unclip retaining clips (**arrows**) from long sides of bulb housing and remove housing.

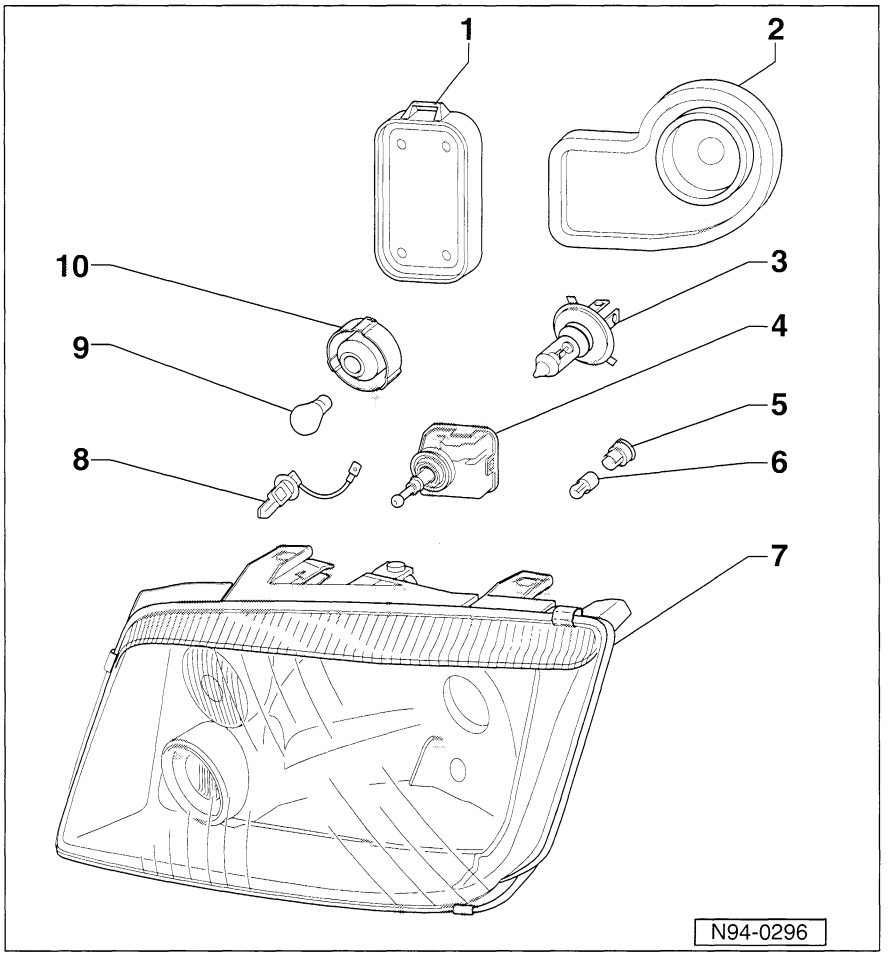
NOTE —

The bulb holder is a circuit board with 32 soldered LED's which are covered by a plastic strip. Changing an individual LED is not recommended and Volkswagen only provides the complete bulb holder as a replacement part.

– Install housing in reverse order of removal.

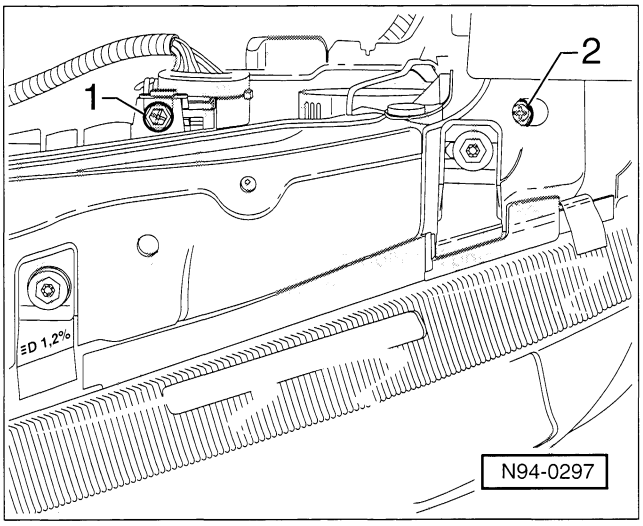
JETTA EXTERIOR LIGHTS

Headlight assembly (Jetta sedan and wagon)



1. **Sealing cap**
2. **Sealing cap**
3. **Dual filament bulb for high and low beam lights**
   - 12V, 70/60W
4. **Headlight beam range control positioning motor**
   - Adjusts headlight beam based on vehicle load
   - Not currently available on U.S. models
5. **Side light bulb holder**
   - Not applicable for US/CDN models
6. **Side light bulb**
   - Not applicable for US/CDN models
   - 12V, 5W
7. **Headlight housing**
8. **Fog light bulb**
   - 12V, 55W
9. **Turn signal/parking light bulb**
   - 12V, 21W/5W
10. **Turn signal/parking light bulb holder**

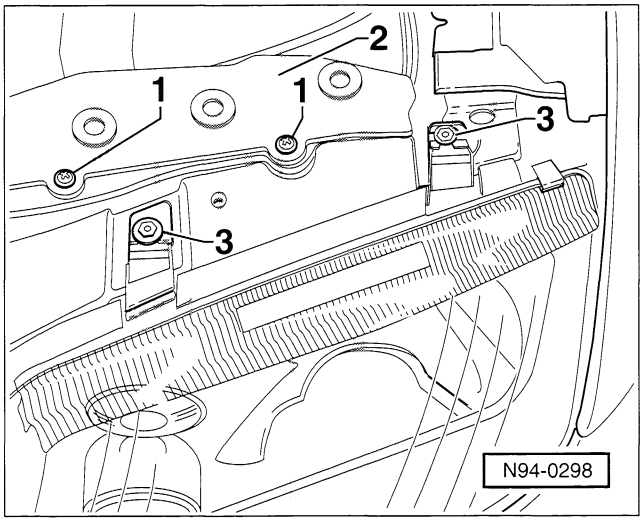
Headlight aim, adjusting



➤ Adjusting the headlights is best accomplished with a commercial headlight adjusting unit using vertical (**2**) and horizontal (**1**) adjustment screws.

NOTE —
Headlight adjustments are done using a screwdriver on the vertical and horizontal adjustment screws that turn the adjustment wheels on the back of headlight.

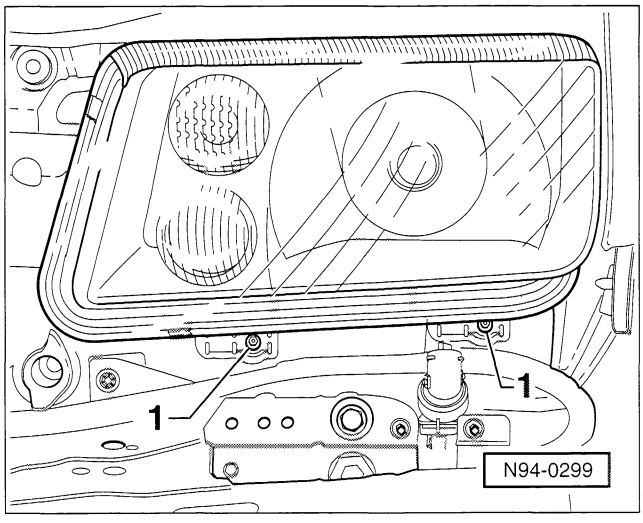
Headlights, removing and installing



– Remove bumper cover, see **63 Bumpers**.

➤ Remove mounting screws (**1**) for headlight upper cover (**2**) in engine compartment and remove cover. Remove upper mounting screws (**3**) for headlight housing.

– Disconnect harness connector from back of headlight.



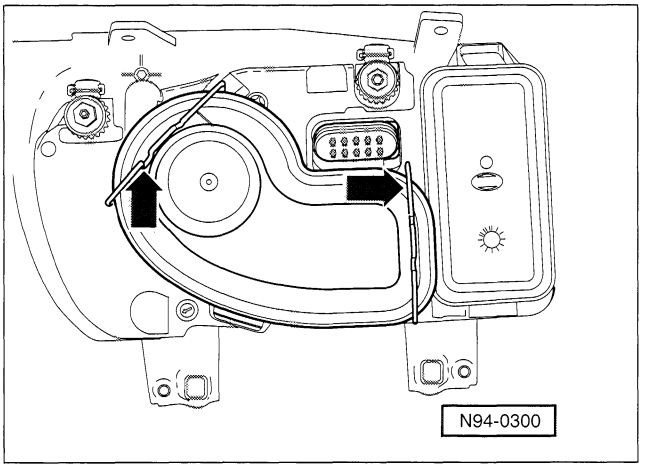
➤ Remove headlight housing lower mounting screws (**1**).

– Remove headlight housing by pulling out forward.

– Installation is the reverse of removal.

– Check headlight aim as necessary.

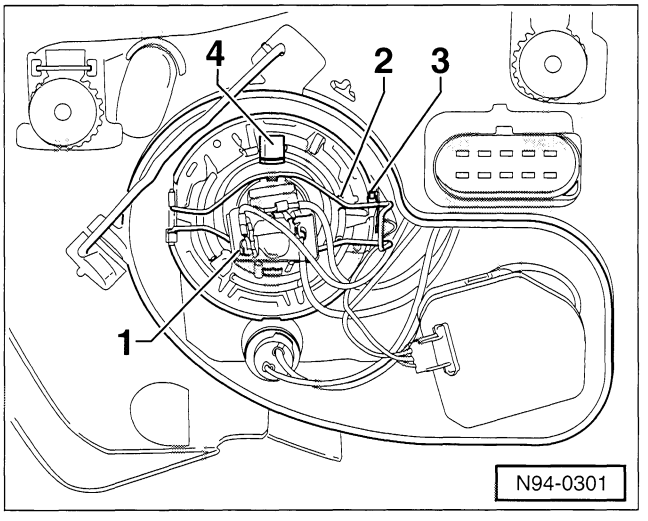
Headlight bulbs, replacing



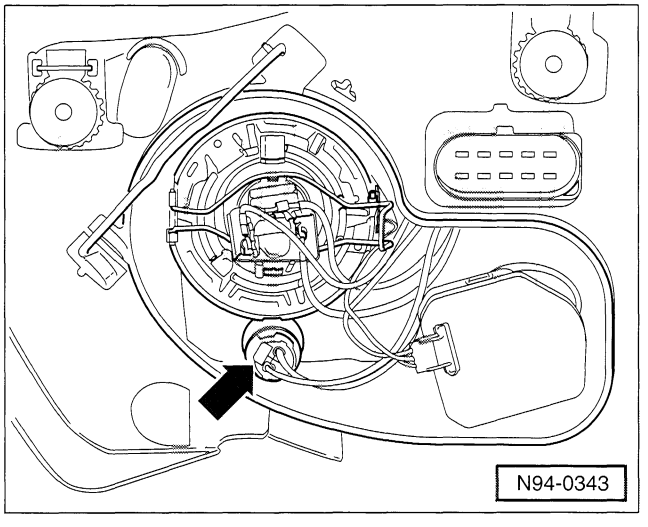
NOTE —

- *Do not touch bulb glass with bare skin when replacing bulb. Fingers leave traces of grease on the glass which can cause the bulb to cloud over or burn out prematurely.*
- *On vehicles with headlight washer system, move hoses to one side if necessary.*

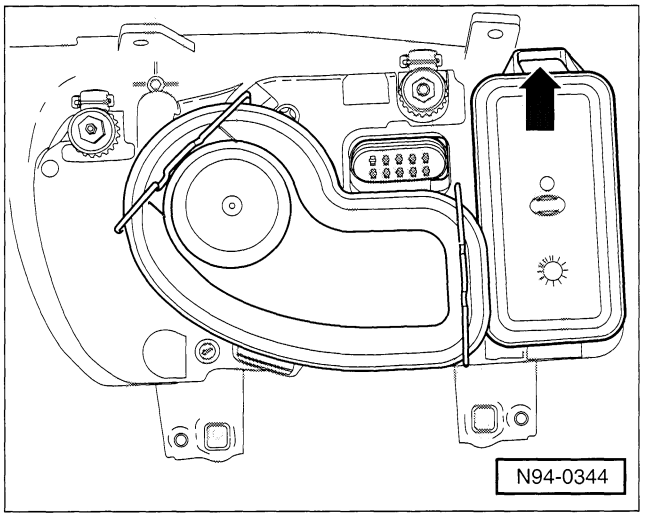
➤ If replacing high/low beam bulb or side light bulb, release spring clip (**arrow**) on back of headlight and remove larger sealing cover for those bulbs.



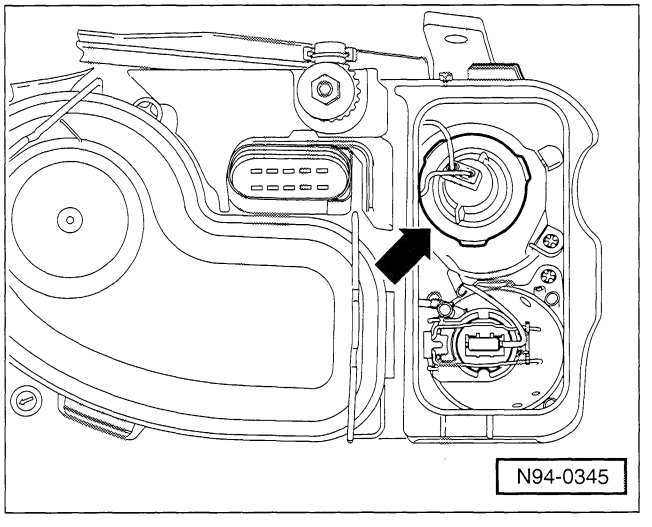
➤ To replace high/low beam bulb, pull harness connector (**1**) off back of bulb and push retaining clip (**2**) over retaining lugs (**3**) and release clip. Pull bulb out of reflector.



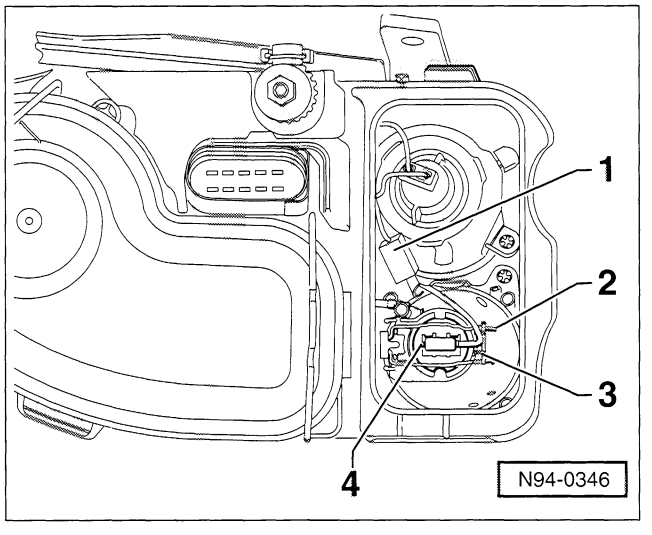
➤ To replace side light bulb, pull bulb holder (**arrow**) out of housing and remove bulb from holder.



➢ To replace front turn signal or fog light bulb, release spring clip (**arrow**) on back of headlight and remove smaller sealing cover for turn signal and fog light bulbs.



➢ To replace turn signal bulb, turn bulb holder (**arrow**) to left and pull out of housing. Remove bulb from holder.



➢ To replace fog light bulb, pull harness connector (**1**) off bulb and push retaining clip (**2**) over retaining lugs (**3**) and release clip. Pull bulb (**4**) out of reflector.

– When installing new bulbs be sure lugs on the bulb plate align with the cut-outs in the reflector, or for turn signal bulb ensure bulb holder engages in housing.

– Secure bulb retaining clip (as applicable), push harness connector back onto bulb and replace sealing cap and spring clip.

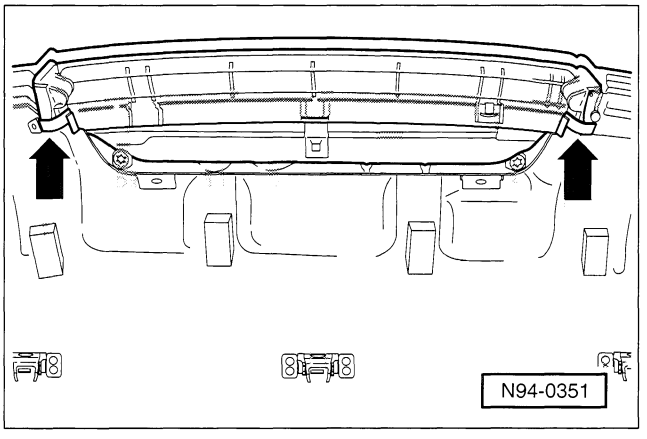
– Check headlight aim and operation of all bulbs.

High-mount brake light, removing and installing

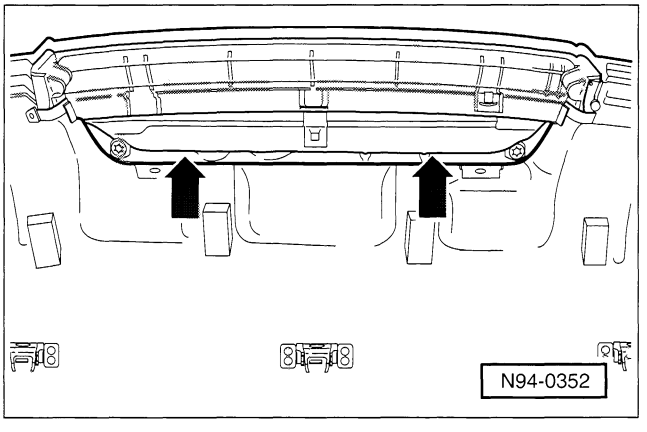
NOTE —
For Jetta wagon models, see High-mount brake light, removing and installing for Golf/GTI models, given earlier.

– Remove harness connector from back of high-mount brake light.

– Remove rear parcel shelf with high-mount brake light, see **70 Trim–Interior**.



➢ Unclip high-mount brake light from rear parcel shelf at **arrows**.



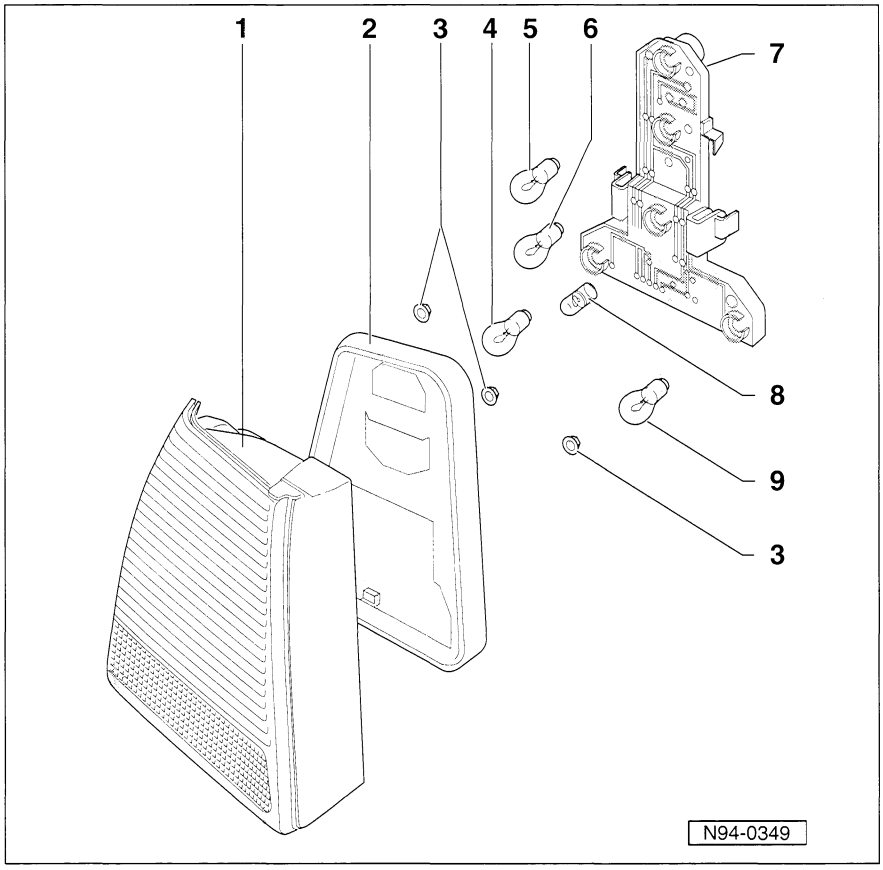
➢ Unclip bulb holder at **arrows** from high-mount brake light housing.

NOTE —
The bulb holder is a circuit board with 18 soldered LED's which are covered by a plastic strip. Changing an individual LED is not recommended and Volkswagen only provides the complete bulb holder as a replacement part.

– Install housing in reverse order of removal.

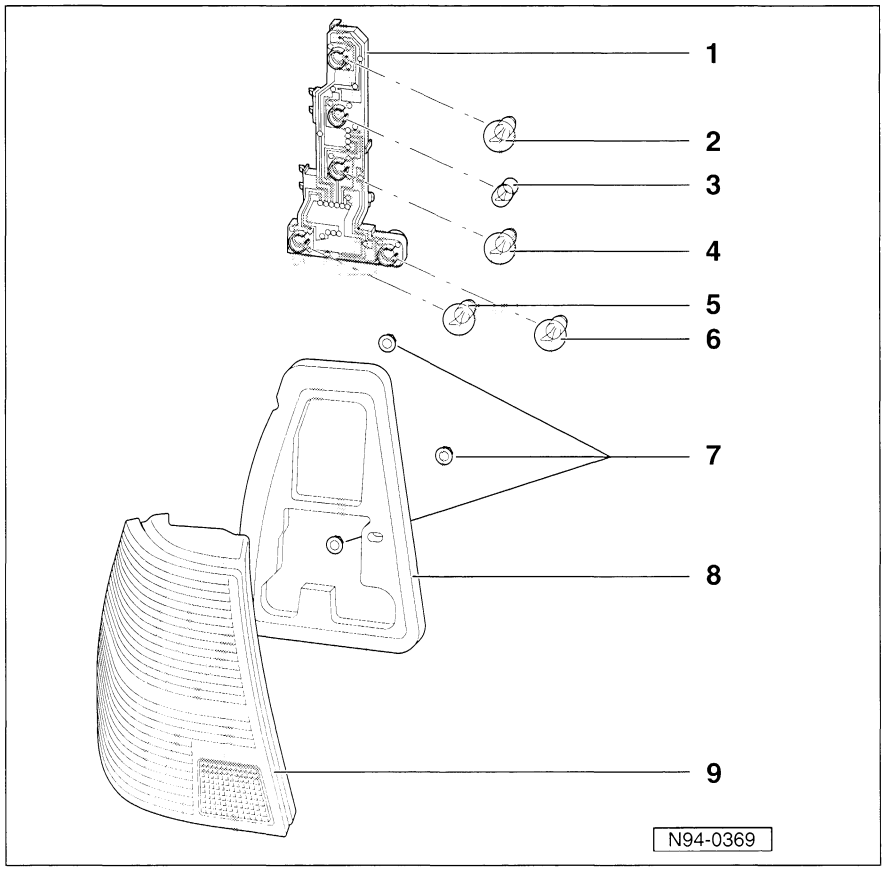
Taillight assembly (Jetta sedan)

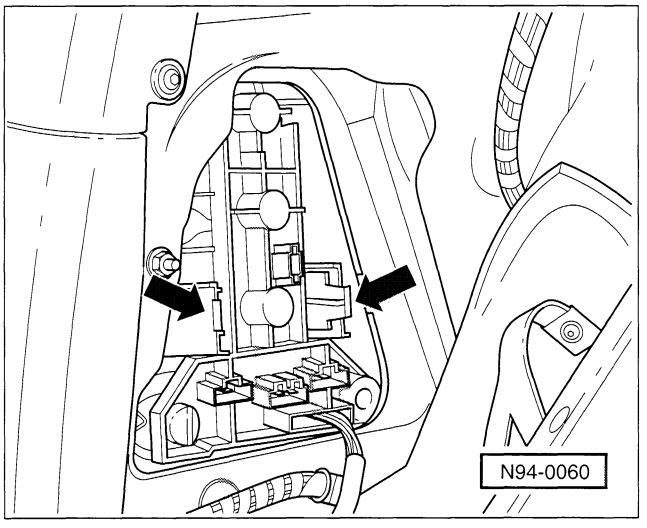
1. **Taillight housing**
   - Removing and installing, see **Taillight housing, removing and installing**
2. **Gasket**
3. **Hex nuts (3)**
4. **Rear fog light bulb**
   - 12V, 21W
   - Where applicable, left side only
5. **Brake light bulb**
   - 12V, 21W
6. **Turn signal bulb**
   - 12V, 21W
7. **Bulb holder**
   - Removing and installing, see **Taillight bulb holder, removing and installing**
8. **Tail light bulb**
   - 12V, 5W
9. **Reverse light bulb**
   - 12V, 21W



Taillight assembly (Jetta wagon)

1. **Bulb holder**
   - Removing and installing, see **Taillight bulb holder, removing and installing**
2. **Brake light bulb**
   - 12V, 21W
3. **Tail light bulb**
   - 12V, 5W
4. **Turn signal bulb**
   - 12V, 21W
5. **Rear fog light bulb**
   - 12V, 21W
   - Where applicable, left side only
6. **Reverse light bulb**
   - 12V, 21W
7. **Hex nuts (3)**
8. **Gasket**
9. **Taillight housing**
   - Removing and installing, see **Taillight housing, removing and installing**





Taillight bulb holder, removing and installing

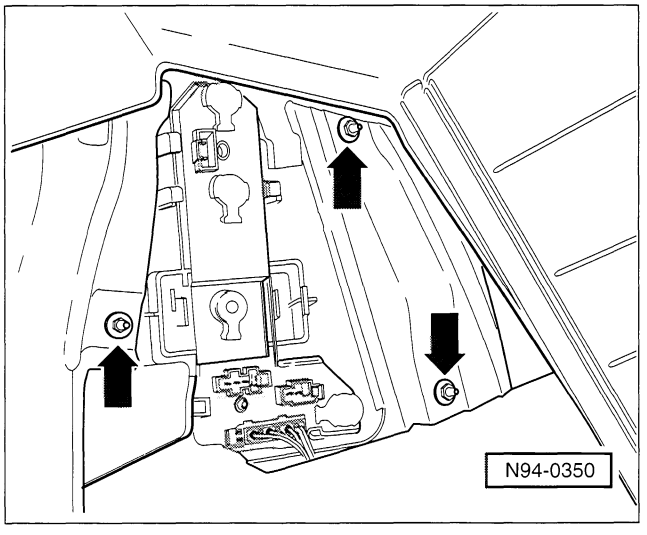
– Remove trunk liner and rear luggage compartment trim for appropriate side, see **70 Trim–Interior**.

– Pull off harness connector.

NOTE —
It is not necessary to pull off harness connector if only replacing bulbs.

➢ Release retainer clips (**arrows**) and pull bulb holder out.

– Install in reverse order of removal.



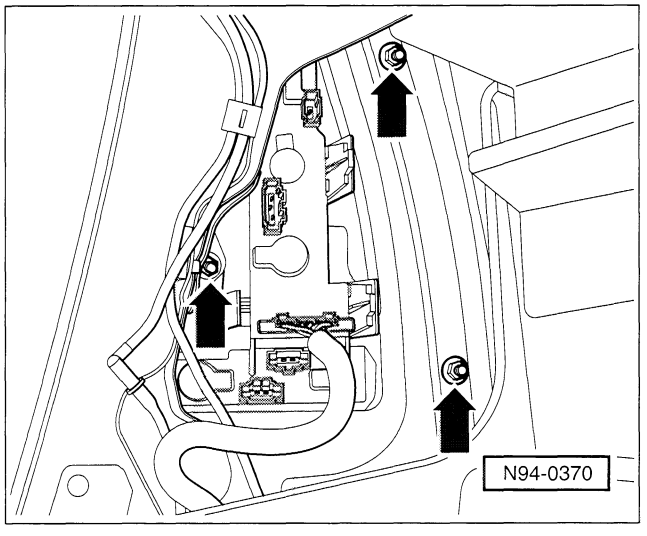
Taillight housing, removing and installing

– Remove trunk liner and rear luggage compartment trim for appropriate side, see **70 Trim–Interior**.

– Remove bulb holder as shown above.

➢ Remove securing nuts (**arrows**) and pull off tail light assembly. (Jetta sedan shown)

– When installing, tighten securing nuts to 3 Nm (27 in-lb).



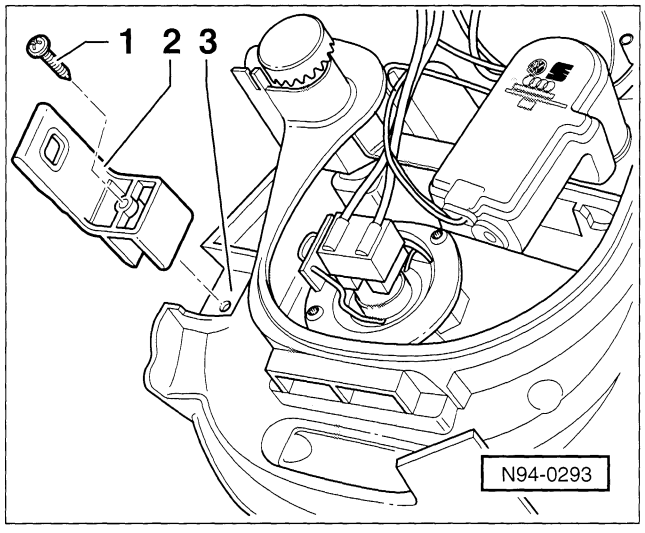
➢ Remove securing nuts (**arrows**) and pull off tail light assembly. (Jetta wagon shown)

– When installing, tighten securing nuts to 3 Nm (27 in-lb).

GOLF/GTI/JETTA EXTERIOR LIGHTS

This section contains procedures for components that are common to all the vehicles covered by this manual.

Headlight upper securing lugs, servicing



NOTE —
If the headlight upper securing tabs have broken off it is possible to replace the tabs with a repair kit from Volkswagen.

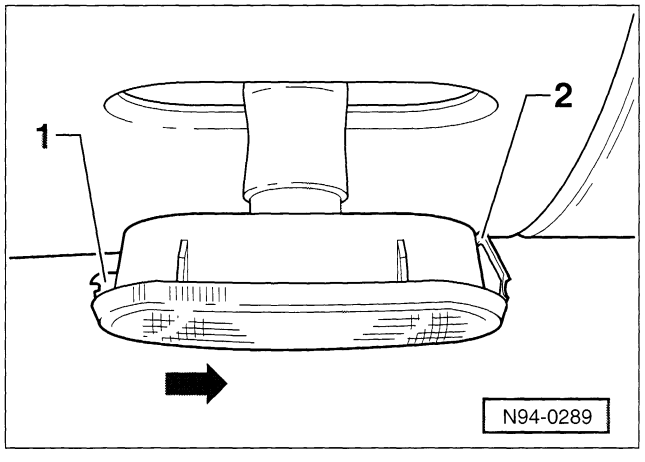
– Remove headlight as previously described.

– Sand down broken headlight tab flat.

➤ Position replacement tab (**2**) onto headlight securing tab socket (**3**) and secure with mounting screw (**1**).

– Install headlight and check aim, adjust as necessary.

Side mounted turn signals, removing and installing



NOTE —
Use extreme caution when removing side-mounted turn signal since it can only be removed in one direction and it is difficult to recognize on which side of the turn signal the spring clip or mounting pin sits.

➤ Using a plastic pry tool, carefully press turn signal at mounting side (**1**) in direction of **arrow** against force of spring clip (**2**) and remove.

NOTE —
Protect paint surface using adhesive tape if necessary.

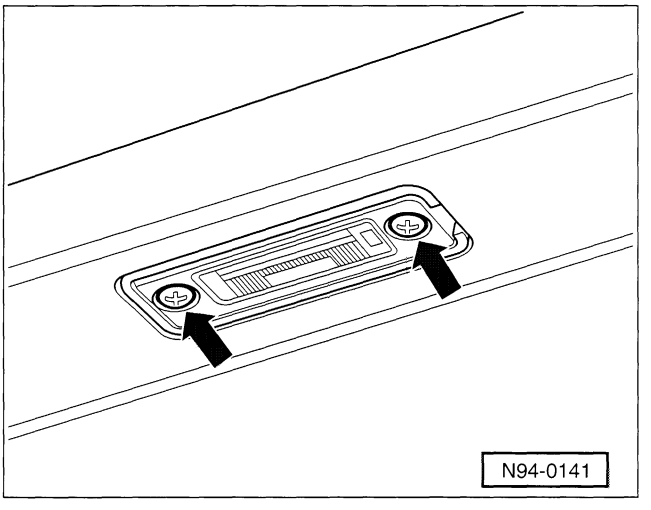
– Pull rubber holder and push-fit bulb from bulb housing.

– Remove bulb (12v, 5W) by pulling from holder and replace if necessary.

– To install, place rubber holder and push-fit bulb onto bulb housing.

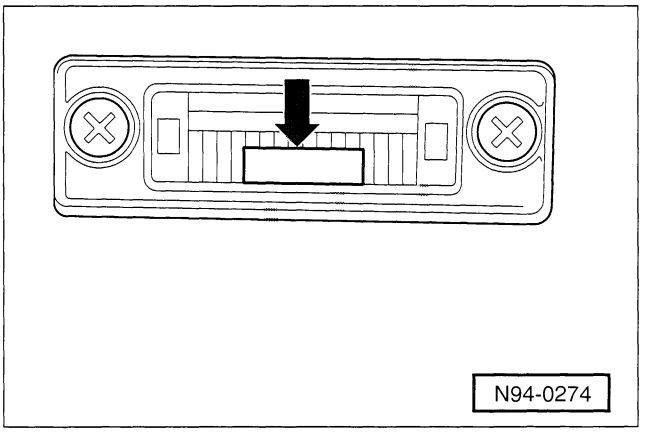
– Carefully install turn signal into body panel and check for proper operation of turn signal.

License plate light, removing and installing



- Remove mounting screws (**arrows**) for license plate light.
- Remove license plate light lens with bulb and disconnect harness connector.
- Remove bulb (12V/5W) and replace as necessary.

> ***CAUTION —***
> *Do not touch the glass portion of the bulb with bare hands. The moisture and/or grease from fingers that evaporates on the bulb during operation, can cause the glass to cloud over.*



- When installing license plate light, be sure that the small silver covered strip (**arrow**) on the license plate light is oriented toward the rear bumper.

96 Lights, Accessories–Interior

GENERAL 96-1

INTERIOR LIGHTS AND SWITCHES 96-1
- Headlight switch, removing and installing 96-2
- Instrument panel light dimmer switch, removing and installing 96-2
- Mirror adjustment switch, removing and installing 96-3
- Door panel switches, removing and installing (driver's side) 96-3
- Door panel switches, removing and installing (passenger side) 96-3
- Instrument panel switches–center, removing and installing 96-4
- Interior light and sunroof switch, removing and installing 96-5
- Rear reading light 96-6
- Luggage compartment light 96-6
- Glovebox light 96-6
- Door warning light 96-6
- Remote fuel tank door/rear lid unlock switch, removing and installing 96-7
- Rear lid handle release button, removing and installing (Jetta) 96-7

ANTI-THEFT IMMOBILIZER 96-8

QUALITY REVIEW 96-10

GENERAL

This section covers electrical light switches and accessories located in the passenger compartment. Items such as radio, heating and A/C that require detailed coverage have their own repair groups. See **97 Wiring Diagrams, Fuses and Relays** for additional information.

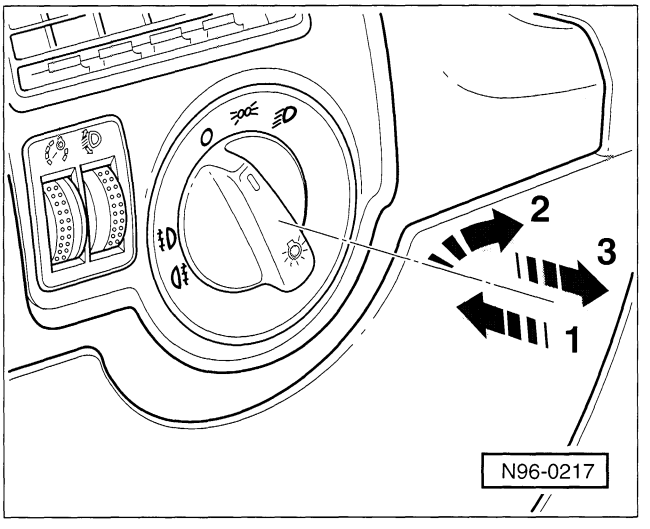
WARNING —
- *Before working on electrical system disconnect negative (–) battery cable.*
- *Before disconnecting battery be sure to obtain radio anti-theft code.*

INTERIOR LIGHTS AND SWITCHES

NOTE —
- *The luggage compartment light switch is integrated into the trunk lock and cannot be replaced separately. If the luggage compartment light switch is faulty the complete trunk lock must be replaced, see* **70 Trim–Interior**.
- *The door contact switch is integrated into the door lock and cannot be replaced individually. The complete door lock must be replaced if the door contact switch is faulty, see* **70 Trim–Interior**.
- *For steering column switches, see* **48 Steering**.

Headlight switch, removing and installing

– Turn rotary knob of light switch to "0" position.

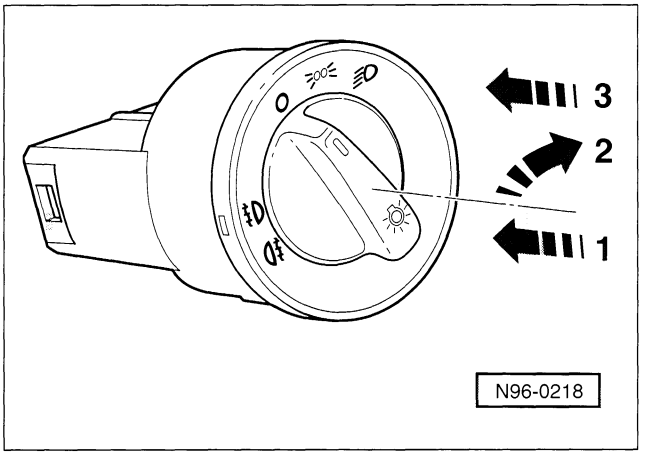


➢ Press rotary knob inward (**arrow 1**) and turn slightly to right (**arrow 2**).

– Hold rotary knob in this position, pull (**arrow 3**) on rotary knob and remove light switch from instrument panel.

– Disconnect harness connector.

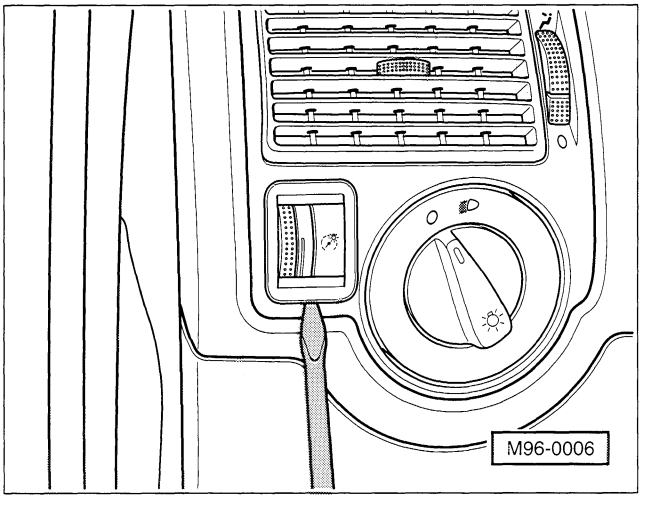
– To install, first connect harness connector.



➢ Hold light switch and press rotary knob inward (**arrow 1**) and turn slightly to right (**arrow 2**). Hold rotary knob in this position and slide light switch into instrument panel (**arrow 3**).

– Turn rotary knob to "0" position, release and engage switch.

Instrument panel light dimmer switch, removing and installing



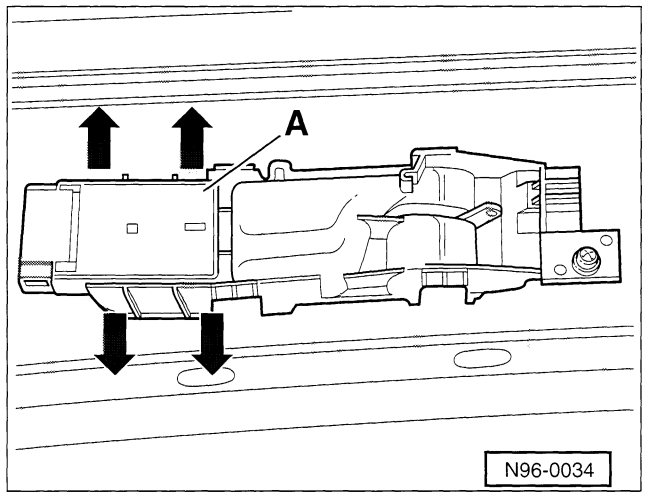
➢ Place screwdriver behind switch housing and carefully pry switch carefully out of locking device.

NOTE —
Use adhesive tape around switch on dashboard and/or on screwdriver to prevent marring of trim.

– Disconnect harness connector.

– To install, first connect harness connector.

– Insert switch into locking device and engage.



Mirror adjustment switch, removing and installing

– Remove interior door trim, see **70 Trim–Interior**.

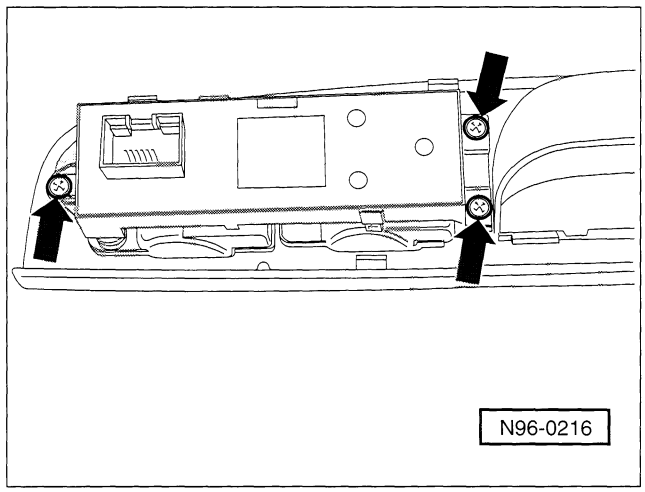
– Disconnect harness connector from switch.

➢ Pry mounting frame outward (**arrows**) on long side of switch and remove switch (**A**) from mounting frame.

– To install, insert switch in mounting frame and engage.

– Connect harness connector.

– Install interior door trim.



Door panel switches, removing and installing (driver's side)

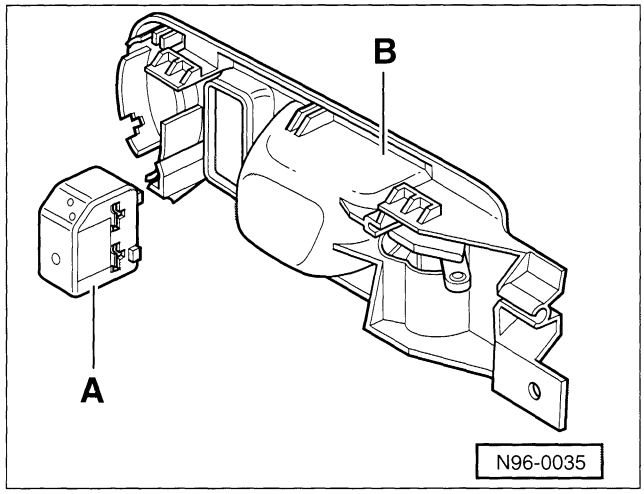
NOTE —
The interior lock and electric window switches in the driver's door panel cannot be removed individually. The complete window control unit must be removed as described below.

– Remove window control unit with door pull handle from the driver's door panel as shown in **70 Trim–Interior, Driver's door panel, removing and installing**.

– Disconnect harness connector from back of window control unit.

➢ Remove mounting screws (**arrows**) for window control unit and pull out control unit.

– Install in reverse order of removal.



Door panel switches, removing and installing (passenger side)

NOTE —
Removing and installing the front and rear passenger electric window switches (on four door vehicles) is the same.

– Remove interior door trim, see **70 Trim–Interior**.

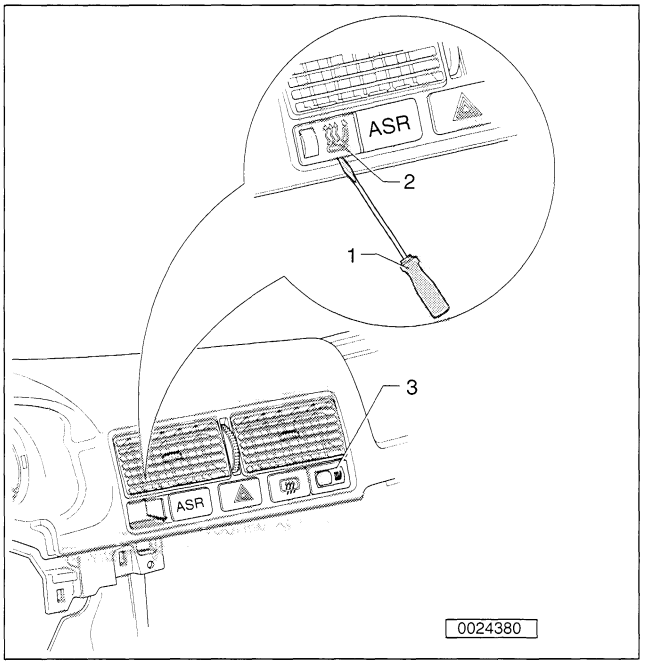
– Disconnect harness connector from switch.

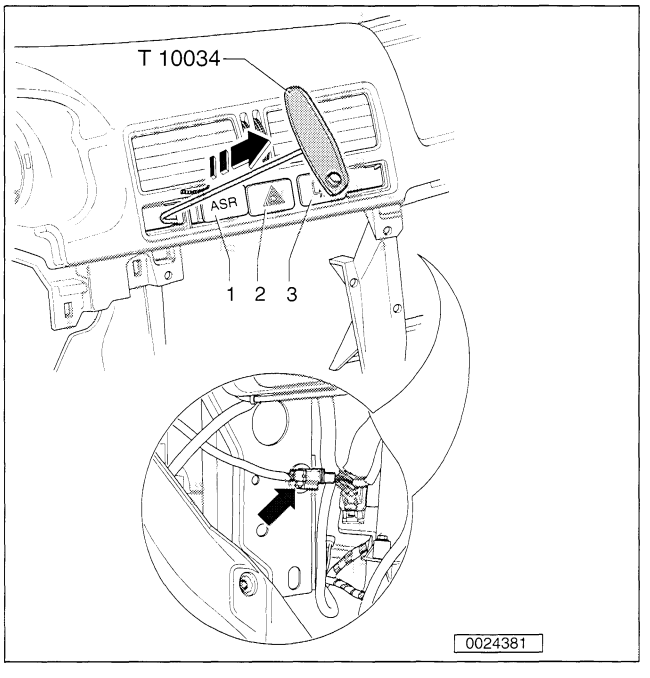
➢ Release switch housing (**A**) by pressing sideways out from locking device in mounting frame (**B**) and remove.

– To install, first connect harness connector.

– Insert switch in recess of mounting frame and engage.

– Install door trim.





Instrument panel switches–center, removing and installing

NOTE —

- *Removing and installing is the same procedure for all switches. Only the hazard warning light switch is described here.*
- *The switch must be pulled out from the instrument panel in order to disconnect harness connector.*
- *A wooden or plastic wedge should be used to prevent damage to plastic trim and adjacent switches.*
- *It may be necessary to remove a switch on the left of the relevant switch in order to pull out the wiring sufficiently.*
- *Depending on vehicle options, there may be covers in place of some switches. The covers can be removed in the same manner as the switches.*

– Protect instrument panel and adjacent switches with adhesive tape if necessary.

➢ To remove switch for heated seats carefully pry out switch using flat plastic wedge or screwdriver (**1**). Switch for driver's seat is at position **2** and for passenger at position **3**.

NOTE —

Heated seat control module is part of heated seat switch.

– Disengage and disconnect harness connector from back of switch. Remove switch.

– To remove switch for rear window defrost, emergency flasher or ASR (Anti-Slip Regulation) it is necessary to use Volkswagen special tool T10034 to pull switch out.

NOTE —

- *Do not use a screwdriver to remove rear window defrost, emergency flasher, or ASR switches due to the stronger springs in their release mechanisms.*
- *Before removing the ASR or rear window defrost switch, remove the seat heater switch or switch hole cover next to each switch as described above.*

➢ Reach behind the ASR switch and use the tip of special tool T10034 to release spring loaded retaining button and pull ASR switch (**1**) out from dash.

– Disengage and remove harness connector. Remove switch.

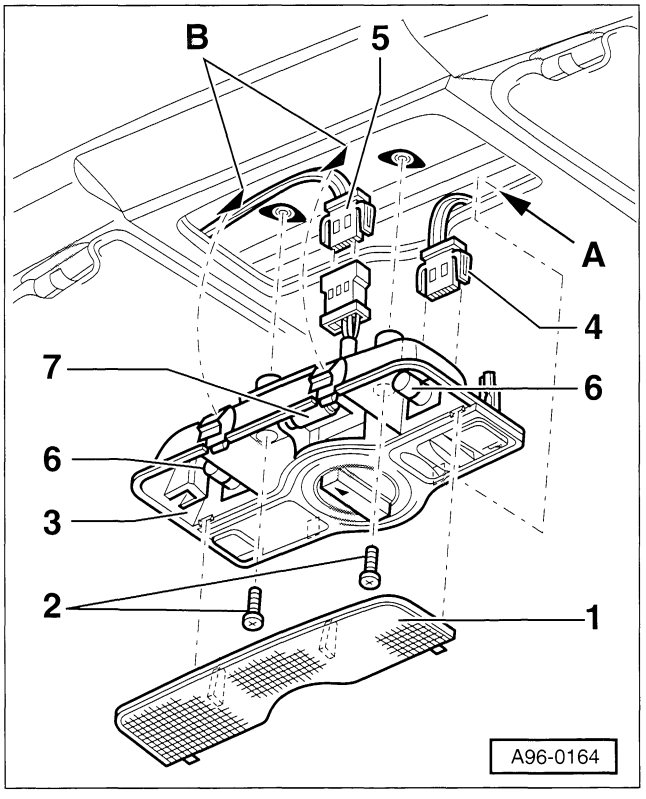
– Repeat for emergency flasher (**2**) and rear window defrost (**3**) switches as necessary.

– To install, first connect harness connector and lock down retaining mechanism.

– Insert switch into dash and engage properly.

Interior light and sunroof switch, removing and installing

NOTE —
Ignore references to sunroof switch in procedure below for vehicles not equipped with a sunroof.



– Carefully pry out interior light lens (**1**) at front edge and remove.

◀ Remove mounting screws (**2**) for interior light/sunroof switch assembly. Use a screwdriver to pry out assembly at retaining clips (**B**) to release assembly from headliner.

– Disconnect harness connectors from light and sunroof switch.

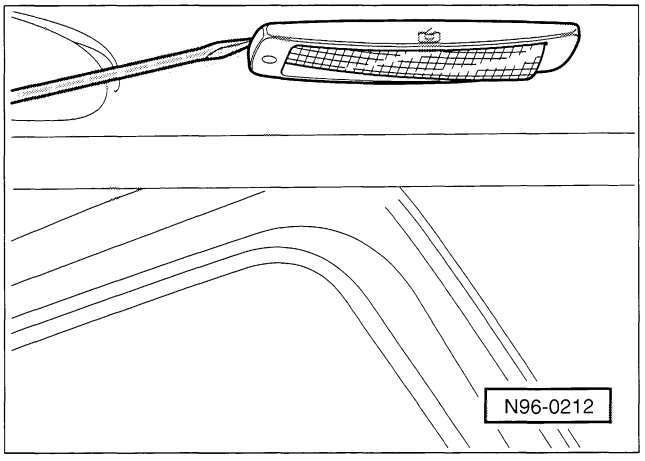
NOTE —
To replace sunroof switch, the entire interior light/sunroof switch assembly must be replaced.

– To install, connect harness connectors and position retaining hooks at rear of assembly into headliner. Push up front part of assembly until retaining clips engage.

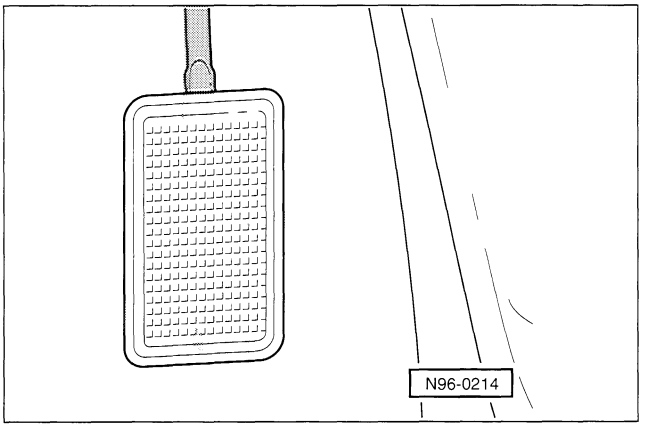
– Remaining installation is the reverse of removal. See **60 Sunroof** for sunroof motor replacement and sunroof components.

Various other interior lights shown below can all be removed by carefully prying out with a screwdriver as shown in the following illustrations:

Rear reading light

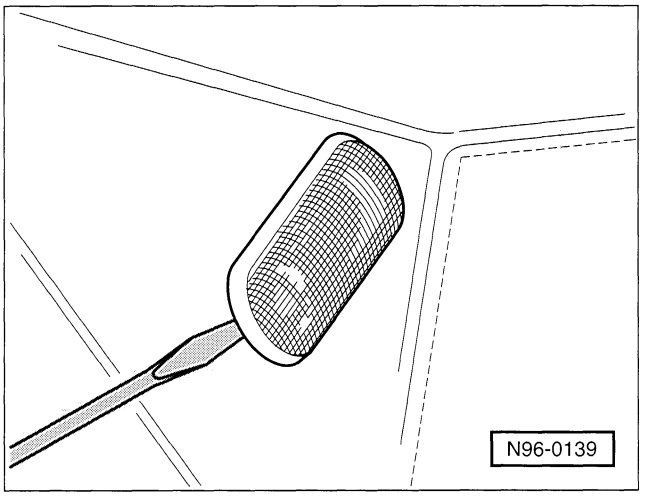


◀ Insert screwdriver into lens recess and pry out reading light.



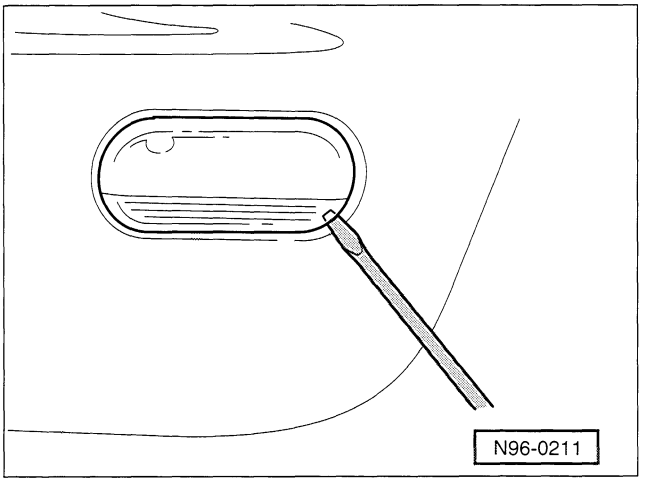
Luggage compartment light

- Pry out lens from top with screwdriver.



Glovebox light

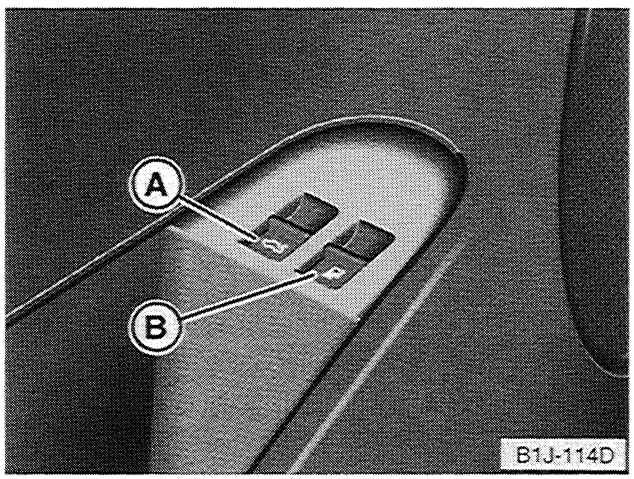
- Pry out glovebox light as shown. Check for proper operation after installing light to ensure light goes out when door is closed.



Door warning light

- Insert screwdriver behind lens and pry out.

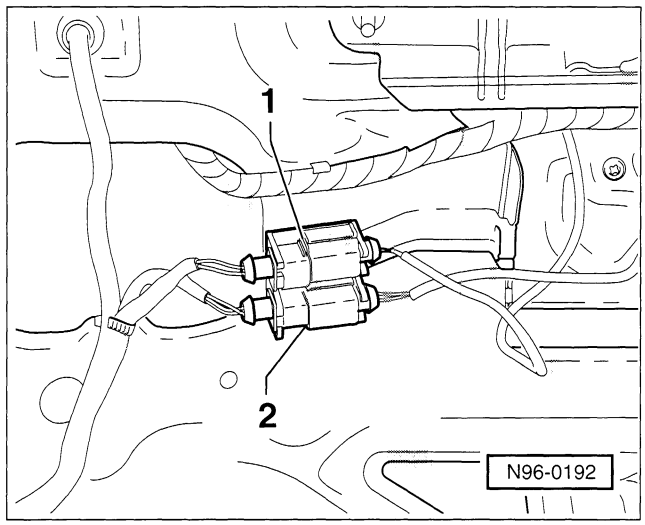
Remote fuel tank door/rear lid unlock switch, removing and installing



Switches for remote rear trunk lid (**A**) and remote fuel tank door (**B**).

- Remove interior door trim, see **70 Trim–Interior**.
- Disconnect harness connector from back of switches.
- Release switch housing by pressing locking tabs and remove from door trim.
- To install, insert switch into door trim and engage.
- Connect harness connector.
- Install door trim.

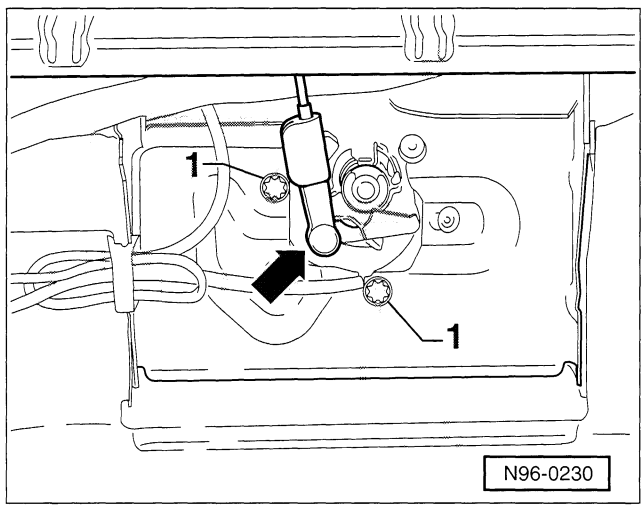
Rear lid handle release button, removing and installing (Jetta)



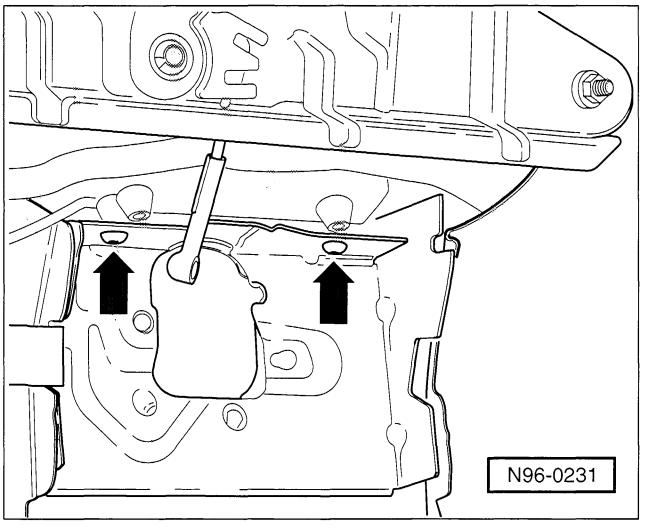
- Remove trim for rear lock housing, see **70 Trim–Interior**. For wagon models remove rear wiper assembly.

Unclip rear lock harness connectors (**1** and **2**) from retaining clips and separate connectors.

- Unclip operating rod from lock cylinder.



Unclip operating rod (**arrow**) and remove lock cylinder mounting screws (**1**). Remove lock cylinder in upward direction.



➤ Remove mounting screws (**arrows**) for rear lid handle release button and remove handle.

– Installation is the reverse of removal.

ANTI-THEFT IMMOBILIZER

Golf/Jetta/GTI models from m.y. 2000 are equipped with an anti-theft immobilizer system. When the vehicle key is inserted into the ignition switch a signal is sent from the induction coil of the anti-theft immobilizer that energizes the electronic transponder in the key. The transponder then sends a unique signal back to the induction coil which is sent to the Immobilizer control module. When the key is recognized as valid, then the vehicle can be started. The Immobilizer authentication happens so quickly that the driver does not notice the slightest hesitation between the time the vehicle key is turned and the engine starts.

Immobilizer functions are supported by:

- Control electronics ("control module") integrated with instrument cluster
- A warning light for anti-theft immobilizer (K117) in instrument cluster (speedometer display)
- An adapted Engine Control Module (ECM)
- An induction coil on the ignition lock
- Adapted ignition keys with electronic components (transponder and response reader memory)

NOTE —

Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*

An intact immobilizer system is indicated by the warning light for anti-theft immobilizer (K117) lighting up and going out after approx. 3 seconds when the ignition is switched on.

When the ignition is switched "on", the warning lamp flashes or lights up continuously to indicate a malfunction in the system when:

- Adapting the ignition key has been carried out incorrectly
- No transponder (response reader memory) is present in ignition key
- An unauthorized ignition key is used
- An unauthorized engine control module is detected
- A malfunction in the induction coil of anti-theft immobilizer (D2)
- A malfunction in the data wiring is present

If the warning light for anti-theft immobilizer (K117) does not light up after switching on ignition:

- The immobilizer control module has detected an authorized key
- The immobilizer control module has not detected an incorrect engine control module
- The immobilizer control module is currently "adapting keys" and after adapting the keys no malfunction has occurred

To troubleshoot the Immobilizer system, perform On Board Diagnostic (OBD) program and retrieve stored information with VAS 5051 Vehicle Diagnostic, Testing and Information System in mode "Guided Fault Finding". If malfunctions occur in sensors and components being monitored, they will be stored in Diagnostic Trouble Code (DTC) memory together with an indication of the type of malfunction. A maximum of 4 DTCs can be stored simultaneously. Sporadic malfunctions are automatically cancelled if they are not repeated in next 50 engine starts.

Anti-theft immobilizer control module functions are integrated with the instrument cluster. In the event of faulty anti-theft immobilizer control module functions, the entire instrument cluster must be replaced. Replacement of instrument cluster requires replacement unit to be adapted to vehicle's Engine Control Module (ECM) using VAS 5051.

The induction coil of anti-theft immobilizer (D2) is integrated with the steering column lock cylinder housing and cannot be replaced separately. In the event of immobilizer induction coil malfunction, the complete lock cylinder housing requires replacement.

Replacement or servicing of the transponder integrated vehicle keys is not possible. In the event of transponder malfunction, the complete key assembly requires replacement.

When working on Immobilizer system, try to have all the vehicle keys available. Some repairs require the adaptation of the keys. If only one key is adapted, the remaining keys will not start the vehicle.

Before replacing any Immobilizer system parts, use a Scan Tool to record the VIN and 14-digit Immobilizer number from the Instrument Cluster (Address Word 17) or the Engine Control Module (Address Word 01). If this is not possible, obtain 14-digit Immobilizer number from instrument cluster label. Record the coding for the instrument cluster and all the adaptation numbers if possible.

When replacing only an ECM, it is not necessary to adapt the vehicle keys. If you're only replacing the instrument cluster, it is necessary to adapt the vehicle keys. If you replace both the ECM and instrument cluster at the same time, you will have to replace all the vehicle keys.

QUALITY REVIEW

When you have finished working under the hood and around other areas of the vehicle, it is advisable to take a moment to quality check or review your work. This helps to insure that the operation or repair has been completed properly with all affected systems functioning within normal parameters.

97 Wiring Diagrams, Fuses and Relays

GENERAL 97-1

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- 2003-2005 models 97-760

TABLES

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c. Fuses above relay panel 97-4
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GENERAL

This section contains wiring diagrams for 1999 and later m.y. (model year) vehicles covered by this manual.

> ***WARNING —***
> *Special airbag precautions apply to any electrical system testing or repair. The airbag unit is an explosive device and must be handled with extreme care. Before starting any work on the vehicle, refer to the warnings and cautions in* **69 Seatbelts, Airbags**.

> ***NOTE —***
> *Standardized terms for automotive components are used throughout this manual, including the alternator, which should always be referred to as a generator.*

> ***CAUTION —***
> - *Before working on the electrical system always switch the ignition off and disconnect battery ground strap from battery negative (–) terminal.*
> - *Be sure to have the anti-theft radio code on hand before disconnecting the battery.*
> - *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased.*

FUSES AND RELAYS

Fuse panels

The central electric panel (fuse panel) is located behind an access panel on left edge of the instrument panel. It contains both standard size fuses and mini-fuses. The use of mini-fuses allows protection of individual circuits.

There is also a main fuse box located on top of the battery in the engine compartment. It contains special fuses for high current applications and prevents the main wiring harness in the event of a short circuit. See Fig. 1. To access these fuses, squeeze tabs of plastic fuse cover and pull upward.

NOTE —

Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.

Main fuse box on top of battery

- Standard fuse applications
  - Coolant fan (S180) 30A
  - ABS (S179) 30A
  - ABS-hydraulic pump (S178) 30A
- Metal fuse applications
  - Generator (S177)
    - 90 Amp 110A
    - 120 Amp 150A
  - Interior relay panel (S176) 110A
  - Coolant fan and control module (S164) 40A
  - Fuel pump relay or glow plug relay (S163) 50A
  - Secondary air injection relay or coolant pre-heating relays (S162) 50A

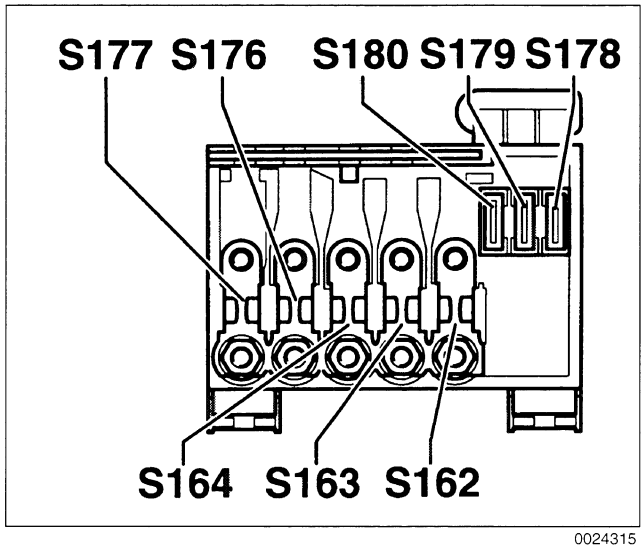


Fig. 1. Main fuse box on top of battery with fuse identification.

WARNING —

Metal fuses in the main fuse box should be changed by an authorized Volkswagen service professional.

NOTE —

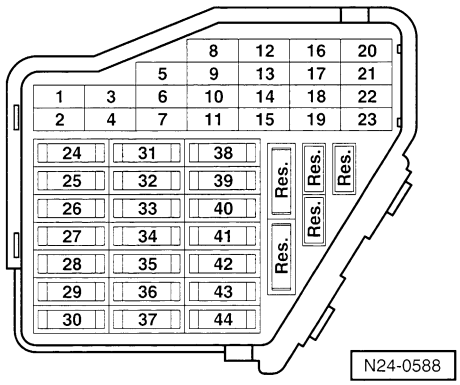
- *Fuse application and amperage may vary depending on equipment level.*
- *All fuses are identified in the wiring diagrams with the prefix of S, i.e. fuse #4 is S4.*
- *"RES" in the central electric panel refers to reserve, or places for spare fuses.*

Fuse colors and amperage

- Green 30A
- White 25A
- Yellow 20A
- Blue 15A
- Red 10A
- Brown 7.5A
- Beige 5A
- Violet 3A

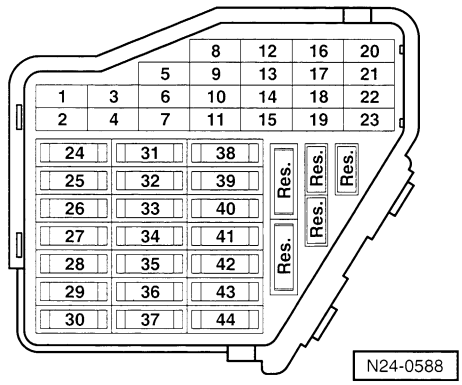
The fuses in the central electric panel are identified in **Table a**.

Table a. Fuse identification



Position	Description	Amperage
1	Heated washer nozzles, glove compartment light, memory seat	10
2	Turn signal system	10
3	Fog light relay, inst. panel dimmer switch	5
4	License plate light	5
5	Comfort system, cruise control, Climatronic, A/C, heated seat control modules, day/night dimming mirror, control module and control unit for multi-function steering wheel	7.5
6	Central locking system	5
7	Back-up lights, speedometer vehicle speed sensor	10
8	open	-
9	Anti-lock brakes (ABS)	5
10	ECM, gasoline engine ECM, diesel engine (m.y. 2000 >)	10 5
11	Instrument cluster, shift lock solenoid	5
12	B+ (battery positive voltage) for Data Link Connector (DLC)	7.5
13	Brake lights	10
14	Interior lights, central locking system	10
15	Instrument cluster, automatic transmission control module (TCM)	5
16	A/C clutch, after-run coolant pump	10
17	open	-
18	High beam right	10
19	High beam left	10
20	Low beam right	15
21	Low beam left	15
22	Parking and side marker lights, right	5
23	Parking and side marker lights, left	5
24	Front wiper motor, washer pump	20
25	Fresh air blower, Climatronic, A/C	25

Table a. Fuse identification



Position	Description	Amperage
26	Rear window defogger	25
27	Rear wiper motor	15
28	Fuel pump, gasoline	15
29	Engine control module (ECM), gasoline Engine control module (ECM), diesel	15 10
30	Sunroof control module	20
31	Automatic transmission control module	20
32	Fuel Injectors (gasoline) ECM (diesel)	10 15
33	Headlight washer system	20
34	Engine control elements	10
35	12V power outlet (in luggage comp.)	30
36	Fog lights	15
37	Radio terminal 86S, instrument cluster	10
38	Central locking system (with power windows) luggage compartment light, remote fuel tank door, rear lid unlock	15
39	Emergency flashers	15
40	Dual tone horn	20
41	Cigarette lighter	15
42	Radio system	25
43	Engine control elements	10
44	Heated seats	15

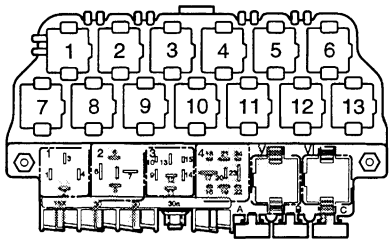
NOTE —

Fuses number 23 through 44 are identified in wiring diagrams with an additional prefix of 2 (i.e. fuse #40 is S240).

Relay positions

The relay panel is located under the left side of the instrument panel. There are three fuses on the lower relay panel which are identified in **Table b**. The relays are also identified in **Table b**.

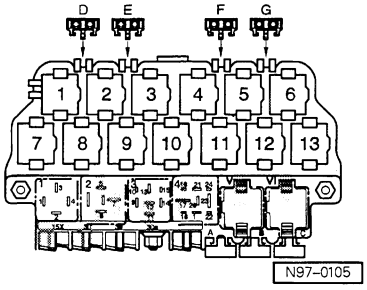
Table b. Relay panel identification



Position	Description	Number on relay
	Lower relay panel	
1	Dual horn relay	53
2	Load reduction relay	18/100
3	open	-
4	Fuel pump relay	409
V, VI	Wiper/Washer intermittent relay vehicles without headlight washer system vehicles with headlight washer system Vehicles with rain sensor	 377 389 192
	Fuses on lower relay panel	
A	Power (Memory) seat circuit breaker	-
B	open	-
C	Power windows, central locking, heated power mirrors	-
	Relays on upper (auxiliary) relay panel	
1	open	-
2	Rear lid remote unlock motor relay (➤ 01.99)	79
3	Anti-theft starter lock relay (clutch pedal switch)	185, 53
4	Fog light relay	53
5	Multi-function steering wheel relay (as applicable)	450
6	Multi-function steering wheel relay (as applicable)	450
7	Daytime running lights (from April 1999)	173
8	Daytime running lights (through March 1999)	173
9	open	-
10	Glow plug relay	180
11	Park/Neutral position relay	175
12	Power supply (terminal 30b, B+) relay	109
13	open	-

There are also additional fuses above the relay panel which are identified in **Table c**.

Table c. Fuses above relay panel



Position	Description	Amperage
D	open	-
E	open	-
F	Central locking, anti-theft warning	15
G	Central locking, anti-theft warning	15

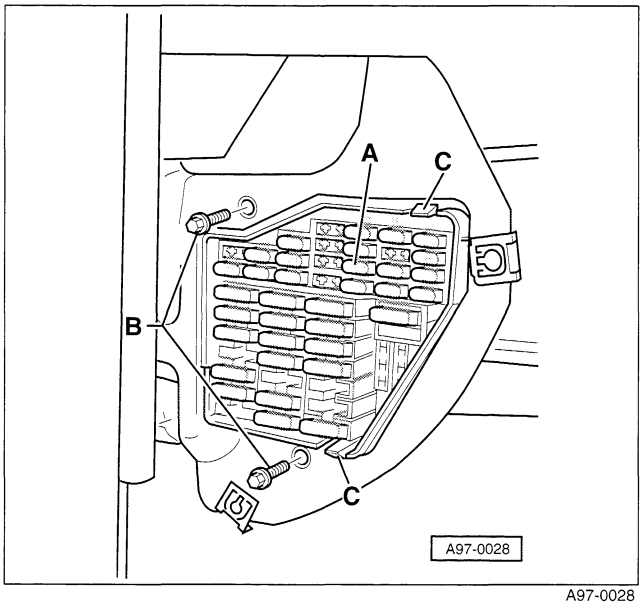
Fuse panel, removing and installing

1. Disconnect battery ground (GND) strap from battery negative (–) terminal. See the **Cautions** at the beginning of this repair group regarding battery disconnection.

2. Pry off fuse panel cover from left side of dashboard.

3. Remove steering column lower trim, see **70 Trim–Interior**.

4. Remove fuse panel mounting screws. Press retaining clips on top and bottom of fuse panel and push panel inward to remove. See Fig. 2.



A97-0028

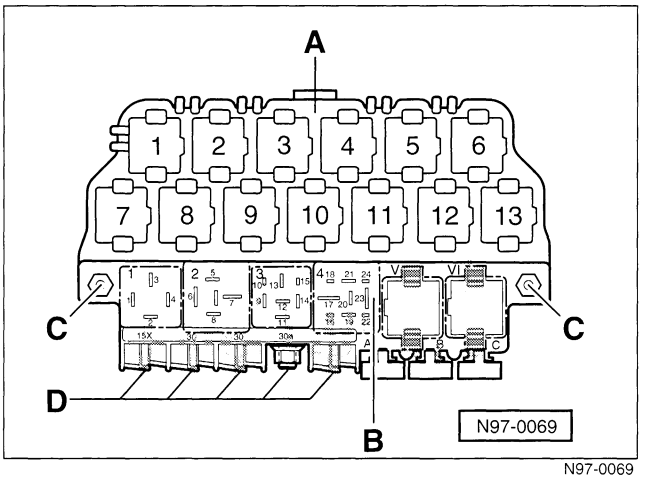
Fig. 2. Remove mounting screws (**B**), press retaining clips (**C**) and push fuse panel (**A**) inward to remove.

Relay panel, removing and installing

1. Disconnect battery ground (GND) strap from battery negative (–) terminal. See the **Cautions** at the beginning of this repair group regarding battery disconnection.

2. Remove steering column lower trim, see **70 Trim–Interior**.

3. Remove mounting nuts on either side of relay panel and disconnect screw-on wire connections at bottom of panel. Pull down panel to remove. See Fig. 3.



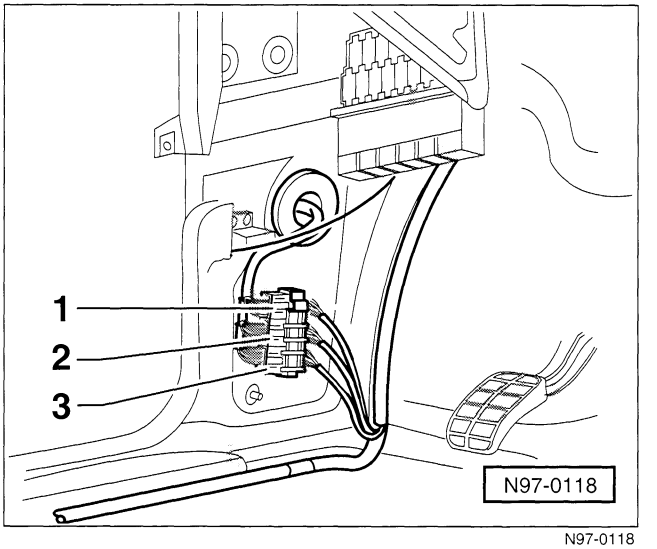
N97-0069

Fig. 3. Remove mounting nuts (**C**) and loosen screw-on connections (**D**) to remove central electric (**B**) and relay panel (**A**).

CONNECTOR STATIONS

Various connector stations are located throughout the vehicles covered by this manual. Some of those connector stations are shown below.

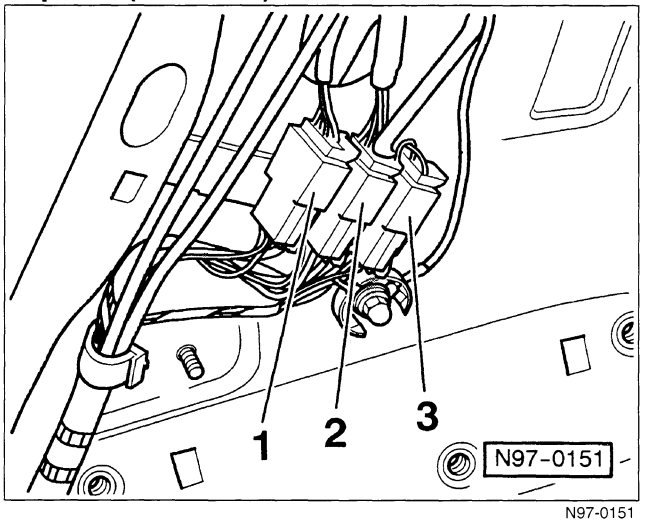
Lower A-pillar



N97-0118

Fig. 4. Connector station in driver's side lower A-pillar. Passenger side is a mirror image of above. Brown connector (**1**) is for central locking system, blue connector (**2**) is for power mirrors, black connector (**3**) is for loudspeaker and power windows.

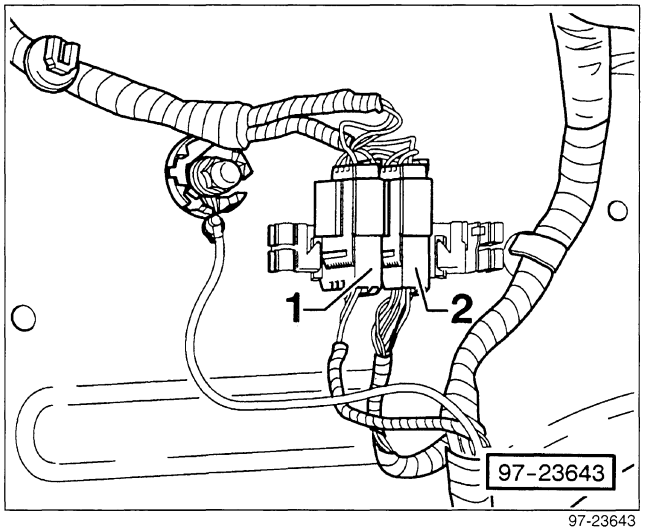
C-pillar (Golf/GTI)



N97-0151

Fig. 5. Connector station on C-pillar of Golf/GTI. Black connector (**1**) is for heated rear window, luggage compartment light, high mount brake light, and rear window defrost. Pink connector (**2**) is for rear wiper motor. Brown connector (**3**) is for central locking and rear lid unlock motor.

C-pillar (Jetta)

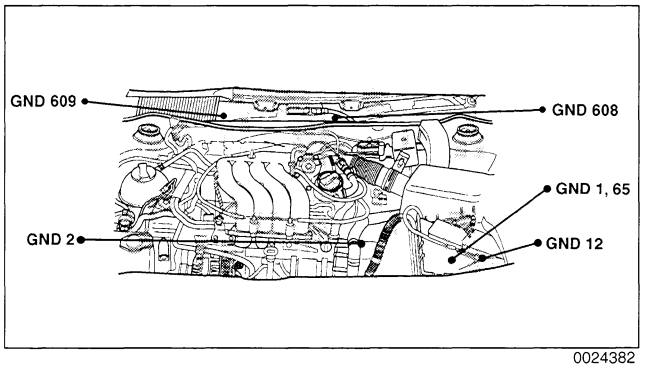


97-23643

Fig. 6. Connector station on C-pillar of Jettas. Black connector (**1**) is for license plate light and luggage compartment light. Brown connector (**2**) is for central locking and rear lid unlock motor.

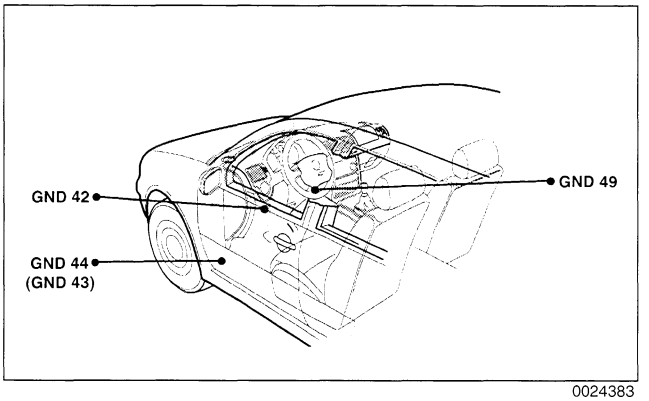
GROUND LOCATIONS

Various ground locations are identified in the figures shown below. Be sure to inspect these for clean tight connections when troubleshooting electrical problems.



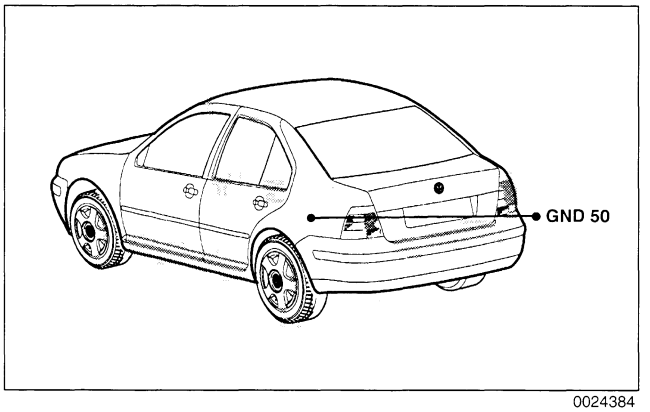
0024382

Fig. 7. Ground locations in the engine compartment. **GND 1**, **12**, and **65** are located below battery tray. **GND 2** is on transmission, near engine block. **GND 608** is in the left side of the plenum in front of the ECM. **GND 609** is in the right side of the plenum in front of the dust and pollen filter housing.



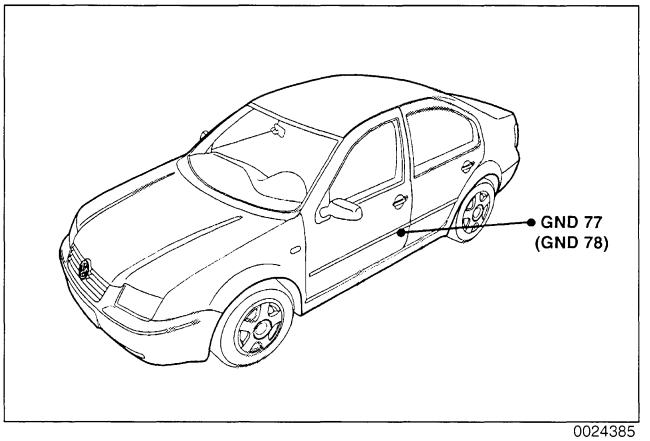
0024383

Fig. 8. Ground locations inside vehicle. **GND 42** is above driver's footwell, to left of pedal cluster. **GND 44** is at the bottom of left-side A-pillar. **GND 43** is at the bottom of right-side A-pillar. **GND 49** is on the steering column, left side, above lock cylinder housing.



0024384

Fig. 9. Ground locations in rear of vehicle. **GND 50** is in luggage compartment, left side, below C-pillar.



0024385

Fig. 10. Ground locations in front of vehicle. **GND 77** and **78** are on the lower left and right B-pillars, above seat belt reel.

COMPONENT LOCATIONS

Table d. Component locations

Component (code)	Application	Location and additional information
ABS control module (J104)	all with ABS	to left of vacuum brake booster, on bottom of hydraulic unit
ABS wheel speed sensors: right rear (G44), left rear (G46) right front (G45), left front (G47)	all with ABS	 at appropriate rear stub axle in appropriate front wheel bearing housing
A/C cut-out thermal switch (F163)	all with A/C	in "T" in coolant line, between radiator and engine cylinder head
After-run coolant pump (V51)	2.8L	on cylinder head, left rear
Airbag control module (J234)	all	on center tunnel, front, beneath heater housing
Airbag igniter, driver side (N95)	all	mounted on steering wheel
Airbag igniter, passenger side (N131)	all	instrument panel, above glovebox
Airbag spiral spring (F138)	all	on steering column, with wiring for horn contact
Alarm horn (H8)	central locking	in plenum, left side
Ambient temperature switch (F38)	all with A/C	in plenum, left side
Back-up light switch (F4)	all manual	top of transmission, on front selector mechanism housing
Brake fluid level warning switch (F34)	all	in brake fluid reservoir cap
Brake light switch (F)	all	above brake pedal, integral with (F47)
Brake vacuum vent valve switch (F47)	all	above brake pedal, integral with (F), for cruise control
Camshaft position sensor (G40)	4-cylinder 6-cylinder	on cylinder head, right side, behind camshaft sprocket on cylinder head, left side, behind ignition coil
Change-over valve for intake manifold flap (N239)	1.9L	back of intake manifold
Closed throttle position switch (F60)	2.0L (AEG) 1.9L	on throttle body on bulkhead, above accelerator pedal, part of throttle position sensor
Clutch pedal position switch (F194)	all manual	above clutch pedal
Clutch vacuum vent valve switch (F36)	all manual	above clutch pedal
Cold start injector (N108)	1.9L	on bottom of diesel injection pump
Comfort system central control module (J393)	comfort system	above pedal cluster, to left of steering column
Connectors, 2-pin for engine glow plugs (T2a) for needle lift sensor (T2b) (T2c)	1.9L	 in engine compartment, left side, behind air cleaner housing in front of engine block, to left of diesel injection pump in engine compartment, left side, behind air cleaner housing
Connector, 3-pin for RPM sensor (T3)	2.0L 1.9L 2.8L	in front of engine cylinder block, above oil filter flange in front of engine block, to left of diesel injection pump in front of engine, left side, below secondary air injection pump
Connector, 4-pin for 02S (T4c)	gasoline	on bottom right side floor panel, inside protective housing
Connector, 4-pin for A/C clutch & generator (T4)	all	above starter
Connector, 4-pin for HO2S (T4b)	gasoline	on bottom right side floor panel, inside protective housing
Connector, 6-pin brown (T6)	all	in connector station in plenum, left side beneath windshield wiper linkage
Connector, 10-pin (T10a)	all	in engine compartment, left side, to rear of air cleaner housing, in guide
Connectors, 10-pin: orange (T10) green (T10d) black (T10e) grey (T10g) blue (T10h)	all	in connector station in plenum, left side beneath windshield wiper linkage
Connectors, 10-pin for door components black (T10i) black (T10k) black (T10l) black (T10m) brown (T10n) brown (T10p) blue (T10q) blue (T10r)	all with power windows and locks	 bottom of driver side A-pillar bottom of passenger side A-pillar driver side B-pillar passenger side B-pillar bottom of driver side A-pillar bottom of passenger side A-pillar bottom of driver side A-pillar bottom of passenger side A-pillar

Table d. Component locations

Component (code)	Application	Location and additional information
Connector, 12-pin for CD changer	all	luggage compartment left side
Connector, 12-pin for solenoid valves and ATF temperature sensor	all automatics	on top of final drive housing
Coolant fan control module (J293)	all	engine compartment. lower left below front support
Coolant fan control thermal switch (F18)	all	back of radiator, bottom left
Coolant preheating relay, low heat output (J359)	1.9L	engine compartment, left rear under protective cover
Coolant preheating relay, high heat output (J360)	1.9L	engine compartment, left rear under protective cover
Crash sensor for side airbag driver side (G179) passenger side (G180)	all with side airbags	 under driver's seat and carpet under front passenger's seat and carpet
Door control module driver side (J386) passenger side (J387) left rear (J388) right rear (J389)	all with power windows	in door, on component carrier, integral with window motor
EGR vacuum regulator solenoid valve (N18)	1.9L	engine compartment, rear, left side, to right of wastegate bypass valve
Engine control module (J220)	all	in plenum, center
Engine coolant level sensor (G32)	all	in coolant reservoir (expansion tank)
Engine coolant temperature sensor (G2)	all	in coolant flange on cylinder head, left side, integral with (G62)
Engine coolant temperature sensor (G62)	all	in coolant flange on cylinder head, left side, integral with (G2)
Engine speed (RPM) sensor (G28)	all	on front of engine block, lower left, near transmission flange
Evaporative emission canister purge regulator valve (N80)	gasoline	in engine compartment, right side, next to coolant reservoir
Fresh air blower (V2)	all	in front of glove box
Fresh air blower series resistance with fuse (N24)	all	in front of glove box, beneath fresh air blower
Fresh/recirculating air door servo motor (V154)	all	in front of glove box, to right of fresh air blower housing
Fuel cut-off valve (N109)	1.9L	on top of diesel injection pump, left side
Fuel gauge sender (G)	all	in fuel tank, beneath rear seat, part of fuel pump module (gasoline only)
Fuel pump (G6)	gasoline	in fuel tank, beneath rear seat, part of fuel pump module
Fuel tank lid unlock (V155)	all	luggage compartment, right side, behind wheel housing
Fuel temperature sensor (G81)	1.9L	on front of diesel injection pump, integral with modulating piston displacement sensor and quantity adjuster
Generator (C)	all	front of engine, right side
Hood alarm switch (F120)	central locking	on hood latch mechanism
Ignition coil (N152)	4-cyl. gasoline 6-cyl. gasoline	on front of engine block, left side on cylinder head, left side
Intake air temperature sensor (G72)	2.0L 1.9L, 1.8L	in intake air duct, to right of air cleaner housing in intake air duct between charge air cooler and intake manifold
Intake manifold change-over valve (N156)	6-cylinder	in front of engine, left side, above oil filter housing
Kick down switch for automatic transmission (F8)	1.9L 2.0L	on bulkhead above accelerator pedal, component of throttle position sensor in engine compartment, to right of vacuum brake booster
Knock sensor 1 (G61)	4-cyl. gasoline 6-cyl. gasoline	on front of engine cylinder block, right side on engine cylinder block, right rear, below exhaust manifold
Knock sensor 2 (G66)	4-cyl. gasoline 6-cyl. gasoline	on front of engine cylinder block, behind ignition coil on engine cylinder block, left front, above engine oil cooler
Leak detection pump (V144)	gasoline	inside right-rear wheelhousing, toward rear, near fuel-filler neck
Lock unit for central locking driver side (F220), passenger side (F221) left rear (F222), right rear (F223)	central locking	component of door lock assembly, includes motor and switches
Manifold absolute pressure sensor (G71)	1.8L and 1.9L	in intake air duct between charge air cooler and intake manifold
Mass air flow sensor (G70)	all	in intake air duct, to right of air cleaner housing

Table d. Component locations

Component (code)	Application	Location and additional information
Modulating piston displacement sensor (G149)	1.9L	on front of diesel injection pump, integral with fuel temperature sensor and quantity adjuster
Multi-function transmission range switch (F125)	all automatics	rear of transmission housing, top
Needle lift sensor (G80)	1.9L	front of cylinder head, part of cylinder no. 3 fuel injector
Oil pressure switch (F1)	4-cylinder 6-cylinder	front of engine on oil filter flange on top of oil filter housing
Oxygen sensor ahead of catalytic converter, heated (G39)	gasoline	in exhaust system, ahead of catalytic converter
Oxygen sensor behind catalytic converter (G130)	gasoline	in exhaust system, at back of catalytic converter
Parking brake warning switch (F9)	all	central tunnel, below parking brake lever
Positive crankcase ventilation heating element (N79)	gasoline diesel	in hose between cylinder head cover and intake air duct, near throttle body in PCV hose between cylinder head cover and intake air duct
Quantity adjuster (N146)	1.9L	on front of diesel injection pump, integral with fuel temperature sensor and displacement sensor
Rear lid unlock motor (V139)	Jetta	rear lid, attached to rear lock cylinder carrier
Seat belt tensioner igniter driver side (N153) passenger side (N154)	all	bottom of B-pillar
Secondary air injection solenoid valve (N112)	4-cyl. gasoline 6-cyl. gasoline	in engine compartment, left side, above brake fluid reservoir in front of engine, left side, above oil cooler housing
Secondary air injection motor (V101)	gasoline	in engine compartment, left side
Secondary air injection pump relay (J299)	gasoline	engine compartment, left side, behind air cleaner housing, under protective cover
Shift lock solenoid (N110)	all automatics	on central tunnel, with gear selector mechanism
Side airbag igniter, driver side (N199)	side airbags	on left side of driver seat backrest, beneath seat cover
Side airbag igniter, passenger side (N200)	side airbags	on right side of passenger seat backrest, beneath seat cover
Speedometer vehicle speed sensor (G22)	all	top of final drive housing
Throttle position actuator (V60)	gasoline	mounted on throttle body, part of throttle valve control module
Throttle position sensor (G69)	2.0L (AEG)	mounted on throttle body, component of throttle valve control module
Throttle position sensor (G79)	all with electronic throttle	on bulkhead, above accelerator pedal, integral with kick-down switch and closed throttle position switch
Throttle position sensor (G88)	gasoline	mounted on throttle body, component of throttle valve control module
Throttle valve control module (J338)	gasoline	mounted on throttle body, contains CTP switch, TP sensors and TP actuator
Transmission control module (J217)	all automatics	in plenum, right side
Transmission vehicle speed sensor (G38)	all automatics	top of transmission housing, to left of transmission cooler
Trunk lock alarm/central locking switch	central locking	on trunk lock cylinder, in rear lid
Vehicle speed sensor (G68)	all automatics	top of transmission housing, below transmission mount
Voltage regulator (C1)	all	on back of generator, later model regulators cannot be replaced separately
Wastegate bypass regulator valve (N75)	1.9L	engine compartment, rear, left side, to left of EGR solenoid valve
Window regulator motor driver side front (V147) passenger side front (V148) driver side rear (V26), passenger side rear (V27)	all with power windows	in door on component carrier, integral with door control module
Windshield and rear window (Golf only) washer pump (V59)	all	on windshield washer fluid reservoir
Windshield washer fluid level sensor (G33)	all	in windshield washer fluid reservoir

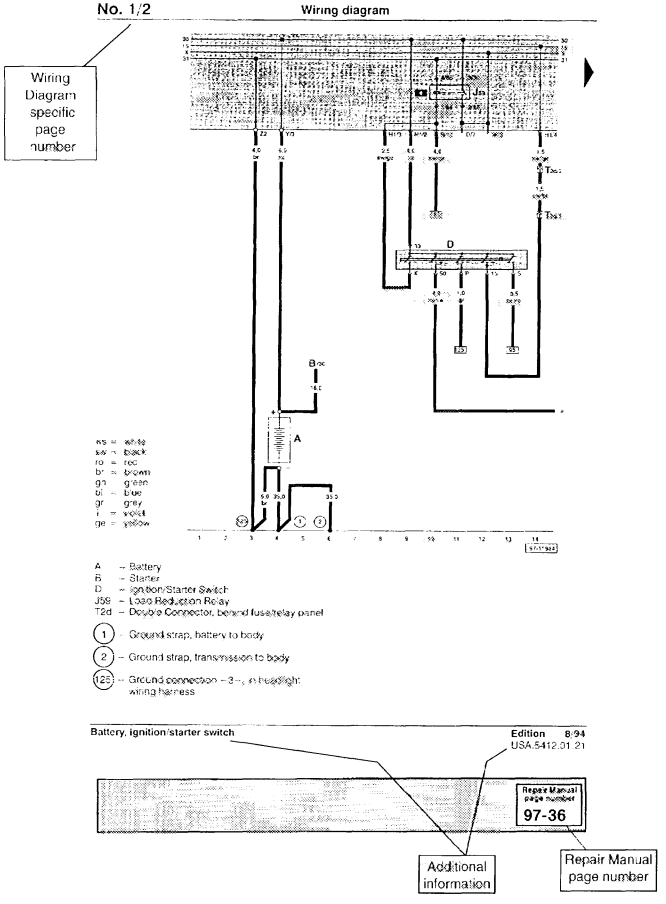
USING WIRING DIAGRAMS

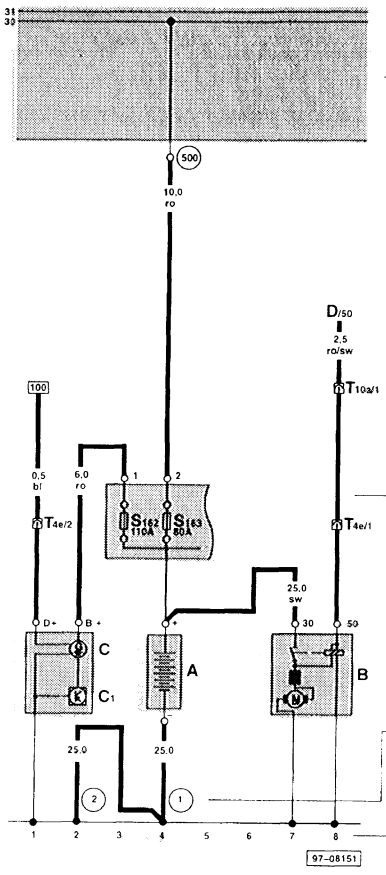
The wiring diagrams are oriented on the pages in a 2-up horizontal format in order to facilitate easier tracking of the various circuits which frequently run across several pages.

This electrical wiring diagram section has been organized based on the way the electrical wiring diagrams were originally distributed. Each wiring diagram page appears in its original and complete form, including original page numbers or technical bulletin numbers. In addition, every page contains a unique Repair Manual page number to facilitate indexing and easy access to individual circuits.

The electrical wiring diagram section has several comprehensive indexes designated by model year and identified by black page tabs. These indexes list the various components and electrical systems on a particular vehicle model, or systems that are common to all models. The actual wiring diagrams themselves follow the indexes.

The diagram below shows important wiring diagram information.

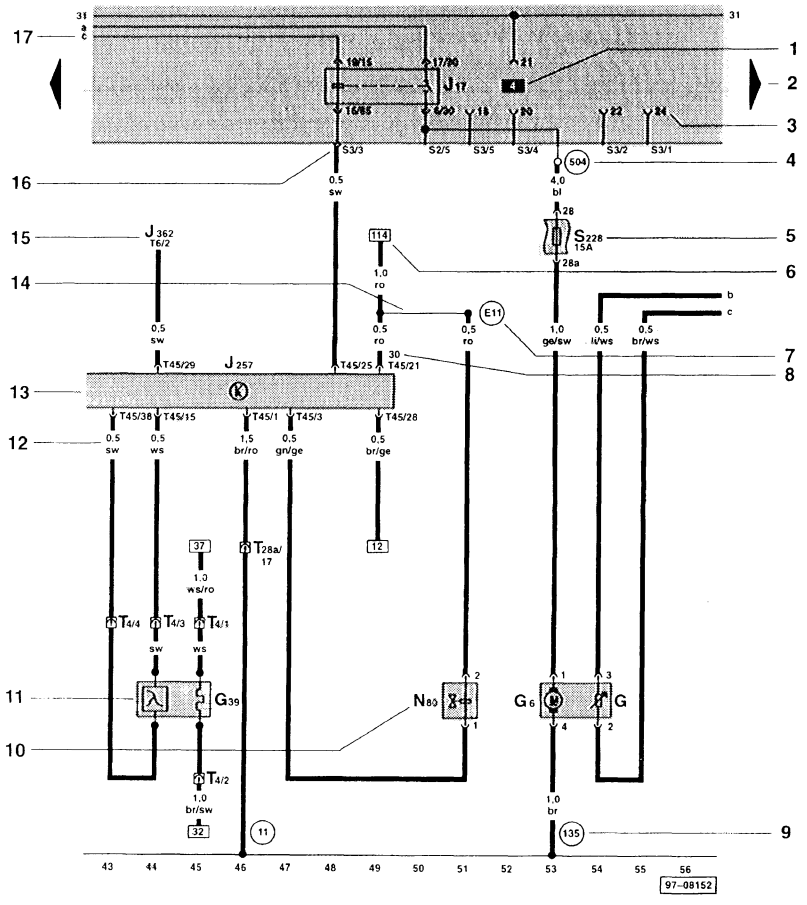




A – Battery
B – Starter
C – Generator(GEN)
C1 – Voltage Regulator(VR)
D – Ignition/Starter Switch
S162 – Fuse -1- (30) in fuse bracket / battery
S163 – Fuse -2- (30) in fuse bracket / battery
T4e – 4-Pin Connector, on transmission
T10a – 10-Pin Connector, on protective housing for control module, in engine compartment, left
(1) – Ground strap, battery to body
(2) – Ground strap, transmission to body
(500) – Screw connection -1- (30), on relay panel

Legend
In all wiring diagrams the same component designation (code) is used for a particular component; for example, always A for battery.

Edition 01/98
USA.5132.01.21



1 – **Relay location number**
Indicates location on relay panel.

2 – **Arrow**
Indicates wiring circuit is continued on the previous and/or next page.

3 – **Connection designation – relay control module on relay panel**
Shows the individual terminals in a multi-point connector.
For example: contact 24 on terminal 4 on relay panel.

4 – **Diagram of threaded pin on relay panel**
White circle shows a detachable connection.

5 – **Fuse designation**
For example: S228 = Fuse number 228, 15 amps, in relay panel

6 – **Reference of wire continuation (current track number)**
Number in frame indicates current track where wire is continued.

7 – **Wire connection designation in wiring harness**
Location of wire connections are indicated in the legend.

8 – **Terminal designation**
Designation which appears on actual component and/or terminal number of a multi-point connector

9 – **Ground connection designation in wire harness**
Locations of ground connections are indicated in legend.

10 – **Component designation**
Use legend at bottom of page to identify the component code.

11 – **Component symbols (see Symbols used in wiring diagrams)**

12 – **Wire cross-section size (in mm²) and wire colours**
Abbreviations are explaining in colour chart beside the wiring diagram.

13 – **Component symbol with open drawing side**
Indicated component is continued on another wiring diagram. The number of corresponding wiring diagram can taken from list of contents.

14 – **Internal connections (thin lines)**
These connections are **not** wires. Internal connections are current carrying and are listed to allow tracing of current flow inside components and wiring harness.

15 – **Reference of continuation of wire to component**
For example: Control module for anti-theft immobilizer J362 on 6-Pin Connector, terminal 2

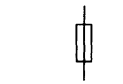
16 – **Relay panel connectors**
Shows wiring of multi-point or single connectors on relay panel
For example: S3/3 – Multi-point connector S3, terminal 3

17 – **Reference of internal connection continuation**
Letters indicate where connection continues on the previous and/or next page.

Wiring diagram terminal (circuit) identification

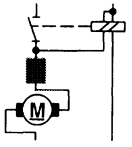
Several wiring circuits in the vehicle's electrical system are identified with a number or letter designation. These circuits are identified the same in all wiring diagrams and are most commonly shown near the top of each page in the fuse/relay panel portion of the wiring diagram. The circuit designations may also be used to identify switch connector terminals (switch circuits). Following are the most common numbered/lettered circuits:

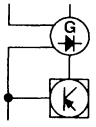
Terminal (circuit) 1-	Ignition coil/ignition distributor low voltage (typically used as an Engine Speed (RPM) signal for the tachometer)
Terminal (circuit) 15-	Switched Battery Positive Voltage (B+) from ignition/starter switch
Terminal (circuit) 30-	Battery Positive Voltage (B+), hot at all times
Terminal (circuit) 31-	Ground (GND)
Terminal (circuit) 50-	Starter control; switched B+ from ignition/starter switch
Terminal (circuit) 56-	Switched headlight B+ from light switch
Terminal (circuit) 58-	Switched parking light, taillight, illumination B+ from light switch
Terminal (circuit) S (SU)-	Key in ignition circuit; switched B+ from ignition/starter switch
Terminal (circuit) X-	Load reduction circuit; switched B+ from load reduction relay

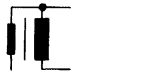

Fuse

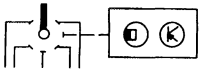

Thermo-fuse
(Circuit Breaker)


Battery


Starter


Generator(GEN)

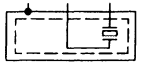

Ignition Coil


Distributor (electronic)


Spark plug connector
and plug


Glow plug
Heater element


Crankshaft position sensor
(CKP)


Knock sensor (KS)

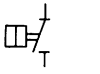

Motor


Switch
(manually operated)


Switch
(thermally operated)


Push putton switch
(manually operated)


Switch
(mechanically operated)


Switch
(pressure operated)

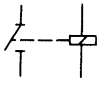

Multiple switch
(manually operated)


Resistance


Variable resistor
(Rheostat)

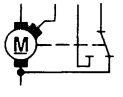

Resistor
temperature dependent


Heater element
temperature dependent


Relay


Multi-function
indicator


Speed sensor


Wiper motor
2-speed


Diode

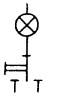

Zener diode


Diode
light sensitiv


Light bulb


Light bulb
(dual filament)


LED

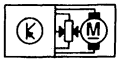

Interior light


Instrument
(Gauge)


Electronic control
module


Rear window defogger
heat element


Cigarette lighter


Control motor,
headlight range adjustment


Analog clock


Digital clock

Speed sensor

Solenoid valve

Magnetic clutch

Wire connector

Pin connector

Multi-point connector
at component

Internal connections
in component

Wire connection
detachable

Wire connection
fixed

Wire connection in
wiring harness

Resistance wire

Shield wire

Airbag spiral spring

Horn

Radio

Speaker

Antenna with electronic
antenna amplifier

Standard equipment, from Sept. 1998

	Wiring Diagram page number	Repair Manual page number
● **Golf/Jetta - Standard Equipment, from September 1998**	1/1	97-46
- Battery, ignition/starter switch	1/2	97-47
- Instrument cluster, starting interlock relay, clutch pedal position (CPP) switch, generator (GEN) warning light	1/3	97-48
- Instrument cluster, tachometer, odometer display headlight high beam indicator light, low fuel level warning light	1/4	97-49
- Instrument cluster, parking brake warning light switch, brake fluid level warning switch, low windshield washer fluid level indication, left and right turn signal indicator lights	1/5	97-50
- Turn signal switch, headlight dimmer/flasher switch, left front turn signal light, light for side marker front left, left headlight	1/6	97-51
- Emergency flasher switch, turn signal relay, right front turn signal light, light for side marker front right, right headlight	1/7	97-52
- Back-up light switch, left rear turn signal light, left back-up light, left brake/tail light, high-mount brake light (Golf only)	1/8	97-53
- Brake light switch, right rear turn signal light, right back-up light, right brake/tail light, high-mount brake light (Jetta only)	1/9	97-54
- Data Link Connector (DLC), radio connection, cigarette lighter	1/10	97-55
- Light switch, instrument panel vent illumination	1/11	97-56
- License plate light	1/12	97-57
- Dual tone horn, fuel tank door remote	1/13	97-58
- Instrument panel light dimmer switch, glove compartment light, rear window defogger switch, heated rear window	1/14	97-59
- Fresh air blower switch, fresh air/recirculating flap switch, fresh air blower	1/15	97-60
- Motor for rear windshield wiper, windshield and rear window washer pump	1/16	97-61
- Windshield wiper/washer switch, windshield wiper intermittent regulator, windshield wiper motor, wiper/washer intermittent relay	1/17	97-62

2.0L engine (code AEG), from Sept.1998

	Wiring Diagram page number	Repair Manual page number
● **2.0L - Engine – Motronic Multiport Fuel Injection (MFI)/85 kW, code AEG, from September 1998**	2/1	97-64
– Battery, ignition/starter switch	1/2	97-47
– Instrument cluster, starting interlock relay, clutch pedal position (CPP) switch, generator (GEN) warning light	1/3	97-48
– Generator (GEN), starter	2/2	97-65
– Motronic engine control module (ECM), ignition system	2/3	97-66
– Motronic engine control module (ECM), camshaft position (CMP) sensor, engine coolant temperature (ECT) sensor, knock sensor (KS) 1	2/4	97-67
– Motronic engine control module (ECM), throttle valve control module, knock sensor (KS) 2, engine speed (RPM) sensor	2/5	97-68
– Motronic engine control module (ECM), injectors	2/6	97-69
– Motronic engine control module (ECM), leak detection pump (LDP)	2/7	97-70
– Motronic engine control module (ECM), secondary air injection (AIR) pump motor, secondary air injection (AIR) solenoid valve	2/8	97-71
– Motronic engine control module (ECM), mass air flow (MAF) sensor, heated oxygen sensor (HO2S), evaporative emission (EVAP) canister purge regulator valve	2/9	97-72
– Fuel pump (FP), fuel level sensor, positive crankcase ventilation (PCV) heating element, engine coolant level (ECL) sensor	2/10	97-73
– Instrument cluster, oil pressure switch, speedometer vehicle speed sensor, generator (GEN) warning light, engine coolant level/temperature (ECL/ECT) warning light	2/11	97-74
– Instrument cluster, multi-function indicator (MFI), engine coolant temperature (ECT) gauge, fuel gauge, malfunction indicator lamp (MIL), outside air temperature sensor	2/12	97-75

1.9L engine (code ALH) w/manual transmission from Sept. 1998

	Wiring Diagram page number	Repair Manual page number
● **1.9L - Engine – Turbo Diesel Fuel Injection (DFI)/66KW, code ALH, (with manual transmission), from September 1998**	4/1	97-90
– Battery, ignition/starter switch	1/2	97-47
– Instrument cluster, starting interlock relay, clutch pedal position (CPP) switch, generator (GEN) warning light	1/3	97-48
– Generator (GEN)	4/2	97-91
– Glow plug relay, starter, glow plugs (engine)	4/3	97-92
– Diesel direct fuel injection (DFI) engine control module (ECM), power supply (terminal 30, B+) relay	4/4	97-93
– Diesel direct fuel injection (DFI) engine control module (ECM), closed throttle position (CTP) switch, intake air temperature (IAT) sensor, manifold absolute pressure (MAP) sensor	4/5	97-94
– Diesel direct fuel injection (DFI) engine control module (ECM), engine speed (RPM) sensor, engine coolant temperature (ECT) sensor, needle lift sensor	4/6	97-95
– Diesel direct fuel injection (DFI) engine control module (ECM), quantity adjuster, mass air flow (MAF) sensor, fuel temperature sensor, modulating piston displacement sensor	4/7	97-96
– Diesel direct fuel injection (DFI) engine control module (ECM), cold start injector, fuel cut-off valve, wastegate bypass regulator valve, EGR vacuum regulator solenoid valve	4/8	97-97
– Diesel direct fuel injection (DFI) engine control module (ECM), cruise control switch, brake vacuum vent valve switch, brake light switch, clutch vacuum vent valve switch	4/9	97-98
– Diesel direct fuel injection (DFI) engine control module (ECM)	4/10	97-99
– Diesel direct fuel Injection (DFI) engine control module (ECM), fuel level sensor, glow plugs (coolant), engine coolant level (ECL) sensor	4/11	97-100
– Instrument cluster, oil pressure switch, speedometer vehicle speed sensor, engine coolant level/temperature (ECL/ECT) warning light, glow plug indicator light	4/12	97-101
– Instrument cluster, multi-function indicator (MFI), engine coolant temperature (ECT) gauge, fuel gauge, speedometer, malfunction indicator lamp (MIL), outside air temperature sensor	4/13	97-102

1.9L engine (code ALH) w/auto. transmission from Sept. 1998

	Wiring Diagram page number	Repair Manual page number
● **1.9L - Engine – Turbo Diesel Fuel Injection (DFI)/66KW, code ALH, (with automatic transmission), from September 1998**	5/1	97-104
– Generator (GEN)	5/2	97-105
– Glow plug relay, starter, glow plugs (engine)	5/3	97-106
– Diesel direct fuel injection (DFI) engine control module (ECM), power supply (terminal 30, B+) relay	5/4	97-107
– Diesel direct fuel injection (DFI) engine control module (ECM), closed throttle position (CTP) switch, intake air temperature (IAT) sensor, manifold absolute pressure (MAP) sensor	5/5	97-108
- Diesel direct fuel injection (DFI) engine control module (ECM), engine speed (RPM) sensor, engine coolant temperature (ECT) sensor, needle lift sensor	5/6	97-109
- Diesel direct fuel injection (DFI) engine control module (ECM), quantity adjuster, mass air flow (MAF) sensor, fuel temperature sensor, modulating piston displacement sensor	5/7	97-110
- Diesel direct fuel injection (DFI) engine control module (ECM), cold start injector, fuel cut-off valve, wastegate bypass regulator valve, EGR vacuum regulator solenoid valve	5/8	97-111
- Diesel direct fuel injection (DFI) engine control module (ECM), cruise control switch, brake vacuum vent valve switch, brake light switch	5/9	97-112
- Diesel direct fuel injection (DFI) engine control module (ECM)	5/10	97-113
- Diesel direct fuel Injection (DFI) engine control module (ECM), fuel level sensor, engine coolant level (ECL) sensor, positive crankcase ventilation (PCV) heating element	5/11	97-114
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor, engine coolant level/temperature (ECL/ECT) warning light, glow plug indicator light	5/12	97-115
- Instrument cluster, multi-function indicator (MFI), engine coolant temperature (ECT) gauge, fuel gauge, speedometer, malfunction indicator lamp (MIL), outside air temperature sensor	5/13	97-116

2.8L engine (code AFP), from Dec. 1998

	Wiring Diagram page number	Repair Manual page number
● **2.8L - Engine – Motronic Multiport Fuel Injection (MFI)/130 kW, code AFP, from December 1998**	3/1	97-76
– Battery, ignition/starter switch	1/2	97-47
– Instrument cluster, starting interlock relay, clutch pedal position (CPP) switch, generator (GEN) warning light	1/3	97-48
– Generator (GEN), starter	3/2	97-77
– Motronic engine control module (ECM), ignition system	3/3	97-78
– Motronic engine control module (ECM), throttle valve control module, engine speed (RPM) sensor, camshaft position (CMP) sensor	3/4	97-79
– Motronic engine control module (ECM), knock sensor (KS) 1, knock sensor (KS) 2, engine coolant temperature (ECT) sensor	3/5	97-80
– Motronic engine control module (ECM), injectors	3/6	97-81
– Motronic engine control module (ECM), after-run coolant pump	3/7	97-82
– Motronic engine control module (ECM), leak detection pump (LDP), intake manifold change-over valve, positive crankcase ventilation (PCV) heating element	3/8	97-83
– Motronic engine control module (ECM), cruise control switch, brake light switch, clutch vacuum vent valve switch, brake vacuum vent valve switch	3/9	97-84
– Motronic engine control module (ECM), angle sensors for throttle drive (power accelerator actuation), heated oxygen sensor (HO2S)	3/10	97-85
– Motronic engine control module (ECM), secondary air injection (AIR) pump system, oxygen sensor (O2S) behind three way catalytic converter (TWC), evaporative emission (EVAP) canister purge regulator valve	3/11	97-86
– Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor	3/12	97-87
– Instrument cluster, oil pressure switch, speedometer vehicle speed sensor, generator (GEN) warning light, engine coolant level/temperature (ECL/ECT) warning light	3/13	97-88
– Instrument cluster, multi-function indicator (MFI), engine coolant temperature (ECT) gauge, fuel gauge, malfunction indicator lamp (MIL), outside air temperature sensor	3/14	97-89

1999 m.y. additional electrical wiring diagrams

	Wiring Diagram page number	Repair Manual page number
● **Airbag systems,** from September 1998	10/1	97-140
● **Airbag systems, vehicles with overlay wiring harness repair,** from September 1998	45/1	97-420
● **Air conditioning (manual control, not Climatronic),** from September 1998		
1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66 kW, code ALH	14/1	97-152
2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code AEG	14/1	97-152
2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/130 kW, code AFP	15/1	97-158
● **Anti-lock brake system (ABS), Anti-lock brake system (ABS) with electronic differential lock (EDL) and anti-slip control (ASC),** from September 1998	9/1	97-134
● **Anti-theft warning system,** from September 1998		
see Comfort System (without power windows)	25/1	97-206
see Comfort System (with power windows)	27/1	97-230
● **Automatic transmission,** from September 1998		
1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66 kW, code ALH	7/1	97-122
2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code AEG	6/1	97-118
2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/130 kW, code AFP	6/1	97-118
● **CD changer wiring preparation (Radio system),** from September 1998	28/1	97-249
● **Central locking system with remote control,** from September 1998		
see Comfort System (without power windows)	25/1	97-206
see Comfort System (with power windows)	27/1	97-230
● **Climatronic (automatic climate control),** from September 1998		
2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/130 kW, code AFP	23/1	97-194
● **Comfort System (without power windows),** from September 1998	25/1	97-206
● **Comfort System (with power windows),** from September 1998	27/1	97-230
● **Coolant Fan, single speed,** from September 1998	11/1	97-144
● **Coolant Fan, two speeds,** from September 1998	12/1	97-146
● **Coolant Fan (with after-run coolant pump),** from September 1998		
2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/130 kW, code AFP	13/1	97-148
● **Cruise control,** from September 1998		
1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66 kW, code ALH, manual transmission	4/9	97-98
1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66 kW, code ALH, automatic transmission	5/9	97-112
2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code AEG	8/1	97-130
2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/130 kW, code AFP	3/9	97-84
● **Daytime running lights,** from September 1998	16/1	97-164
● **Fog lights,** from September 1998	17/1	97-172
● **Fuel tank lid unlock system,** from September 1998		
see Comfort System (without power windows)	25/1	97-206
see Comfort System (with power windows)	27/1	97-230
● **Headlight washer,** from September 1998	18/1	97-178
● **Heated seats,** from September 1998	19/1	97-182
● **Heated leather seats,** from September 1998	20/1	97-184
● **Heated outside mirrors,** from September 1998,		
see Comfort System (without power windows)	25/1	97-206
see Comfort System (with power windows)	27/1	97-230
● **Heated power mirrors,** from September 1998, see Comfort System (with power windows)	27/1	97-230
● **Interior lights,** from September 1998		
see Comfort System (without power windows)	25/1	97-206
see Comfort System (with power windows)	27/1	97-230
● **Interior rear view mirror (self-dimming),** from September 1998	24/1	97-220
● **Luggage compartment light,** from September 1998		
see Comfort System (without power windows)	25/1	97-206
see Comfort System (with power windows)	27/1	97-230
● **Power seats and mirror adjustment with Memory,** from September 1998	26/1	97-220
● **Power sunroof,** from September 1998		
see Comfort System (without power windows)	25/1	97-206
see Comfort System (with power windows)	27/1	97-230
● **Power outlet (12V),** from September 1998	22/1	97-192
● **Power windows,** from September 1998, see Comfort System (with power windows)	27/1	97-230
● **Radio system (with CD changer wiring preparation),** from September 1998	28/1	97-249
● **Rain-sensor,** from September 1998	24/1	97-202
● **Rear lid unlock system,** from September 1998		
see Comfort System (without power windows)	25/1	97-206
see Comfort System (with power windows)	27/1	97-230
● **Seat belt control,** from September 1998	10/1	97-140
● **Seat belt tensioner,** from September 1998	10/1	97-140
● **Warning light for rear lid unlocked,** from September 1998		
see Comfort System (without power windows)	25/1	97-206
see Comfort System (with power windows)	27/1	97-230
● **Washer nozzle heaters,** from September 1998	21/1	97-190

Standard equipment

	Wiring Diagram page number	Repair Manual page number
● Golf/Jetta - Standard Equipment, from May 1999	29/1	97-252
- Battery, ignition/starter switch	29/2	97-253
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay	29/3	97-254
- Instrument cluster, tachometer, speedometer, odometer display antitheft immobilizer, warning light for anti-theft imobilizer sensor	29/4	97-255
- Instrument cluster, generator (GEN) warning light, digital clock, low fuel level warning light	29/5	97-256
- Instrument cluster, left front brake pad wear sensor, brake pad wear indicator light, headlight high beam indicator light	29/6	97-257
- Instrument cluster, parking brake warning light switch, brake fluid level warning switch, low windshield washer fluid level indication, left and right turn signal indicator lights	29/7	97-258
- Turn signal switch, headlight dimmer/flasher switch, left front turn signal light, light for side marker front left, left headlight	29/8	97-259
- Emergency flasher switch, turn signal relay, right front turn signal light, light for side marker front right, right headlight	29/9	97-260
- Back-up light switch, left rear turn signal light, left back-up light, left brake/tail light, high-mount brake light (Golf only)	29/10	97-261
- Brake light switch, right rear turn signal light, right back-up light, right brake/tail light, high-mount brake light (Jetta only)	29/11	97-262
- Data Link Connector (DLC) radio connection, cigarette lighter	29/12	97-263
- Light switch, rear fog light switch, instrument panel vent illumination	29/13	97-264
- License plate light	29/14	97-265
- Dual tone horn, fuel tank door remote	29/15	97-266
- Instrument panel light dimmer switch, glove compartment light, rear window defogger switch, heated rear window	29/16	97-267
- Fresh air blower switch, fresh air/recirculating flap switch, fresh air blower	29/17	97-268
- Motor for rear windshield wiper, windshield and rear window washer pump	29/18	97-269
- Windshield wiper/washer switch, windshield wiper intermittent regulator, windshield wiper motor, wiper/washer intermittent relay	29/19	97-270
● Golf/Jetta Sedan - Standard Equipment, from May 2000	52/1	97-495
- Battery, ignition/starter switch	52/2	97-494
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay	52/3	97-497
- Instrument cluster, tachometer, speedometer, odometer display, anti-theft immobilizer, warning light for anti-theft immobilizer sensor	52/4	97-496
- Instrument cluster, generator (GEN) warning light, low fuel level warning light, warning light for rear lid unlocked/door ajar indicator lamp	52/5	97-499
- Instrument cluster, left front brake pad wear sensor, brake pad wear indicator light, headlight high beam indicator light, digital clock	52/6	97-498
- Instrument cluster, parking brake warning light switch, brake fluid level warning switch, low windshield washer fluid level indication, left and right turn signal indicator lights	52/7	97-501
- Turn signal switch, headlight dimmer/flasher switch, left front turn signal light, light for side marker front left, left headlight	52/8	97-500
- Emergency flasher switch, turn signal relay, right front turn signal light, light for side marker front right, right headlight	52/9	97-503
- Left rear turn signal light, left back-up light, left brake/tail light, high-mount brake light (Golf only)	52/10	97-502
- Back-up light switch, brake light switch, right rear turn signal light, right back-up light, right brake/tail light	52/11	97-505
- Data Link Connector (DLC)	52/12	97-504
- Radio connection, cigarette lighter, instrument panel vent illumination	52/13	97-507
- Light switch	52/14	97-506
- License plate light, glove compartment light	52/15	97-509
- Dual tone horn, fuel tank door remote	52/16	97-508
- Instrument panel light dimmer switch, rear window defogger switch, heated rear window	52/17	97-511
- Fresh air blower switch, fresh air/recirculating flap switch, fresh air blower	52/18	97-510
- Motor for rear windshield wiper, windshield and rear window washer pump	52/19	97-513
- Windshield wiper/washer switch, windshield wiper intermittent regulator, windshield wiper motor, wiper/washer intermittent relay	52/20	97-512

2.0L engine (code AEG), from May 1999

	Wiring Diagram page number	Repair Manual page number
● 2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code AEG, from May 1999	30/1	97-272
- Battery, ignition/starter switch	29/2	97-253
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay	29/3	97-254
- Generator (GEN), starter	30/2	97-273
- Motronic engine control module (ECM), ignition system	30/3	97-274
- Motronic engine control module (ECM), camshaft position (CMP) sensor, engine coolant temperature (ECT) sensor, knock sensor (KS) 1	30/4	97-275
- Motronic engine control module (ECM), throttle valve control module, knock sensor (KS) 2, engine speed (RPM) sensor	30/5	97-276
- Motronic engine control module (ECM), injectors	30/6	97-277
- Motronic engine control module (ECM), leak detection pump (LDP), positive crankcase ventilation (PCV) heating element,	30/7	97-278
- Motronic engine control module (ECM), secondary air injection (AIR) pump motor, secondary air injection (AIR) solenoid valve	30/8	97-279
- Motronic engine control module (ECM), mass air flow (MAF) sensor, heated oxygen sensor (HO2S), evaporative emission (EVAP) canister purge regulator valve	30/9	97-280
- Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor	30/10	97-281
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor, generator (GEN) warning light, engine coolant level/temperature (ECL/ECT) warning light	30/11	97-282
- Instrument cluster, multi-function indicator (MFI), engine coolant temperature (ECT) gauge, fuel gauge, malfunction indicator lamp (MIL), outside air temperature sensor	30/12	97-283

1.9L engine (code ALH) w/manual transmission from May 1999

	Wiring Diagram page number	Repair Manual page number
● **1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66KW, code ALH, (with manual transmission), from May 1999**	32/1	97-298
- Battery, ignition/starter switch	29/2	97-253
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay	29/3	97-254
- Generator (GEN), starter	32/2	97-299
- Glow plug relay, glow plugs (engine)	32/3	97-300
- Diesel direct fuel injection (DFI) engine control module (ECM), power supply (terminal 30, B+) relay, fuel temperature sensor, quantity adjuster, modulating piston displacement sensor	32/4	97-301
- Diesel direct fuel injection (DFI) engine control module (ECM), engine coolant temperature (ECT) sensor, intake air temperature (IAT) sensor, manifold absolute pressure (MAP) sensor	32/5	97-302
- Diesel direct fuel injection (DFI) engine control module (ECM)	32/6	97-303
- Diesel direct fuel injection (DFI) engine control module (ECM), kick down switch, (CTP) switch, engine speed (RPM) sensor, throttle position (TP) sensor, needle lift sensor	32/7	97-304
- (DFI) engine control module (ECM), mass air flow sensor, change-over valve for intake manifold flap, wastegate bypass regulator valve, EGR vacuum regulator solenoid valve	32/8	97-305
- Diesel direct fuel injection (DFI) engine control module (ECM), cruise control switch, clutch vacuum vent valve switch, cold start injector, fuel cut-off valve	32/9	97-306
- Diesel direct fuel injection (DFI) engine control module (ECM), brake light switch, brake vacuum vent valve switch for cruise control/diesel, glow plugs (coolant)	32/10	97-307
- Fuel level sensor, engine coolant level (ECL) sensor	32/11	97-308
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor, generator (GEN) warning light, engine coolant level/temperature (ECL/ECT) warning light	32/12	97-309
- Instrument cluster, engine coolant temperature (ECT) gauge, fuel gauge, tachometer, speedometer, glow plug indicator light	32/13	97-310

1.9L engine (code ALH) w/auto. transmission from May 1999

	Wiring Diagram page number	Repair Manual page number
● **1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66KW, code ALH, (with automatic transmission), from May 1999**	33/1	97-312
- Generator (GEN), starter	33/2	97-313
- Glow plug relay, glow plugs (engine)	33/3	97-314
- Diesel direct fuel injection (DFI) engine control module (ECM), power supply (terminal 30, B+) relay, fuel temperature sensor, quantity adjuster, modulating piston displacement sensor	33/4	97-315
- Diesel direct fuel injection (DFI) engine control module (ECM), engine coolant temperature (ECT) sensor, intake air temperature (IAT) sensor, manifold absolute pressure (MAP) sensor	33/5	97-316
- Diesel direct fuel injection (DFI) engine control module (ECM)	33/6	97-317
- Diesel direct fuel injection (DFI) engine control module (ECM), kick down switch, (CTP) switch, engine speed (RPM) sensor, throttle position (TP) sensor, needle lift sensor	33/7	97-318
- (DFI) engine control module (ECM), mass air flow sensor, change-over valve for intake manifold flap, wastegate bypass regulator valve, EGR vacuum regulator solenoid valve	33/8	97-319
- Diesel direct fuel injection (DFI) engine control module (ECM), cruise control switch, fuel cut-off valve	33/9	97-320
- Diesel direct fuel injection (DFI) engine control module (ECM), brake light switch, brake vacuum vent valve switch for cruise control/diesel	33/10	97-321
- Fuel level sensor, engine coolant level (ECL) sensor	33/11	97-322
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor, generator (GEN) warning light, engine coolant level/temperature (ECL/ECT) warning light	33/12	97-323
- Instrument cluster, engine coolant temperature (ECT) gauge, fuel gauge, tachometer, speedometer, glow plug indicator light	33/13	97-324

2.8L engine (code AFP), from May 1999

	Wiring Diagram page number	Repair Manual page number
● **2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/130 kW, code AFP, from May 1999**	31/1	97-284
- Battery, ignition/starter switch	29/2	97-253
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay	29/3	97-254
- Generator (GEN), starter	31/2	97-285
- Motronic engine control module (ECM), ignition system	31/3	97-286
- Motronic engine control module (ECM), throttle valve control module, engine speed (RPM) sensor, camshaft position (CMP) sensor	31/4	97-287
- Motronic engine control module (ECM), knock sensor (KS) 1, knock sensor (KS) 2, engine coolant temperature (ECT) sensor	31/5	97-288
- Motronic engine control module (ECM), injectors	31/6	97-289
- Motronic engine control module (ECM), after-run coolant pump	31/7	97-290
- Motronic engine control module (ECM), leak detection pump (LDP), intake manifold change-over valve, (PCV) heating element, brake booster vacuum valve	31/8	97-291
- Motronic engine control module (ECM), cruise control switch, brake light switch, clutch vacuum vent valve switch, brake vacuum vent valve switch	31/9	97-292
- Motronic engine control module (ECM), angle sensors for throttle drive (power accelerator actuation), heated oxygen sensor (HO2S)	31/10	97-293
- Motronic engine control module (ECM), secondary air injection (AIR) pump system, oxygen sensor (O2S) behind three way catalytic converter (TWC)	31/11	97-294
- Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor	31/12	97-295
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor, generator (GEN) warning light, engine coolant level/temperature (ECL/ECT) warning light	31/13	97-296
- Instrument cluster, multi-function indicator (MFI), engine coolant temperature (ECT) gauge, fuel gauge, malfunction indicator lamp (MIL), electronic power control (EPC) warning lamp	31/14	97-297

1.8L engine (code AWD), from Nov. 1999

	Wiring Diagram page number	Repair Manual page number
● **1.8L - Engine - Motronic Multiport Fuel Injection (MFI)/110 kW, code AWD, from November 1999**	41/1	97-368
- Generator (GEN), starter	41/2	97-369
- Motronic engine control module (ECM) power supply relay	41/3	97-370
- Motronic engine control module (ECM), ignition system	41/4	97-371
- Motronic engine control module (ECM)	41/5	97-372
- Motronic engine control module (ECM), (ECT) sensor, charge air pressure sensor, camshaft position (CMP) sensor 2, wastegate bypass regulator valve, recirculating valve for turbocharger	41/6	97-373
- Motronic engine control module (ECM), angle sensor for throttle drive (power accelerator actuation), intake air temperature (IAT) sensor, knock sensor (KS) 1, leak detection pump (LDP)	41/7	97-374
- Motronic engine control module (ECM), pressure switch/power steering, engine speed (RPM) sensor, knock sensor (KS) 2	41/8	97-375
- Motronic engine control module (ECM), heated oxygen sensor (HO2S), injectors	41/9	97-376
- Motronic engine control module (ECM), throttle position (TP) sensor, oxygen sensor (O2S) behind three way catalytic converter (TWC), evaporative emission (EVAP) canister purge	41/10	97-377
- Motronic engine control module (ECM), fuel pump (FP) relay, cruise control switch, mass air flow (MAF) sensor	41/11	97-378
- Motronic engine control module (ECM), secondary air injection (AIR) pump system, brake light switch, clutch vacuum vent valve switch, brake vacuum vent valve switch	41/12	97-379
- Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor	41/13	97-380
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensorm, oil pressure warning light	41/14	97-381
- Instrument cluster, engine coolant temperature (ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning Light	41/15	97-382
- Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, fault light for power accelerator activation	41/16	97-383

2000 m.y. additional electrical wiring diagrams

	Wiring Diagram page number	Repair Manual page number
● **Airbag systems,** from May 1999	34/1	97-326
● **Air conditioning (manual control, not Climatronic),** from May 1999		
1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66 kW, code ALH	38/1	97-348
1.8L - Engine - Motronic Multiport Fuel Injection (MFI)/110 kW, code AWD	38/1	97-348
2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code AEG	38/1	97-348
2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/130 kW, code AFP	38/1	97-348
● **Anti-lock brake system (ABS),** **Anti-lock brake system (ABS) with electronic differential lock (EDL) and anti-slip control (ASC),** from September 1998	9/1	97-134
● **Anti-theft warning system,** from May 1999		
see Comfort System (without power windows)	42/1	97-384
see Comfort System (with power windows)	43/1	97-398
● **Automatic transmission,** from May 1999		
1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66 kW, code ALH	36/1	97-336
1.8L - Engine - Motronic Multiport Fuel Injection (MFI)/110 kW, code AWD	35/1	97-331
2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code AEG	35/1	97-331
2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/130 kW, code AFP	35/1	97-331
● **CD changer wiring preparation (Radio system),** from September 1998	28/1	97-249
● **Central locking system with remote control,** from May 1999		
see Comfort System (without power windows)	42/1	97-384
see Comfort System (with power windows)	43/1	97-398
● **Climatronic (automatic climate control),** from May 1999		
2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/130 kW, code AFP	39/1	97-355
● **Comfort System (without power windows),** from May 1999	42/1	97-384
● **Comfort System (with power windows),** from May 1999	43/1	97-398
● **Coolant Fan, single speed,** from September 1998	11/1	97-144
● **Coolant Fan, two speeds,** from September 1998	12/1	97-146
● **Coolant Fan (with after-run coolant pump),** from May 1999		
2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/130 kW, code AFP	37/1	97-344
● **Cruise control,** from May 999		
1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66 kW, code ALH, manual transmission	32/10	97-307
1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66 kW, code ALH, automatic transmission	33/10	97-321
2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code AEG	44/1	97-416
2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/130 kW, code AFP	31/9	97-292
● **Cruise control,** from November 1999		
1.8L - Engine - Motronic Multiport Fuel Injection (MFI)/110 kW, code AWD	41/11	97-378
● **Daytime running lights,** from September 1998	16/1	97-164
● **Fog lights,** from September 1998	17/1	97-172
● **Fuel tank lid unlock system,** from May 1999		
see Comfort System (without power windows)	42/1	97-384
see Comfort System (with power windows)	43/1	97-398
● **Headlight washer,** from September 1998	18/1	97-178
● **Heated seats,** from May 1999	68/1	97-702
● **Heated leather seats,** from May 1999	69/1	97-706
● **Heated outside mirrors,** from May 1999		
see Comfort System (without power windows)	42/1	97-384
see Comfort System (with power windows)	43/1	97-398
● **Heated power mirrors,** from September 1998, see Comfort System (with power windows)	43/1	97-398
● **Interior lights,** from May 1999		
see Comfort System (without power windows)	42/1	97-384
see Comfort System (with power windows)	43/1	97-398
● **Interior rear view mirror (self-dimming),** from May 1999	70/1	97-710
● **Luggage compartment light,** from May 1999		
see Comfort System (without power windows)	42/1	97-384
see Comfort System (with power windows)	43/1	97-398
● **Power seats and mirror adjustment with Memory,** from September 1998	26/1	97-220
● **Power sunroof,** from May 1999		
see Comfort System (without power windows)	42/1	97-384
see Comfort System (with power windows)	43/1	97-398
● **Power outlet (12V),** from September 1998	22/1	97-192
● **Power windows,** from May 1999, see Comfort System (with power windows)	43/1	97-398
● **Radio system (with CD changer wiring preparation),** from September 1998	28/1	97-249
● **Radio system "Monsoon" (with CD changer wiring preparation),** from May 1999	40/1	97-362
● **Rain-sensor,** from May 1999	70/1	97-710
● **Rear lid unlock system,** from May 1999		
see Comfort System (without power windows)	42/1	97-384
see Comfort System (with power windows)	43/1	97-398
● **Seat belt control,** from May 1999	34/1	97-326
● **Seat belt tensioner,** from September 1998	34/1	97-326
● **Warning light for rear lid unlocked,** from May 1999		
see Comfort System (without power windows)	42/1	97-384
see Comfort System (with power windows)	43/1	97-398
● **Washer nozzle heaters,** from May 1999	67/1	97-700

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Golf/Jetta sedan standard equipment from May 2000

	Wiring Diagram page number	Repair Manual page number
● **Golf/Jetta Sedan - Standard Equipment, from May 2000**	52/1	97-495
- Battery, ignition/starter switch	52/2	97-494
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay	52/3	97-497
- Instrument cluster, tachometer, speedometer, odometer display, anti-theft immobilizer, warning light for anti-theft immobilizer sensor	52/4	97-496
- Instrument cluster, generator (GEN) warning light, low fuel level warning light, warning light for rear lid unlocked/door ajar indicator lamp	52/5	97-499
- Instrument cluster, left front brake pad wear sensor, brake pad wear indicator light, headlight high beam indicator light, digital clock	52/6	97-498
- Instrument cluster, parking brake warning light switch, brake fluid level warning switch, low windshield washer fluid level indication, left and right turn signal indicator lights	52/7	97-501
- Turn signal switch, headlight dimmer/flasher switch, left front turn signal light, light for side marker front left, left headlight	52/8	97-500
- Emergency flasher switch, turn signal relay, right front turn signal light, light for side marker front right, right headlight	52/9	97-503
- Left rear turn signal light, left back-up light, left brake/tail light, high-mount brake light (Golf only)	52/10	97-502
- Back-up light switch, brake light switch, right rear turn signal light, right back-up light, right brake/tail light	52/11	97-505
- Data Link Connector (DLC)	52/12	97-504
- Radio connection, cigarette lighter, instrument panel vent illumination	52/13	97-507
- Light switch	52/14	97-506
- License plate light, glove compartment light	52/15	97-509
- Dual tone horn, fuel tank door remote	52/16	97-508
- Instrument panel light dimmer switch, rear window defogger switch, heated rear window	52/17	97-511
- Fresh air blower switch, fresh air/recirculating flap switch, fresh air blower	52/18	97-510
- Motor for rear windshield wiper, windshield and rear window washer pump	52/19	97-513
- Windshield wiper/washer switch, windshield wiper intermittent regulator, windshield wiper motor, wiper/washer intermittent relay	52/20	97-512

Golf/Jetta wagon standard equipment from January 2001

	Wiring Diagram page number	Repair Manual page number
● **Golf/Jetta Wagon - Standard Equipment, from January 2001**	51/1	97-475
- Battery, ignition/starter switch	51/2	97-474
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay	51/3	97-477
- Instrument cluster, tachometer, speedometer, odometer display, anti-theft immobilizer, warning light for anti-theft immobilizer sensor	51/4	97-476
- Instrument cluster, generator (GEN) warning light, low fuel level warning light, warning light for rear lid unlocked/door ajar indicator lamp	51/5	97-479
- Instrument cluster, left front brake pad wear sensor, brake pad wear indicator light, headlight high beam indicator light, digital clock	51/6	97-478
- Instrument cluster, parking brake warning light switch, brake fluid level warning switch, low windshield washer fluid level indication, left and right turn signal indicator lights	51/7	97-481
- Turn signal switch, headlight dimmer/flasher switch, left front turn signal light, light for side marker front left, left headlight	51/8	97-480
- Emergency flasher switch, turn signal relay, right front turn signal light, light for side marker front right, right headlight	51/9	97-483
- Back-up light switch, left rear turn signal light, left back-up light, left brake/tail light, high-mount brake light	51/10	97-484
- Brake light switch, right rear turn signal light, right back-up light, right brake/tail light	51/11	97-485
- Data Link Connector (DLC), radio connection, cigarette lighter	51/12	97-484
- Light switch	51/13	97-487
- License plate light, glove compartment light	51/14	97-486
- Dual tone horn, fuel tank door remote	51/15	97-489
- Instrument panel light dimmer switch, rear window defogger switch, heated rear window	51/16	97-488
- Fresh air blower switch, fresh air/recirculating flap switch, fresh air blower	51/17	97-491
- Motor for rear windshield wiper, windshield and rear window washer pump	51/18	97-490
- Windshield wiper/washer switch, windshield wiper intermittent regulator, windshield wiper motor, wiper/washer intermittent relay	51/19	97-493

1.8L engine (code AWW)

	Wiring Diagram page number	Repair Manual page number
● **1.8L - Engine - Motronic Multiport Fuel Injection (MFI)/110 kW, code AWW, from June 2000**	47/1	97-428
- Battery, ignition/starter switch (Jetta Wagon)	51/2	97-474
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Jetta Wagon)	51/3	97-477
- Battery, ignition/starter switch (Golf/Jetta Sedan)	52/2	97-494
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Golf/Jetta Sedan)	52/3	97-497
- Generator (GEN), starter	47/2	97-429
- Motronic engine control module (ECM) power supply relay	47/3	97-430
- Motronic engine control module (ECM), ignition system	47/4	97-431
- Motronic engine control module (ECM)	47/5	97-432
- Charge air pressure sensor, camshaft position (CMP) sensor, wastegate bypass regulator valve, recirculating valve for turbocharger, valve for camshaft adjustment	47/6	97-433
- Motronic engine control module (ECM), angle sensor for throttle drive (power accelerator actuation), intake air temperature (IAT) sensor, (ECT) sensor, leak detection pump (LDP)	47/7	97-434
- Motronic engine control module (ECM), engine speed (RPM) sensor, knock sensor (KS) 1, knock sensor (KS) 2	47/8	97-435
- Motronic engine control module (ECM), pressure switch/power steering, injectors	47/9	97-436
- Heated oxygen sensor (HO2S), oxygen sensor (O2S) behind three way catalytic converter (TWC), evaporative emission (EVAP) canister purge regulator valve	47/10	97-437
- Motronic engine control module (ECM), brake booster control module, brake vacuum pump	47/11	97-438
- Motronic engine control module (ECM), secondary air injection (AIR) pump system, brake light switch, brake vacuum vent valve switch for cruise control	47/12	97-439
- Motronic engine control module (ECM), cruise control switch, mass air flow (MAF) sensor, clutch vacuum vent valve switch	47/13	97-440
- Motronic engine control module (ECM), throttle position (TP) sensor, fuel pump (FP) relay	47/14	97-441
- Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor	47/15	97-442
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light	47/16	97-443
- Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light	47/17	97-444
- Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp	47/18	97-445
● **1.8L - Engine - Motronic Multiport Fuel Injection (MFI)/110 kW, code AWW,** from February 2001	64/1	97-655
- Battery, ignition/starter switch (Jetta Wagon)	51/2	97-474
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Jetta Wagon)	51/3	97-477
- Battery, ignition/starter switch (Golf/Jetta Sedan)	52/2	97-494
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Golf/Jetta Sedan)	52/3	97-497
- Generator (GEN), starter	64/2	97-654
- Motronic engine control module (ECM) power supply relay	64/3	97-657
- Motronic engine control module (ECM), ignition system	64/4	97-656
- Motronic engine control module (ECM)	64/5	97-659
- Charge air pressure sensor, camshaft position (CMP) sensor, wastegate bypass regulator valve, recirculating valve for turbocharger, valve for camshaft adjustment	64/6	97-658
- Motronic engine control module (ECM), angle sensor for throttle drive (power accelerator actuation), intake air temperature (IAT) sensor, (ECT) sensor, leak detection pump (LDP)	64/7	97-661
- Motronic engine control module (ECM), engine speed (RPM) sensor, knock sensor (KS) 1, knock sensor (KS) 2	64/8	97-660
- Motronic engine control module (ECM), pressure switch/power steering, injectors	64/9	97-663
- Motronic engine control module (ECM), heated oxygen sensor (HO2S), oxygen sensor (O2S) behind three way catalytic converter (TWC), (EVAP) canister purge regulator valve	64/10	97-662
- Motronic engine control module (ECM), brake booster control module, brake system vacuum pump	64/11	97-665
- Motronic engine control module (ECM), secondary air injection (AIR) pump system, brake light switch, brake vacuum vent valve switch for cruise control	64/12	97-664
- Motronic engine control module (ECM), cruise control switch, mass air flow (MAF) sensor, clutch vacuum vent valve switch	64/13	97-667
- Motronic engine control module (ECM), throttle position (TP) sensor, fuel pump (FP) relay	64/14	97-666
- Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor	64/15	97-669
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light	64/16	97-668
- Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light	64/17	97-671
- Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp	64/18	97-670

1.8L engine (code AWP) from June 2001

	Wiring Diagram page number	Repair Manual page number
● **1.8L - Engine - Motronic Multiport Fuel Injection (MFI)/132 kW, code AWP, from June 2001**	62/1	97-629
- Battery, ignition/starter switch (Jetta Wagon)	51/2	97-474
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Jetta Wagon)	51/3	97-477
- Battery, ignition/starter switch (Golf/Jetta Sedan)	52/2	97-494
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Golf/Jetta Sedan)	52/3	97-497
- Generator (GEN), starter	62/2	97-628
- Motronic engine control module (ECM) power supply relay	62/3	97-631
- Motronic engine control module (ECM), ignition system	62/4	97-630
- Motronic engine control module (ECM)	62/5	97-633
- Charge air pressure sensor, camshaft position (CMP) sensor, wastegate bypass regulator valve, recirculating valve for turbocharger, valve for camshaft adjustment	62/6	97-632
- Motronic engine control module (ECM), angle sensor for throttle drive (power accelerator actuation), intake air temperature (IAT) sensor, (ECT) sensor, leak detection pump (LDP)	62/7	97-635
- Motronic engine control module (ECM), engine speed (RPM) sensor, knock sensor (KS) 1, knock sensor (KS) 2	62/8	97-634
- Motronic engine control module (ECM), pressure switch/power steering, injectors	62/9	97-637
- Motronic engine control module (ECM), heated oxygen sensor (HO2S), oxygen sensor (O2S) behind three way catalytic converter (TWC), (EVAP) canister purge regulator valve	62/10	97-636
- Motronic engine control module (ECM), brake booster control module, brake system vacuum pump	62/11	97-639
- Motronic engine control module (ECM), secondary air injection (AIR) pump system, brake light switch, brake vacuum vent valve switch for cruise control	62/12	97-638
- Motronic engine control module (ECM), cruise control switch, mass air flow (MAF) sensor, clutch vacuum vent valve switch	62/13	97-641
- Motronic engine control module (ECM), throttle position (TP) sensor, fuel pump (FP) relay	62/14	97-640
- Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor	62/15	97-643
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light	62/16	97-642
- Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light	62/17	97-645
- Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp	62/18	97-644

1.9L engine (code ALH) from May 1999

	Wiring Diagram page number	Repair Manual page number
● **1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66KW, code ALH, (with manual transmission), from May 1999**	32/1	97-298
- Battery, ignition/starter switch (Jetta Wagon)	51/2	97-474
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Jetta Wagon)	51/3	97-477
- Battery, ignition/starter switch (Golf/Jetta Sedan)	52/2	97-494
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Golf/Jetta Sedan)	52/3	97-497
- Generator (GEN), starter	32/2	97-299
- Glow plug relay, glow plugs (engine)	32/3	97-300
- Diesel direct fuel injection (DFI) engine control module (ECM), power supply (terminal 30, B+) relay, fuel temperature sensor, quantity adjuster, modulating piston displacement sensor	32/4	97-301
- Diesel direct fuel injection (DFI) engine control module (ECM), engine coolant temperature (ECT) sensor, intake air temperature (IAT) sensor, manifold absolute pressure (MAP) sensor	32/5	97-302
- Diesel direct fuel injection (DFI) engine control module (ECM)	32/6	97-303
- Diesel direct fuel injection (DFI) engine control module (ECM), kick down switch, (CTP) switch, engine speed (RPM) sensor, throttle position (TP) sensor, needle lift sensor	32/7	97-304
- (DFI) engine control module (ECM), mass air flow sensor, change-over valve for intake manifold flap, wastegate bypass regulator valve, EGR vacuum regulator solenoid valve	32/8	97-305
- Diesel direct fuel injection (DFI) engine control module (ECM), cruise control switch, clutch vacuum vent valve switch, cold start injector, fuel cut-off valve	32/9	97-306
- Diesel direct fuel injection (DFI) engine control module (ECM), brake light switch, brake vacuum vent valve switch for cruise control/diesel, glow plugs (coolant)	32/10	97-307
- Fuel level sensor, engine coolant level (ECL) sensor	32/11	97-308
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor, generator (GEN) warning light, engine coolant level/temperature (ECL/ECT) warning light	32/12	97-309
- Instrument cluster, engine coolant temperature (ECT) gauge, fuel gauge, tachometer, speedometer, glow plug indicator light	32/13	97-310
● **1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66KW, code ALH, (with automatic transmission), from May 1999**	33/1	97-312
- Battery, ignition/starter switch (Jetta Wagon)	51/2	97-474
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Jetta Wagon)	51/3	97-477
- Battery, ignition/starter switch (Golf/Jetta Sedan)	52/2	97-494
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Golf/Jetta Sedan)	52/3	97-497
- Generator (GEN), starter	33/2	97-313
- Glow plug relay, glow plugs (engine)	33/3	97-314
- Diesel direct fuel injection (DFI) engine control module (ECM), power supply (terminal 30, B+) relay, fuel temperature sensor, quantity adjuster, modulating piston displacement sensor	33/4	97-315
- Diesel direct fuel injection (DFI) engine control module (ECM), engine coolant temperature (ECT) sensor, intake air temperature (IAT) sensor, manifold absolute pressure (MAP) sensor	33/5	97-316
- Diesel direct fuel injection (DFI) engine control module (ECM)	33/6	97-317
- Diesel direct fuel injection (DFI) engine control module (ECM), kick down switch, (CTP) switch, engine speed (RPM) sensor, throttle position (TP) sensor, needle lift sensor	33/7	97-318
- (DFI) engine control module (ECM), mass air flow sensor, change-over valve for intake manifold flap, wastegate bypass regulator valve, EGR vacuum regulator solenoid valve	33/8	97-319
- Diesel direct fuel injection (DFI) engine control module (ECM), cruise control switch, fuel cut-off valve	33/9	97-320
- Diesel direct fuel injection (DFI) engine control module (ECM), brake light switch, brake vacuum vent valve switch for cruise control/diesel	33/10	97-321
- Fuel level sensor, engine coolant level (ECL) sensor	33/11	97-322
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor, generator (GEN) warning light, engine coolant level/temperature (ECL/ECT) warning light	33/12	97-323
- Instrument cluster, engine coolant temperature (ECT) gauge, fuel gauge, tachometer, speedometer, glow plug indicator light	33/13	97-324

1.9L engine (code ALH) from September 2001

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● **1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66KW, code ALH, (with manual transmission),** from September 2001	65/1	97-673
- Battery, ignition/starter switch (Jetta Wagon)	51/2	97-474
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Jetta Wagon)	51/3	97-477
- Battery, ignition/starter switch (Golf/Jetta Sedan)	52/2	97-494
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Golf/Jetta Sedan)	52/3	97-497
- Generator (GEN), starter	65/2	97-672
- Control module for glow plug triggering, glow plugs (engine)	65/3	97-675
- Diesel direct fuel injection (DFI) engine control module (ECM), power supply (terminal 30, B+) relay, fuel temperature sensor, quantity adjuster, modulating piston displacement sensor	65/4	97-674
- Diesel direct fuel injection (DFI) engine control module (ECM), engine coolant temperature (ECT) sensor, intake air temperature (IAT) sensor, manifold absolute pressure (MAP) sensor	65/5	97-677
- Diesel direct fuel injection (DFI) engine control module (ECM)	65/6	97-676
- Diesel direct fuel injection (DFI) engine control module (ECM), kick down switch, (CTP) switch, engine speed (RPM) sensor, throttle position (TP) sensor, needle lift sensor	65/7	97-679
- (DFI) engine control module (ECM), mass air flow sensor, change-over valve for intake manifold flap, wastegate bypass regulator valve, EGR vacuum regulator solenoid valve	65/8	97-678
- Diesel direct fuel injection (DFI) engine control module (ECM), cruise control switch, clutch vacuum vent valve switch, cold start injector, fuel cut-off valve	65/9	97-681
- Diesel direct fuel injection (DFI) engine control module (ECM), brake light switch, brake pedal switch (cruise control/Diesel Direct Fuel Injection), glow plugs (coolant)	65/10	97-680
- Fuel level sensor, engine coolant level (ECL) sensor	65/11	97-683
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor, generator (GEN) warning light, engine coolant level/temperature (ECL/ECT) warning light	65/12	97-682
- Instrument cluster, engine coolant temperature (ECT) gauge, fuel gauge, tachometer, speedometer, glow plug indicator light	65/13	97-685
● **1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66KW, code ALH, (with automatic transmission),** from September 2001	66/1	97-687
- Battery, ignition/starter switch (Jetta Wagon)	51/2	97-474
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Jetta Wagon)	51/3	97-477
- Battery, ignition/starter switch (Golf/Jetta Sedan)	52/2	97-494
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Golf/Jetta Sedan)	52/3	97-497
- Generator (GEN), starter	66/2	97-686
- Control module for glow plug triggering, glow plugs (engine)	66/3	97-689
- Diesel direct fuel injection (DFI) engine control module (ECM), power supply (terminal 30, B+) relay, fuel temperature sensor, quantity adjuster, modulating piston displacement sensor	66/4	97-688
- Diesel direct fuel injection (DFI) engine control module (ECM), engine coolant temperature (ECT) sensor, intake air temperature (IAT) sensor, manifold absolute pressure (MAP) sensor	66/5	97-691
- Diesel direct fuel injection (DFI) engine control module (ECM)	66/6	97-690
- Diesel direct fuel injection (DFI) engine control module (ECM), kick down switch, (CTP) switch, engine speed (RPM) sensor, throttle position (TP) sensor, needle lift sensor	66/7	97-693
- (DFI) engine control module (ECM), mass air flow sensor, change-over valve for intake manifold flap, wastegate bypass regulator valve, EGR vacuum regulator solenoid valve	66/8	97-692
- Diesel direct fuel injection (DFI) engine control module (ECM), cruise control switch, fuel cut-off valve	66/9	97-695
- Diesel direct fuel injection (DFI) engine control module (ECM), brake light switch, brake pedal switch (cruise control/Diesel Direct Fuel Injection)	66/10	97-694
- Fuel level sensor, engine coolant level (ECL) sensor	66/11	97-697
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor, generator (GEN) warning light, engine coolant level/temperature (ECL/ECT) warning light	66/12	97-696
- Instrument cluster, engine coolant temperature (ECT) gauge, fuel gauge, tachometer, speedometer, glow plug indicator light	66/13	97-699

2.0L engine (code AEG), from May 1999

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● **2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code AEG, from May 1999**	30/1	97-272
- Battery, ignition/starter switch (Jetta Wagon)	51/2	97-474
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Jetta Wagon)	51/3	97-477
- Battery, ignition/starter switch (Golf/Jetta Sedan)	52/2	97-494
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Golf/Jetta Sedan)	52/3	97-497
- Generator (GEN), starter	30/2	97-273
- Motronic engine control module (ECM), ignition system	30/3	97-274
- Motronic engine control module (ECM), camshaft position (CMP) sensor, engine coolant temperature (ECT) sensor, knock sensor (KS) 1	30/4	97-275
- Motronic engine control module (ECM), throttle valve control module, knock sensor (KS) 2, engine speed (RPM) sensor	30/5	97-276
- Motronic engine control module (ECM), injectors	30/6	97-277
- Motronic engine control module (ECM), leak detection pump (LDP), positive crankcase ventilation (PCV) heating element,	30/7	97-278
- Motronic engine control module (ECM), secondary air injection (AIR) pump motor, secondary air injection (AIR) solenoid valve	30/8	97-279
- Motronic engine control module (ECM), mass air flow (MAF) sensor, heated oxygen sensor (HO2S), evaporative emission (EVAP) canister purge regulator valve	30/9	97-280
- Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor	30/10	97-281
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor, generator (GEN) warning light, engine coolant level/temperature (ECL/ECT) warning light	30/11	97-282
- Instrument cluster, multi-function indicator (MFI), engine coolant temperature (ECT) gauge, fuel gauge, malfunction indicator lamp (MIL), outside air temperature sensor	30/12	97-283

2.0L engine (code AVH/AZG), from August 2000

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● **2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code AVH, from August 2000**	49/1	97-452
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- Battery, ignition/starter switch (Jetta Wagon)	51/2	97-474
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- Motronic engine control module (ECM), ignition system	49/4	97-455
- Motronic engine control module (ECM)	49/5	97-456
- Motronic engine control module (ECM), throttle position (TP) sensor, camshaft position (CMP) sensor	49/6	97-457
- Motronic engine control module (ECM), angle sensor for throttle drive (power accelerator actuation), (ECT) sensor, leak detection pump (LDP)	49/7	97-458
- Motronic engine control module (ECM), engine speed (RPM) sensor, knock sensor (KS) 1, knock sensor (KS) 2	49/8	97-459
- Motronic engine control module (ECM), injectors, positive crankcase ventilation (PCV) heating element	49/9	97-460
- Heated oxygen sensor (HO2S), oxygen sensor (O2S) behind three way catalytic converter (TWC), evaporative emission (EVAP) canister purge regulator valve	49/10	97-461
- Motronic engine control module (ECM), secondary air injection (AIR) pump motor, secondary air injection (AIR) pump relay	49/11	97-462
- Motronic engine control module (ECM), cruise control switch, mass air flow (MAF) sensor, clutch vacuum vent valve switch, fuel pump (FP) relay	49/12	97-463
- Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor	49/13	97-464
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light	49/14	97-465
- Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light	49/15	97-466
- Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp	49/16	97-467

2.8L engine (code AFP), from May 1999

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● **2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/130 kW, code AFP, from May 1999**	31/1	97-284
- Battery, ignition/starter switch (Jetta Wagon)	51/2	97-474
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Jetta Wagon)	51/3	97-477
- Battery, ignition/starter switch (Golf/Jetta Sedan)	52/2	97-494
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay(Golf/Jetta Sedan)	52/3	97-497
- Generator (GEN), starter	31/2	97-285
- Motronic engine control module (ECM), ignition system	31/3	97-286
- Motronic engine control module (ECM), throttle valve control module, engine speed (RPM) sensor, camshaft position (CMP) sensor	31/4	97-287
- Motronic engine control module (ECM), knock sensor (KS) 1, knock sensor (KS) 2, engine coolant temperature (ECT) sensor	31/5	97-288
- Motronic engine control module (ECM), injectors	31/6	97-289
- Motronic engine control module (ECM), after-run coolant pump	31/7	97-290
- Motronic engine control module (ECM), leak detection pump (LDP), intake manifold change-over valve, (PCV) heating element, brake booster vacuum valve	31/8	97-291
- Motronic engine control module (ECM), cruise control switch, brake light switch, clutch vacuum vent valve switch, brake vacuum vent valve switch	31/9	97-292
- Motronic engine control module (ECM), angle sensors for throttle drive (power accelerator actuation), heated oxygen sensor (HO2S)	31/10	97-293
- Motronic engine control module (ECM), secondary air injection (AIR) pump system, oxygen sensor (O2S) behind three way catalytic converter (TWC)	31/11	97-294
- Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor	31/12	97-295
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor, generator (GEN) warning light, engine coolant level/temperature (ECL/ECT) warning light	31/13	97-296
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- Generator (GEN), starter	71/2	97-714
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- Motronic engine control module (ECM), ignition system	71/4	97-716
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- Motronic engine control module (ECM), throttle valve control module, intake manifold change-over valve, after-run coolant pump, positive crankcase ventilation (PCV) heating element	71/6	97-718
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- Motronic engine control module (ECM), injectors	71/9	97-723
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- Motronic engine control module (ECM), throttle position (TP) sensor, heated oxygen sensor (HO2S)	71/11	97-725
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- Motronic engine control module (ECM), brake booster control module, brake system vacuum pump	71/13	97-727
- Motronic engine control module (ECM), secondary air injection (AIR) pump system, brake light switch, brake vacuum vent valve switch for cruise control	71/14	97-226
- Motronic engine control module (ECM), cruise control switch, clutch vacuum vent valve switch, fuel pump (FP) relay	71/15	97-729
- Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor	71/16	97-728
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light	71/17	97-731
- Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light	71/18	97-730
- Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp	71/19	97-733

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● **Cruise control**		
1.8L - Engine - Motronic Multiport Fuel Injection (MFI)/110 kW, code AWW	64/13	97-667
1.8L - Engine - Motronic Multiport Fuel Injection (MFI)/132 kW, code AWP	62/13	97-641
1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66 kW, code ALH, manual transmission	65/9	97-681
1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66 kW, code ALH, automatic transmission	66/9	97-695
2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code AVH, AZG	79/12	97-838
2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/130 kW, code AFP	31/9	97-292
2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/147 kW, code BDF	71/15	97-729
Multi-function steering wheel for cruise control and radio	46/1	97-424

2002 m.y. additional electrical wiring diagrams (continued)

	Wiring Diagram page number	Repair Manual page number
● **Daytime running lights,** from May 2000	61/1	97-620
● **Fog lights,** from May 2000	60/1	97-614
● **Fuel tank lid unlock system (Jetta Wagon),** from May 2001		
see Comfort System (without power windows)	55/1	97-546
see Comfort System (with power windows)	56/1	97-560
● **Fuel tank lid unlock system (Golf/Jetta Sedan),** from May 2001		
see Comfort System (without power windows)	57/1	97-578
see Comfort System (with power windows)	58/1	97-592
● **Headlight washer,** from May 2000	59/1	97-610
● **Heated seats,** from May 1999	68/1	97-702
● **Heated leather seats,** from May 1999	69/1	97-706
● **Heated outside mirrors (Jetta Wagon),** from May 2001		
see Comfort System (without power windows)	55/1	97-546
see Comfort System (with power windows)	56/1	97-560
● **Heated outside mirrors (Golf/Jetta Sedan),** from May 2001		
see Comfort System (without power windows)	57/1	97-578
see Comfort System (with power windows)	58/1	97-592
● **Heated power mirrors (Jetta Wagon),** from May 2001, see Comfort System (with power windows)	56/1	97-560
● **Heated power mirrors (Golf/Jetta Sedan),** from May 2001, see Comfort System (with power windows)	58/1	97-592
● **Interior lights (Jetta Wagon),** from May 2001		
see Comfort System (without power windows)	55/1	97-546
see Comfort System (with power windows)	56/1	97-560
● **Interior lights (Golf/Jetta Sedan),** from May 2001		
see Comfort System (without power windows)	57/1	97-578
see Comfort System (with power windows)	58/1	97-592
● **Interior rear view mirror (self-dimming),** from May 1999	70/1	97-710
● **Luggage compartment light (Jetta Wagon),** from May 2001		
see Comfort System (without power windows)	55/1	97-546
see Comfort System (with power windows)	56/1	97-560
● **Luggage compartment light (Golf/Jetta Sedan),** from May 2001		
see Comfort System (without power windows)	57/1	97-578
see Comfort System (with power windows)	58/1	97-592
● **Multi-function steering wheel for cruise control and radio,** from May 2000	46/1	97-424
● **Power seats and mirror adjustment with Memory,** from September 1998	26/1	97-220
● **Power sunroof (Jetta Wagon),** from May 2001		
see Comfort System (without power windows)	55/1	97-546
see Comfort System (with power windows)	56/1	97-560
● **Power sunroof (Golf/Jetta Sedan),** from May 2001		
see Comfort System (without power windows)	57/1	97-578
see Comfort System (with power windows)	58/1	97-592
● **Power outlet (12V),** from September 1998	22/1	97-192
● **Power windows (Jetta Wagon),** from May 2001, see Comfort System (with power windows)	56/1	97-560
● **Power windows (Golf/Jetta Sedan),** from May 2001, see Comfort System (with power windows)	58/1	97-592
● **Radio system (with CD changer wiring preparation),** from September 1998	28/1	97-248
● **Radio system (with CD changer wiring preparation),** from August 2001	73/1	97-740
● **Radio system "Monsoon" (with CD changer wiring preparation),** from May 1999	40/1	97-362
● **Radio system "Monsoon" (with CD changer wiring preparation),** from August 2001	72/1	97-734
● **Rain-sensor,** from May 1999	70/1	97-710
● **Rear lid unlock system (Jetta Wagon),** from May 2001		
see Comfort System (without power windows)	55/1	97-546
see Comfort System (with power windows)	56/1	97-560
● **Rear lid unlock system (Golf/Jetta Sedan),** from May 2001		
see Comfort System (without power windows)	57/1	97-578
see Comfort System (with power windows)	58/1	97-592
● **Seat belt control,** from October 2000	50/1	97-468
● **Seat belt tensioner,** from October 2000	50/1	97-468
● **Warning light for rear lid unlocked/door ajar indicator lamp (Jetta Wagon),** from May 2001		
see Comfort System (without power windows)	55/1	97-546
see Comfort System (with power windows)	56/1	97-560
● **Warning light for rear lid unlocked/door ajar indicator lamp (Golf/Jetta Sedan),** from May 2001		
see Comfort System (without power windows)	57/1	97-578
see Comfort System (with power windows)	58/1	97-592
● **Washer nozzle heaters,** from May 1999	67/1	97-700

2.0L engine (code AVH, AZG) from November 2001

	Wiring Diagram page number	Repair Manual page number
● **2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code AVH, AZG** from November 2001	79/1	97-829
- Battery, ignition/starter switch (Jetta Wagon)	51/2	97-475
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Jetta Wagon)	51/3	97-476
- Battery, ignition/starter switch (Golf/Jetta Sedan)	52/2	97-495
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Golf/Jetta Sedan)	52/3	97-496
- Generator (GEN), starter	79/2	97-828
- Power supply relay	79/3	97-831
- Motronic engine control module (ECM), ignition system	79/4	97-830
- Motronic engine control module (ECM)	79/5	97-833
- Motronic engine control module (ECM), throttle position (TP) sensor, camshaft position (CMP) sensor	79/6	97-832
- Motronic engine control module (ECM), angle sensor for throttle drive (power accelerator actuation), (ECT) sensor, leak detection pump (LDP)	79/7	97-835
- Motronic engine control module (ECM), engine speed (RPM) sensor, knock sensor (KS) 1, knock sensor (KS) 2	79/8	97-834
- Motronic engine control module (ECM), injectors, positive crankcase ventilation (PCV) heating element	79/9	97-837
- Heated oxygen sensor (HO2S), oxygen sensor (O2S) behind three way catalytic converter (TWC), evaporative emission (EVAP) canister purge regulator valve	79/10	97-836
- Motronic engine control module (ECM), secondary air injection (AIR) pump motor, secondary air injection (AIR) pump relay	79/11	97-839
- Motronic engine control module (ECM), cruise control switch, mass air flow (MAF) sensor, clutch vacuum vent valve switch, fuel pump (FP) relay	79/12	97-838
- Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor	79/13	97-841
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light	79/14	97-840
- Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light	79/15	97-843
- Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp	79/16	97-842

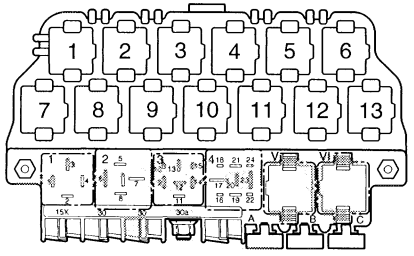
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Golf /Jetta - Standard Equipment,

from September 1998

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97-14163

Relay location on the thirteenfold auxiliary relay panel, above relay panel:

3 Starting Interlock Relay (185)

Relay panel:

1 Dual Horn Relay (53)

2 Load Reduction Relay (18)/(100)

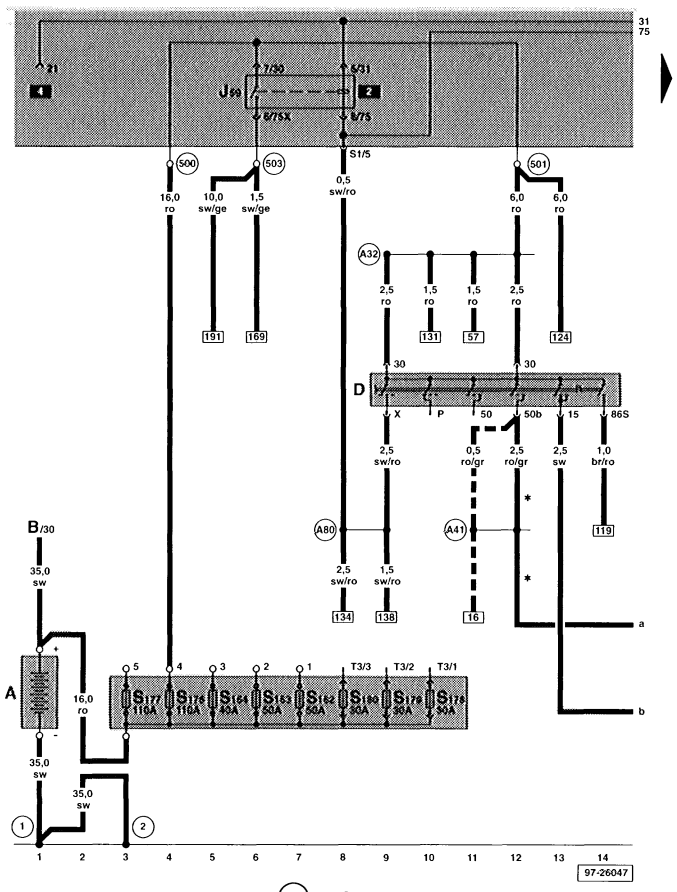
V

VI Wiper/Washer Intermittent Relay (377)

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

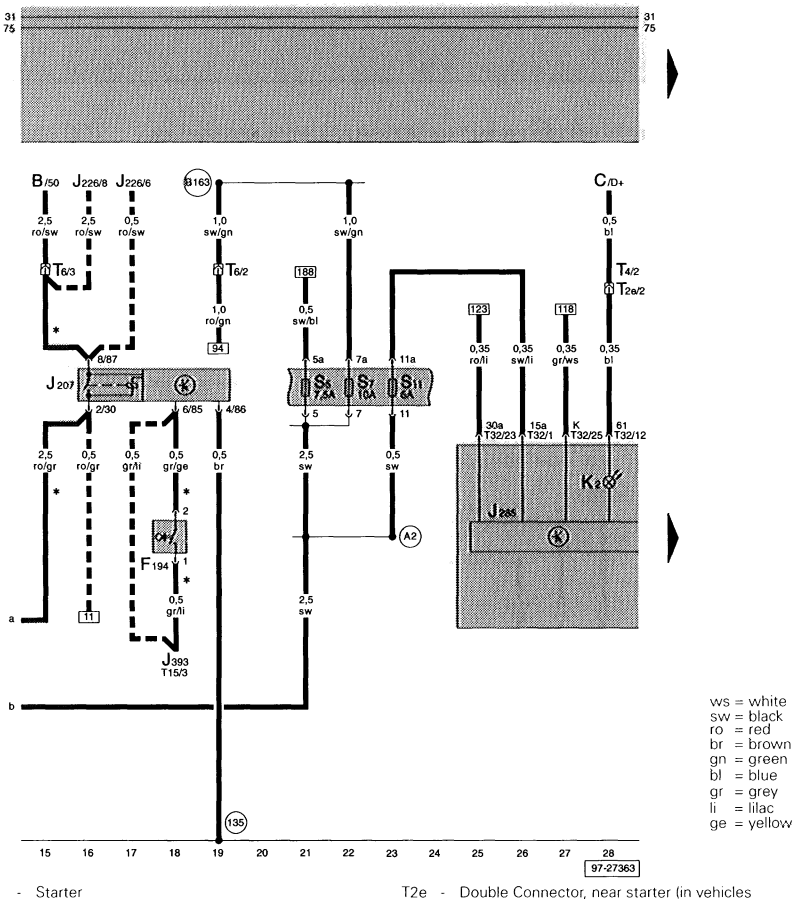


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

A - Battery
B - Starter
D - Ignition/Starter Switch
J59 - Load Reduction Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S164 - Fuse -3- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
S178 - Fuse -6- (30) in fuse bracket/battery
S179 - Fuse -7- (30) in fuse bracket/battery
S180 - Fuse -8- (30) in fuse bracket/battery
T3 - 3-Pin Connector

(1) - Ground strap, battery to body
(2) - Ground strap, transmission to body
(500) - Threaded connection -1- (30) on the relay plate
(501) - Threaded connection -2- (30) on the relay plate
(503) - Threaded connection -2- (75x) on the relay plate
(A32) - Plus connection (30), in instrument panel wiring harness
(A41) - Plus connection (50), in instrument panel wiring harness (gasoline engine only)
(A80) - Connector -1- (X) in instrument panel wiring harness
* - Manual transmission only
--- Automatic transmission only

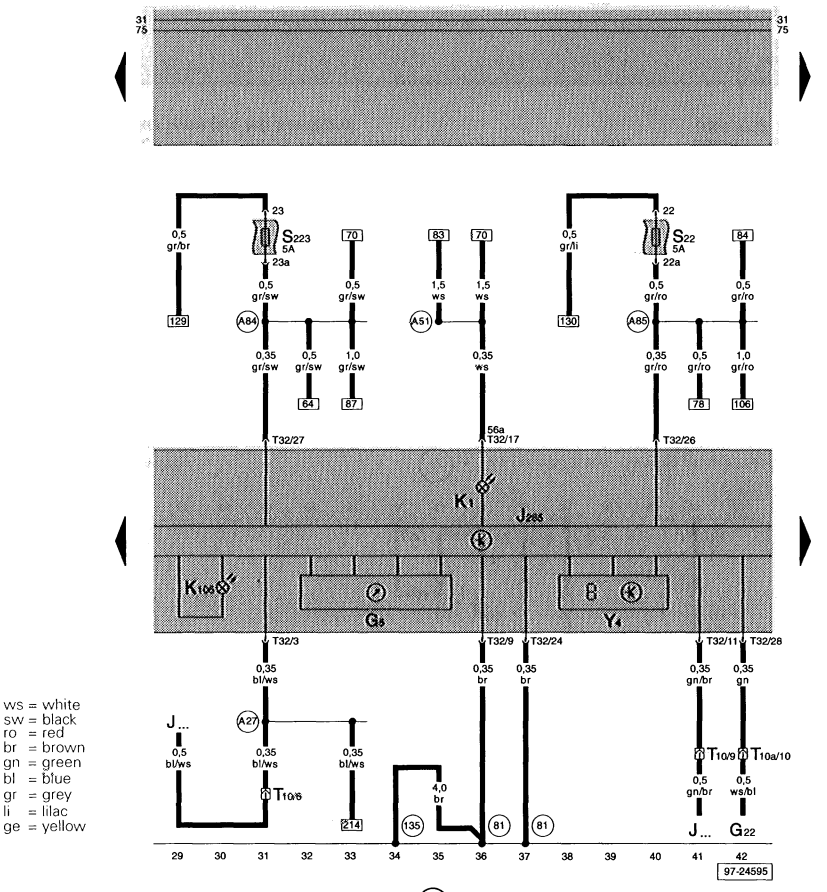
Battery, ignition/starter switch



B - Starter
C - Generator (GEN)
F194 - Clutch Pedal Position (CPP) Switch
J207 - Starting Interlock Relay
J226 - Park/Neutral Position (PNP) Relay
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system
J434 - Locking relay for starter (clutch pedal switch), on the thirteenfold auxiliary relay panel, above relay panel
K2 - Generator (GEN) Warning Light
S5 - Fuse 5 in fuse holder
S7 - Fuse 7 in fuse holder
S11 - Fuse 11 in fuse holder
T2e - Double Connector, near starter (in vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (in vehicles with air conditioning)
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T15 - 15-Pin Connector
T32 - 32-Pin Connector, blue
(135) - Ground connection -2-, in instrument panel wiring harness
(A2) - Plus connection (15), in instrument panel wiring harness
(B163) - Plus connector -1- (15) in wiring harness interior
--- - Automatic transmission only
* - Manual transmission only

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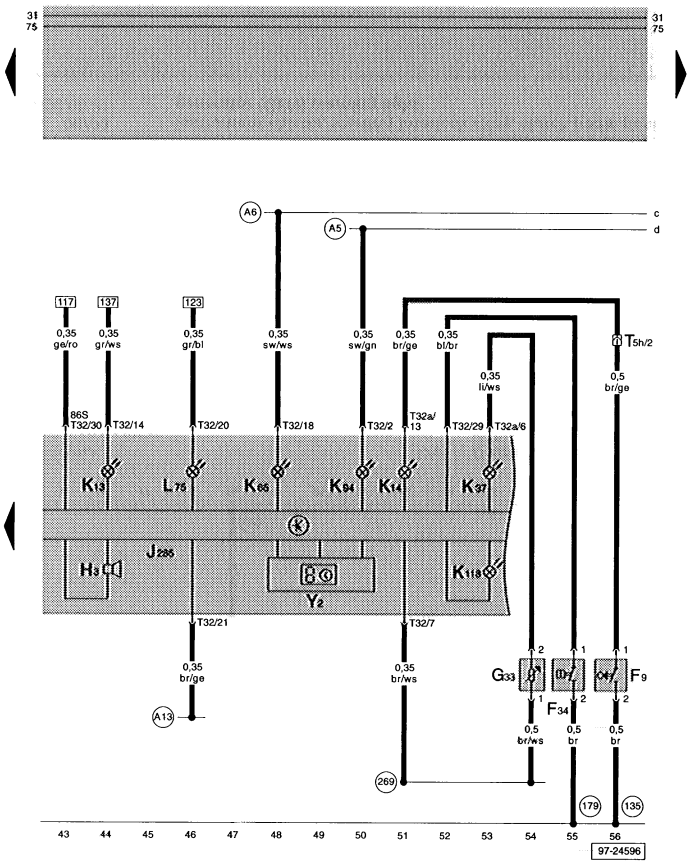
Instrument cluster, starting interlock relay, clutch pedal position (CPP) switch, generator (GEN) warning light



G5 - Tachometer
G22 - Speedometer Vehicle Speed Sensor
J285 - Control module with indicator unit in instrument panel insert
J... - Engine Control Module (ECM)
K1 - Headlight High Beam Indicator Light
K105 - Low Fuel Level Warning Light
S22 - Fuse 22 in fuse holder
S223 - Fuse 23 in fuse holder
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
T32 - 32-Pin Connector, blue
Y4 - Odometer Display
(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness
(A51) - Wire connection (56), in instrument panel wiring harness
(A84) - Connector (58L) in instrument panel wiring harness
(A85) - Connector (58R) in instrument panel wiring harness

Instrument cluster, tachometer, odometer display headlight high beam indicator light, low fuel level warning light

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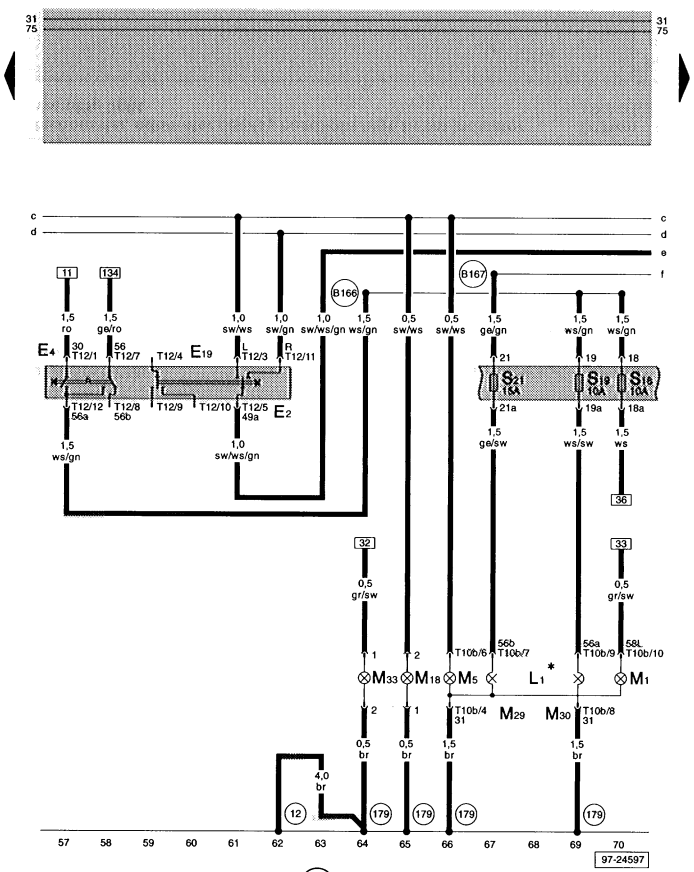


F9 - Parking Brake Warning Light Switch
F34 - Brake Fluid Level Warning Switch
G33 - Windshield Washer Fluid Level Sensor
H3 - Warning buzzer
J285 - Control module with indicator unit in instrument panel insert
K13 - Rear Fog Light Indicator Light
K14 - Parking Brake Indicator Light
K37 - Low Windshield Washer Fluid Level Indicator Light
K65 - Left Turn Signal Indicator Light
K94 - Right Turn Signal Indicator Light
K118 - Warning light for brake system
L75 - Digital Display Light
T5h - 5-Pin Connector, near left A-pillar, lower part, in harness
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green
Y2 - Digital Clock

(135) - Ground connection -2-, in instrument panel wiring harness
(179) - Ground connection, in left headlight wiring harness
(269) - Ground connector (sensor ground) -1-, in instrument panel wiring harness
(A5) - Plus connection (right turn signal), in instrument panel wiring harness
(A6) - Plus connection (left turn signal), in instrument panel wiring harness
(A13) - Wire connection (door contact switch) in instrument panel wiring harness

Edition 12/01 *USA.5102.12.21*

Instrument cluster, parking brake warning light switch, brake fluid level warning switch, low windshield washer fluid level indication, left and right turn signal indicator lights



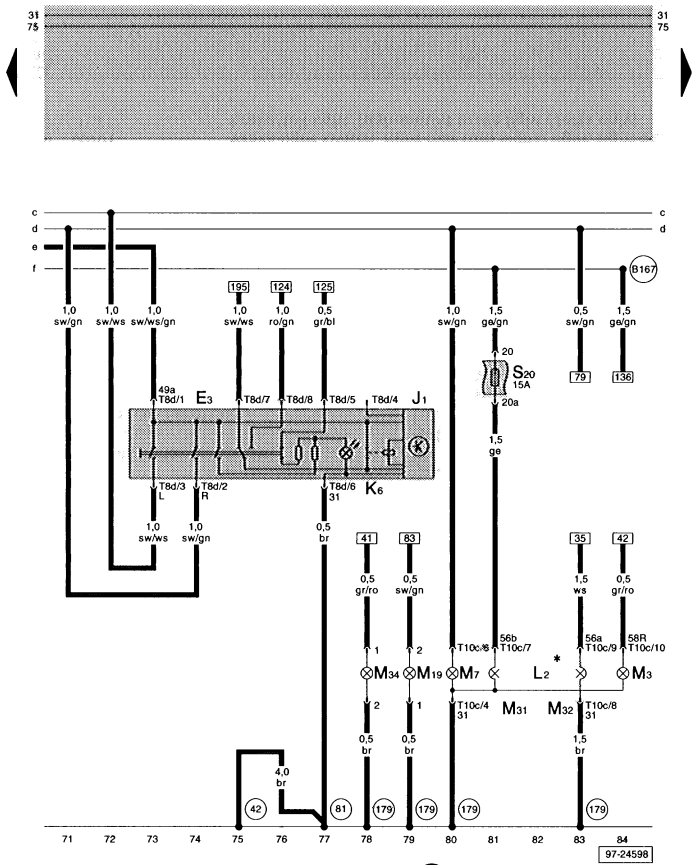
E2 - Turn signal switch
E4 - Headlight Dimmer/Flasher Switch
E19 - Park Light Switch
L1 - Left Headlight*
M1 - Left Parking Light
M5 - Left Front Turn Signal Light
M18 - Left, Side Turn Signal Light
M29 - Left Low Beam Headlight (Golf only)
M30 - Left High Beam Headlight (Golf only)
M33 - Light for side marker front left
S18 - Fuse 18 in fuse holder
S19 - Fuse 19 in fuse holder
S21 - Fuse 21 in fuse holder
T10b - 10-Pin Connector
T12 - 12-Pin Connector

(12) - Ground connection, in engine compartment, left
(179) - Ground connection, in left headlight wiring harness
(B166) - Connection (56a) in passenger compartment wiring harness
(B167) - Connection (56b) in passenger compartment wiring harness

* - Jetta only
- Vehicles with daytime running lights
⇒ wiring diagram No. 16

Turn signal switch, headlight dimmer/flasher switch, left front turn signal light, light for side marker front left, left headlight

Edition 12/01 *USA.5102.12.21*



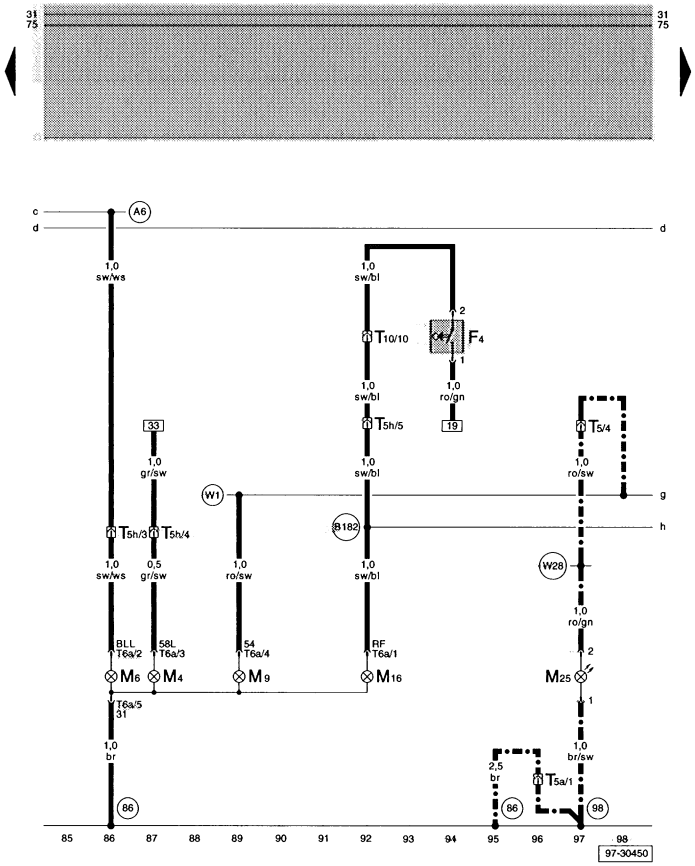
E3 - Emergency Flasher Switch
J1 - Turn Signal Relay
K6 - Indicator light for emergency flasher system
L2 - Right Headlight*
M3 - Right Parking Light
M7 - Right Front Turn Signal Light
M19 - Right, Side Turn Signal Light
M31 - Right Low Beam Headlight (Golf only)
M32 - Right High Beam Headlight (Golf only)
M34 - Light for side marker front right
S20 - Fuse 20 in fuse holder
T8d - 8-Pin Connector
T10c - 10-Pin Connector

(42) - Ground connection, beside steering column

(81) - Ground connection -1-, in instrument panel wiring harness
(179) - Ground connection, in left headlight wiring harness
(B167) - Connection (56b), in passenger compartment wiring harness

* - Jetta only
- Vehicles with daytime running lights ⇒ wiring diagram No.16

Emergency flasher switch, turn signal relay, right front turn signal light, light for side marker front right, right headlight

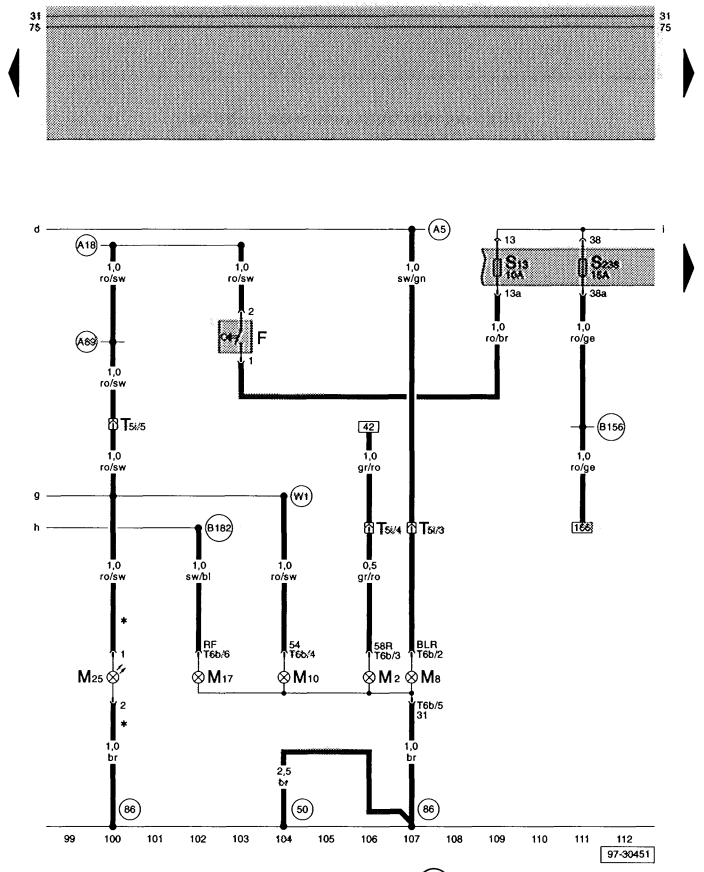


F4 - Back-Up Light Switch
M4 - Left Tail Light
M6 - Left Rear Turn Signal Light
M9 - Left Brake Light
M16 - Left Back-Up Light
M25 - High-mount Brake Light
T5 - 5-Pin Connector, black, connector station C-pillar, left
T5a - 5-Pin Connector, pink, connector station C-pillar, left (Golf only)
T5h - 5-Pin Connector, near left A-pillar, lower part, in harness
T6a - 6-Pin Connector
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left

(86) - Ground connection -1-, in rear wiring harness
(98) - Ground connection, in rear lid wiring harness
(A6) - Plus connection (left turn signal), in instrument panel wiring harness
(B182) - Connection (RF), in passenger compartment wiring harness
(W1) - Plus connection (54), in rear wiring harness
(W28) - Plus connector -2- (54), in wiring harness taillight assembly

-•-•- Golf only

Back-up light switch, left rear turn signal light, left back-up light, left brake/ tail light, high-mount brake light (Golf only)



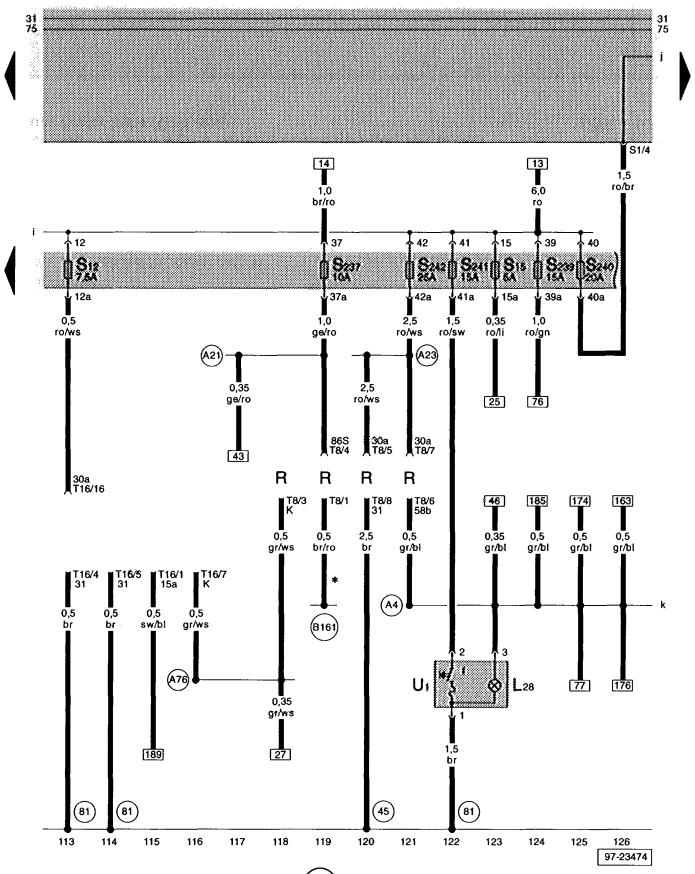
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F - Brake Light Switch
M2 - Right Tail Light
M8 - Right Rear Turn Signal Light
M10 - Right Brake Light
M17 - Right Back-Up Light
M25 - High-mount Brake Light (18 light emitting diodes)*
S13 - Fuse 13 in fuse holder
S238 - Fuse 38 in fuse holder
T5i - 5-Pin Connector, near left A-pillar, lower part, in harness
T6b - 6-Pin Connector

(50) - Ground connection, in luggage compartment, left
(86) - Ground connection -1-, in rear wiring harness
(A5) - Plus connection (right turn signal), in instrument panel wiring harness
(A18) - Wire connection (54), in instrument panel wiring harness
(A89) - Connector (54), in instrument panel wiring harness
(B156) - Plus connector (30a), in wiring harness interior
(B182) - Connection (RF), in passenger compartment wiring harness
(W1) - Plus connection (54), in rear wiring harness

* - Jetta only

Brake light switch, right rear turn signal light, right back-up light, right brake/tail light, high-mount brake light (Jetta only)



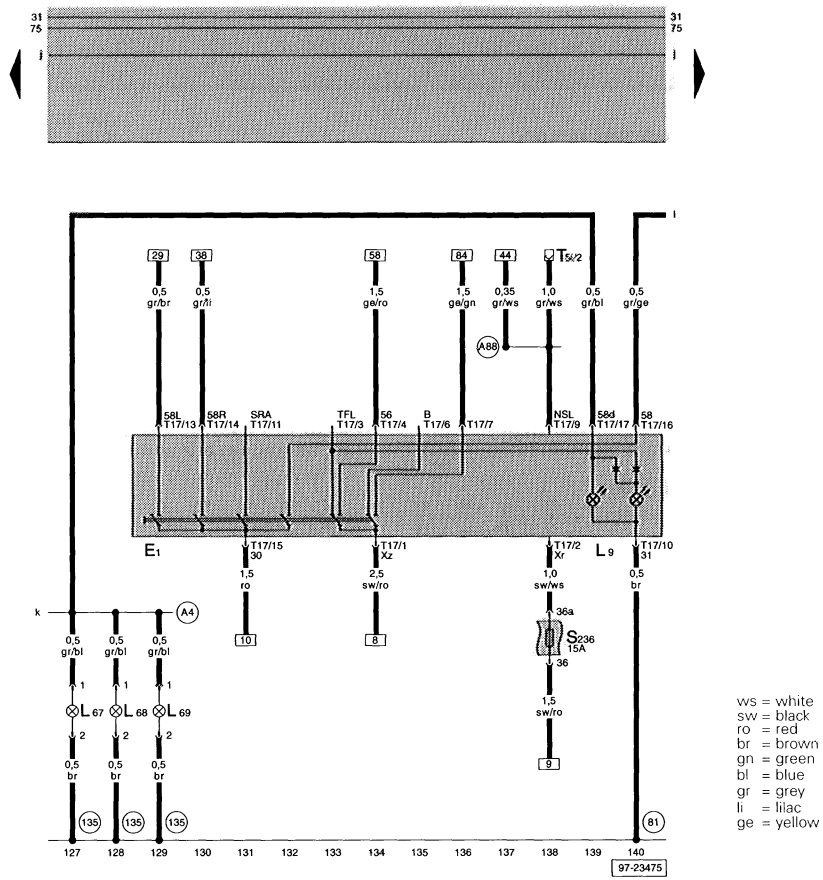
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

L28 - Cigarette Lighter Light
R - Radio
S12 - Fuse 12 in fuse holder
S15 - Fuse 15 in fuse holder
S237 - Fuse 37 in fuse holder
S239 - Fuse 39 in fuse holder
S240 - Fuse 40 in fuse holder
S241 - Fuse 41 in fuse holder
S242 - Fuse 42 in fuse holder
T8 - 8-Pin Connector
T16 - Data Link Connector (DLC), below instrument panel, left
U1 - Cigarette Lighter

(45) - Ground connection, behind instrument panel, center
(81) - Ground connection -1-, in instrument panel wiring harness
(A4) - Plus connection (58b), in instrument panel wiring harness
(A21) - Wire connection (86s), in instrument panel wiring harness
(A23) - Wire connection (30a), in instrument panel wiring harness
(A76) - Connector (K-diagnosis wire) in instrument panel wiring harness
(B161) - Connector (anti-theft warning system), in wiring harness interior*

* - Vehicles with anti-theft warning system only (see wiring diagram comfort system)

Data Link Connector (DLC), radio connection, cigarette lighter

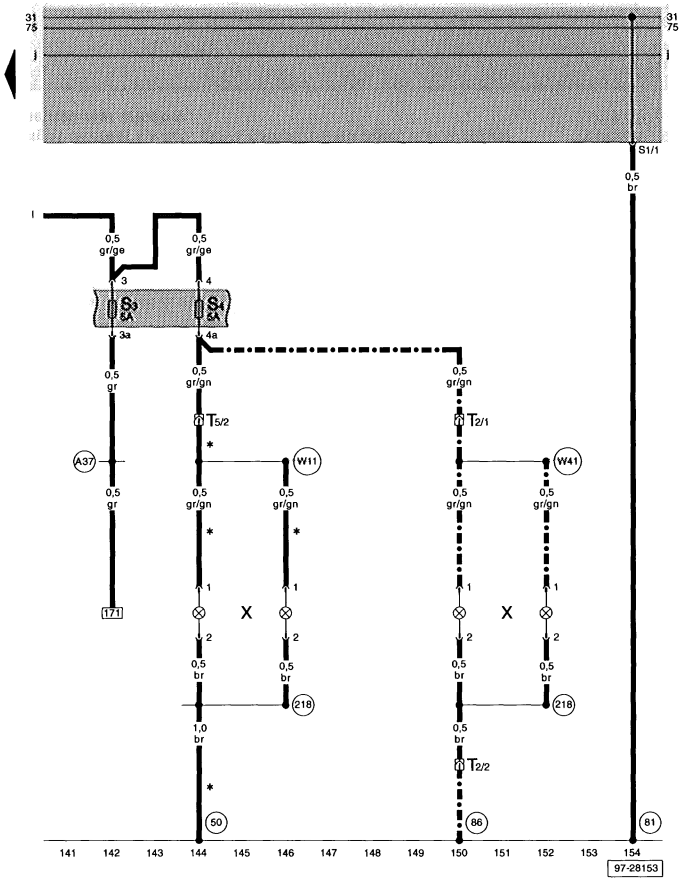


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E1 - Light switch
L9 - Headlight Switch Light
L67 - Left Instrument Panel Vent Illumination
L68 - Center Instrument Panel Vent Illumination
L69 - Right Instrument Panel Vent Illumination
S236 - Fuse 36 in fuse holder
T5i - 5-Pin Connector, near left A-pillar, lower part, in harness
T17 - 17-Pin Connector

(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(A4) - Plus connection (58b), in instrument panel wiring harness

(A88) - Connector fog light, in instrument panel wiring harness



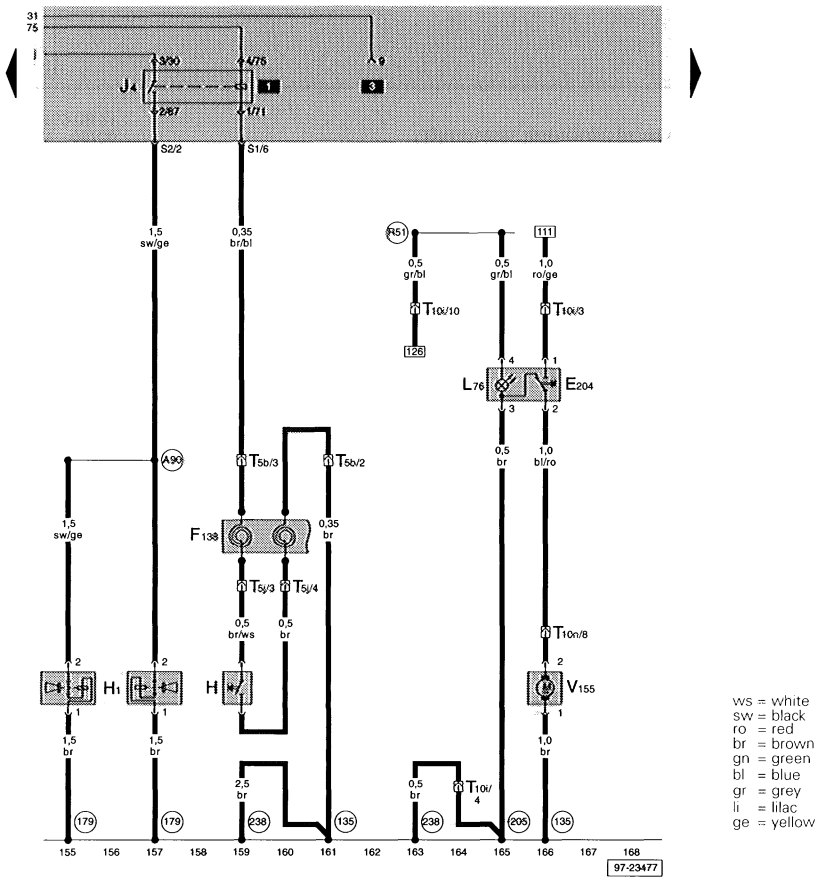
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

S3 - Fuse 3 in fuse holder
S4 - Fuse 4 in fuse holder
T2 - Double Connector, in luggage compartment, left (Golf only)
T5 - 5-Pin Connector, black, connector station C-pillar, left
X - License Plate Light

(50) - Ground connection, in luggage compartment, left
(81) - Ground connection -1-, in instrument panel wiring harness
(86) - Ground connection -1-, in rear wiring harness
(218) - Ground connection -1-, in rear lid wiring harness

(A37) - Wire connection (58a), in instrument panel wiring harness
(W11) - Wire connection (58), in rear lid wiring harness
(W41) - Plus connection (58), in wiring harness

* - Jetta only
-•-•- Golf only

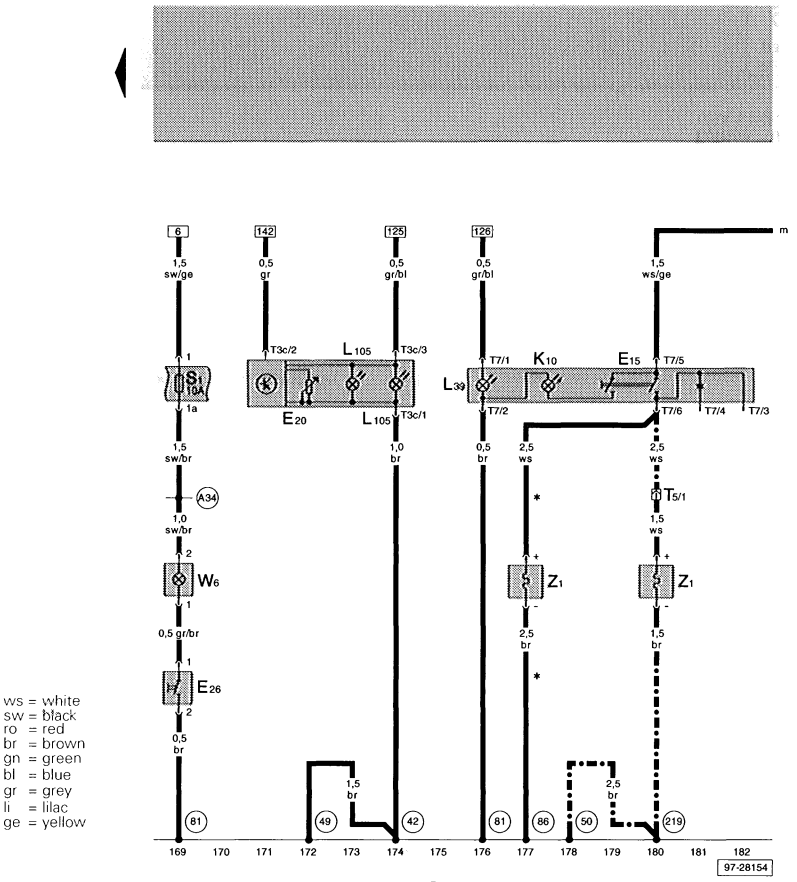


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E204 - Switch for remote/fuel tank door (also see Comfort System with power windows wiring diagram)
F138 - Airbag Spiral Spring/Return Spring with Slip Ring
H - Signal horn activation
H1 - Dual tone horn
J4 - Dual Horn Relay
L76 - Push Button Light
T5b - 5-Pin Connector, on airbag spiral spring
T5j - 5-Pin Connector, behind driver's airbag
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10n - 10-Pin Connector, brown, connector station A-pillar, left
V155 - Motor for fuel tank lid unlock

(135) - Ground connection -2-, in instrument panel wiring harness
(179) - Ground connection, in left headlight wiring harness
(205) - Ground connection, in driver's door wiring harness
(238) - Ground connection -1-, in wiring harness interior
(A90) - Connector (dual tone horn), in instrument panel wiring harness
(R51) - Connection (58b) in door wiring harness, driver side

Dual tone horn, fuel tank door remote



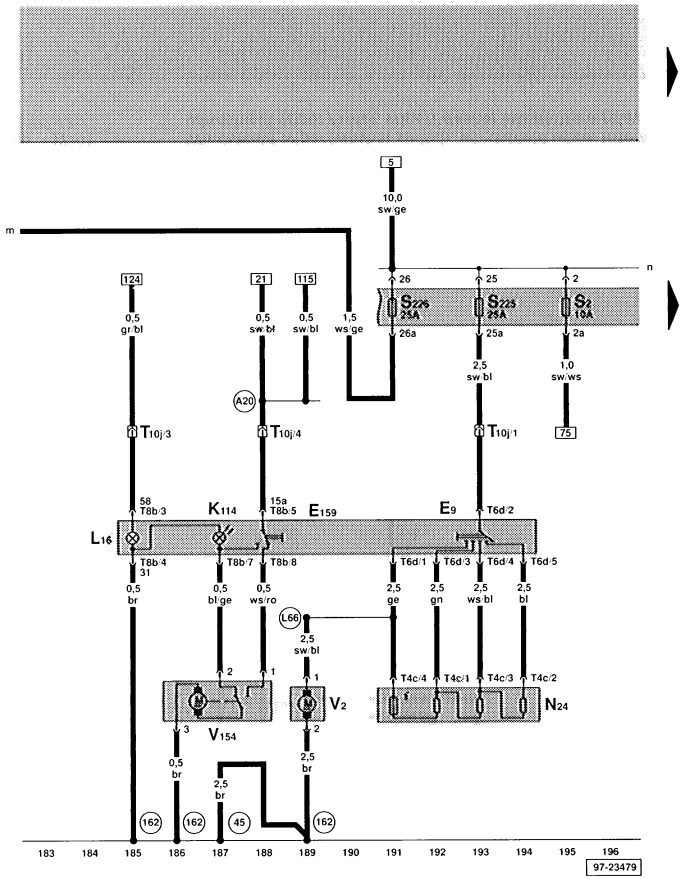
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E15 - Rear window defogger switch
E20 - Instrument Panel Light Dimmer Switch
E26 - Glove compartment light switch
K10 - Indicator light for heated rear windshield
L39 - Rear Window Defogger Switch Light
L105 - Illumination for lighting controller
S1 - Fuse 1 in fuse holder
T3c - 3-Pin Connector
T5 - 5-Pin Connector, black, connector station C-pillar, left (Golf only)
T7 - 7-Pin Connector
W6 - Glove Compartment Light
Z1 - Heated rear window

(42) - Ground connection, beside steering column
(49) - Ground connection, on steering column
(50) - Ground connection, in luggage compartment, left
(81) - Ground connection -1-, in instrument panel wiring harness
(86) - Ground connection -1-, in rear wiring harness
(219) - Ground connection -2-, in rear lid wiring harness
(A34) - Wire connection (75x), in instrument panel wiring harness

* - Jetta only
-•-•- Golf only

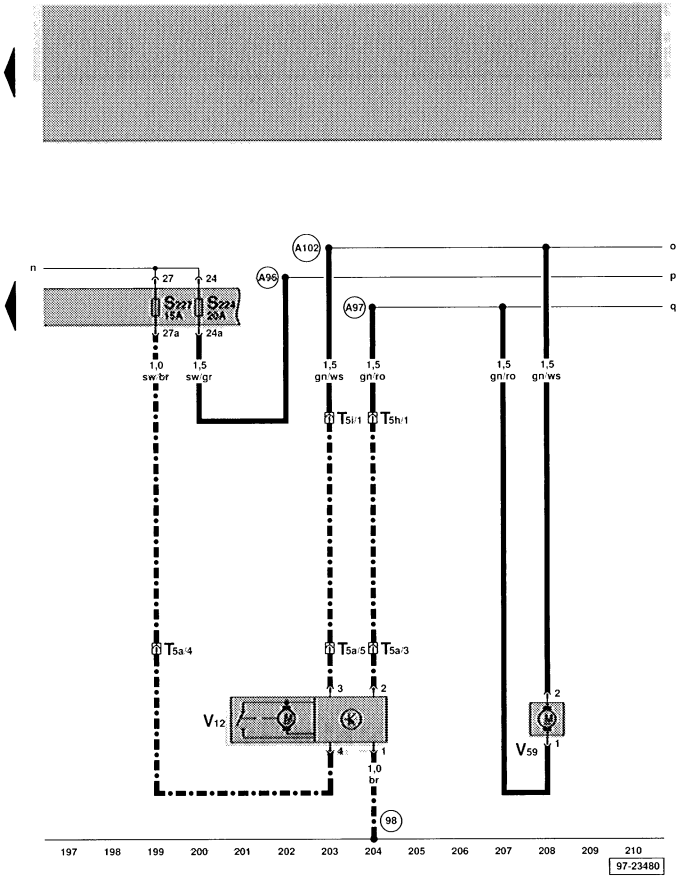
Instrument panel light dimmer switch, glove compartment light, rear window defogger switch, heated rear window



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E9 - Fresh Air Blower Switch
E159 - Fresh Air/Recirculating Flap Switch
K114 - Fresh Air and Recirculating Air Mode Indicator Light
L16 - Fresh Air Control Lever Light
N24 - Fresh Air Blower Series Resistance With Fuse
S2 - Fuse 2 in fuse holder
S225 - Fuse 25 in fuse holder
S226 - Fuse 26 in fuse holder
T4c - 4-Pin Connector
T6d - 6-Pin Connector
T8b - 8-Pin Connector
T10j - 10-Pin Connector, behind instrument panel, center
V2 - Fresh Air Blower
V154 - Servo motor for fresh-/recirculating air door

(45) - Ground connection, behind instrument panel, center
(162) - Ground connection, in blower motor wiring harness
(A20) - Wire connection (15a), in instrument panel wiring harness
(L66) - Connector, in wiring harness heater blower



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

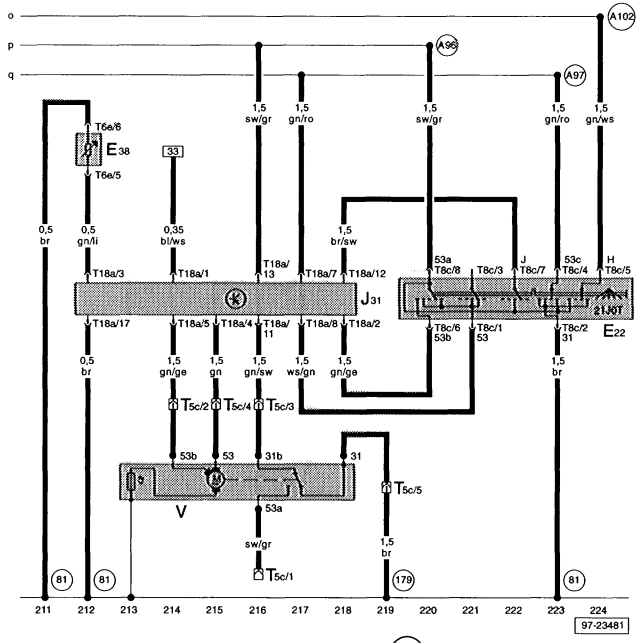
S224 - Fuse 24 in fuse holder
S227 - Fuse 27 in fuse holder
T5a - 5-Pin Connector, pink, connector station C-pillar, left (Golf only)
T5h - 5-Pin Connector, near left A-pillar, lower part, in harness
T5i - 5-Pin Connector, near left A-pillar, lower part, in harness
V12 - Motor for rear windshield wiper
V59 - Windshield and Rear Window Washer Pump

(98) - Ground connection, in rear lid wiring harness
(A96) - Connector (53a), in instrument panel wiring harness
(A97) - Connector (53), in instrument panel wiring harness
(A102) - Connector (windshield wiper), in instrument panel wiring harness

-•-•- Golf only

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Repair Manual page number 97-61



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E22 - Windshield Wiper/Washer Switch
E38 - Windshield Wiper Intermittent Regulator
J31 - Wiper/Washer Intermittent Relay, on relay panel
T5c - 5-Pin Connector, on windshield wiper motor
T6e - 6-Pin Connector
T8c - 8-Pin Connector
T18a - 18-Pin Connector
V - Windshield Wiper Motor

(81) - Ground connection -1-, in instrument panel wiring harness
(179) - Ground connection, in left headlight wiring harness
(A96) - Connector (53a), in instrument panel wiring harness
(A97) - Connector (53), in instrument panel wiring harness
(A102) - Connector (windshield wiper), in instrument panel wiring harness

Edition 12/01
USA.5102.12.21

Windshield wiper/washer switch, windshield wiper intermittent regulator, windshield wiper motor, wiper/washer intermittent relay

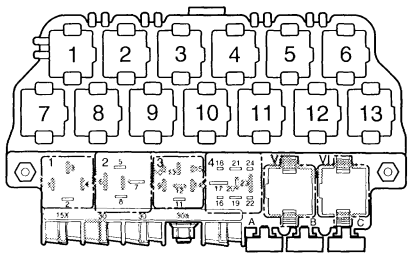
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2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, (without cruise control), code AEG,

from September 1998

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

2 *Load Reduction Relay (100)*

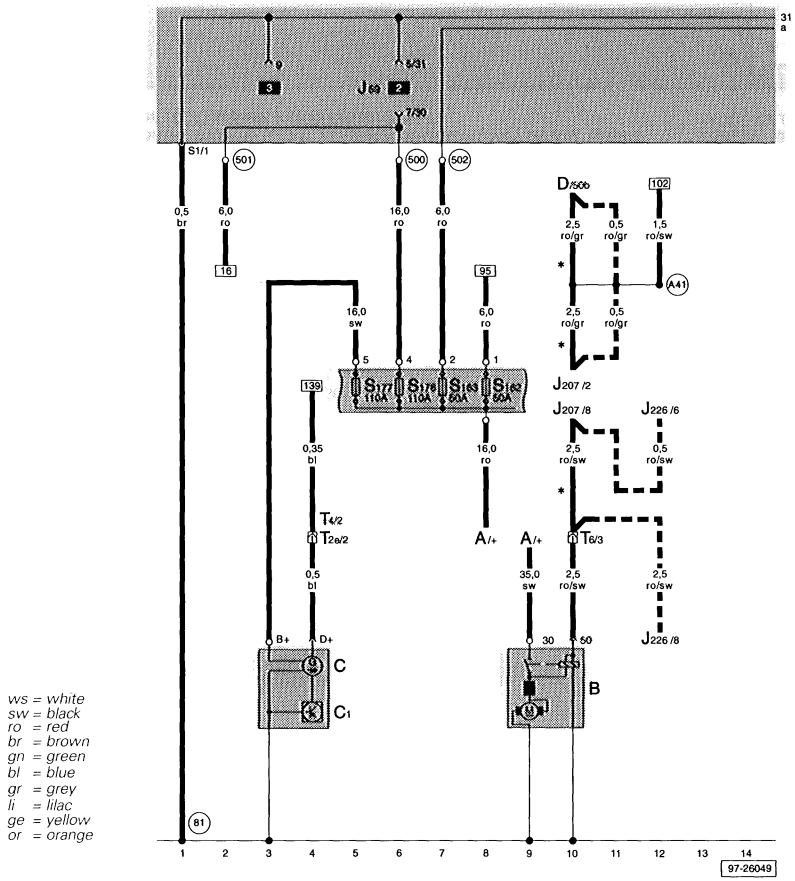
4 *Fuel Pump (FP) Relay (409)*

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

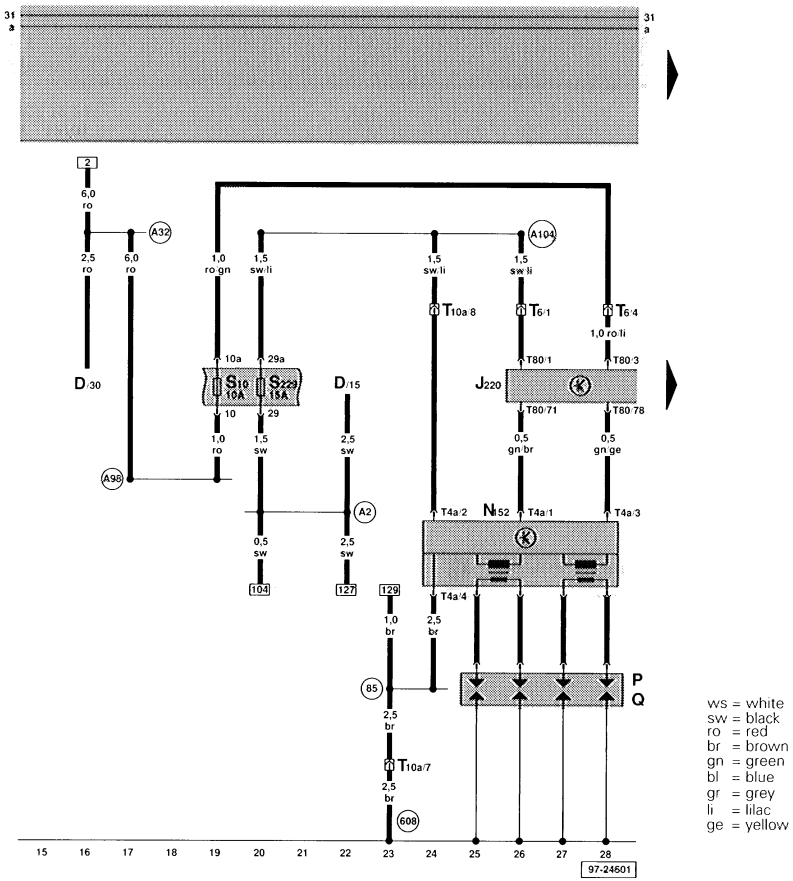
Repair Manual page number **97-64**



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

A - Battery
B - Starter
C - Generator (GEN)
C1 - Voltage Regulator (VR)
D - Ignition/Starter Switch
J59 - Load Reduction Relay
J207 - Starting Interlock Relay
J226 - Park/Neutral Position (PNP) Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
T2e - Double Connector, near starter (vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
(81) - Ground connection -1-, in instrument panel wiring harness
(500) - Threaded connection -1- (30) on the relay plate
(501) - Threaded connection -2- (30) on the relay plate
(502) - Threaded connection -1- (30a) on the relay plate
(A41) - Plus connection (50), in instrument panel wiring harness
** - Manual transmission only*
--- Automatic transmission only

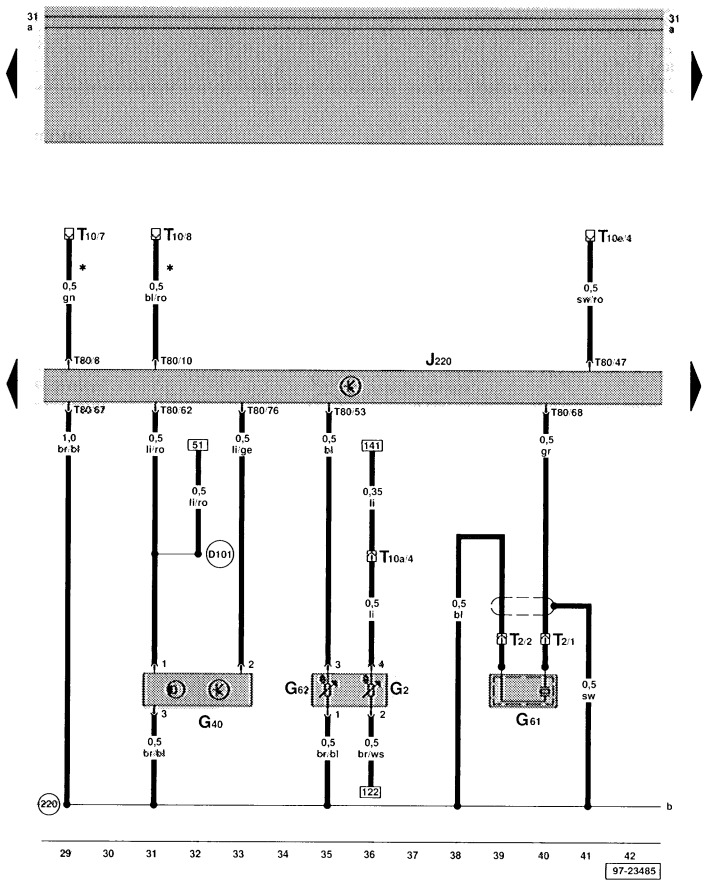
Repair Manual page number **97-65**



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

D - Ignition/Starter Switch
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N152 - Ignition Coil
P - Spark Plug Connectors
Q - Spark Plugs
S10 - Fuse 10 in fuse holder
S229 - Fuse 29 in fuse holder
T4a - 4-Pin Connector
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
T80 - Connector, 80 point

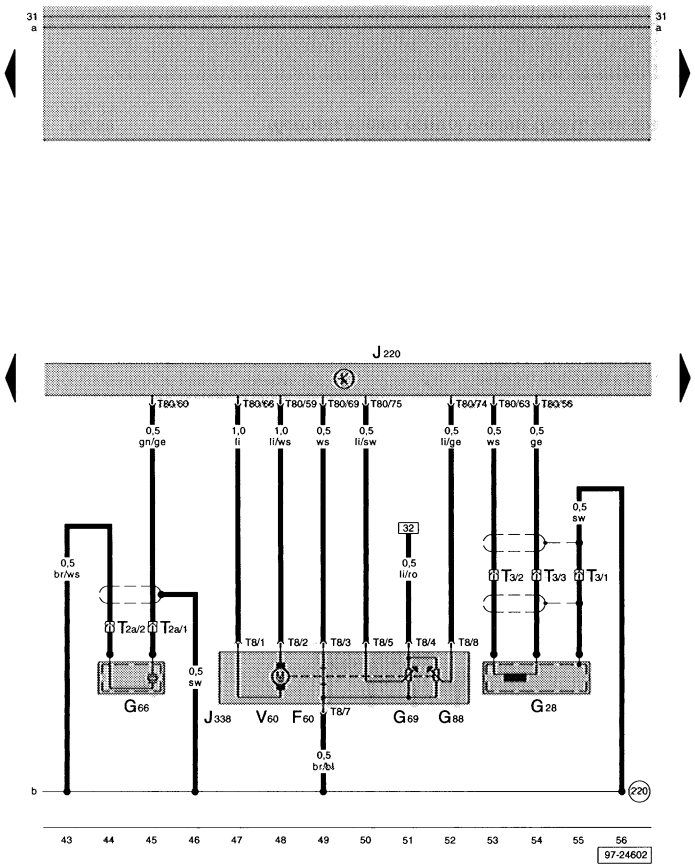
(608) - Ground connection (in center plenum chamber)
(85) - Ground connection -1-, in engine compartment wiring harness
(A2) - Plus connection (15), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness
(A104) - Plus connector -2- (15), in instrument panel wiring harness



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

G2 - Engine Coolant Temperature (ECT) Sensor
G40 - Camshaft Position (CMP) Sensor
G61 - Knock Sensor (KS) 1
G62 - Engine Coolant Temperature (ECT) Sensor
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
T2 - Double Connector, in engine compartment, rear
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
T80 - Connector, 80 point

(220) - Ground connection (sensor ground), in engine compartment wiring harness
(D101) - Wire connection -1-, in engine compartment wiring harness
* - A/C connection

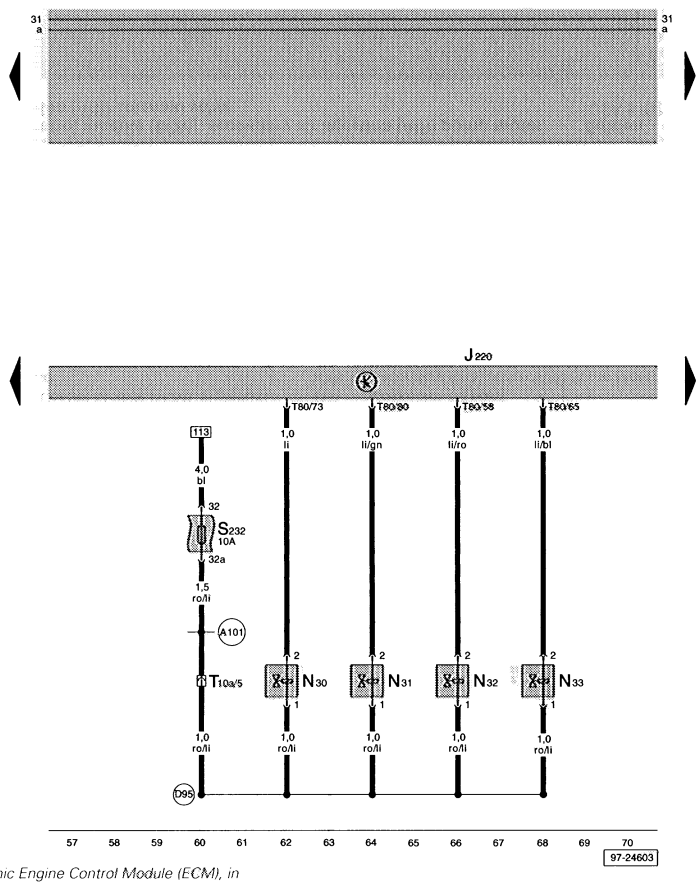


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F60 - Closed Throttle Position (CTP) Switch
G28 - Engine Speed (RPM) Sensor
G66 - Knock Sensor (KS) 2
G69 - Throttle Position (TP) Sensor
G88 - Throttle Position (TP) Sensor
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J338 - Throttle Valve Control Module***
T2a - Double Connector, in engine compartment, front
T3 - 3-Pin Connector, near intake manifold
T8 - 8-Pin Connector***
T80 - Connector, 80 point
V60 - Throttle Position (TP) Actuator

(220) - Ground connection (sensor ground), in engine compartment wiring harness

*** - Vehicles with cruise control see also wiring diagram Cruise Control No. 8/1



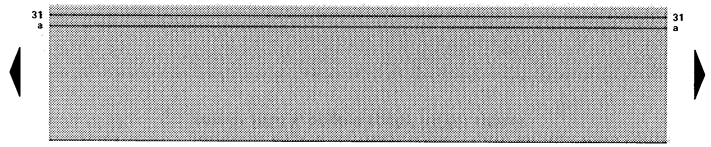
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

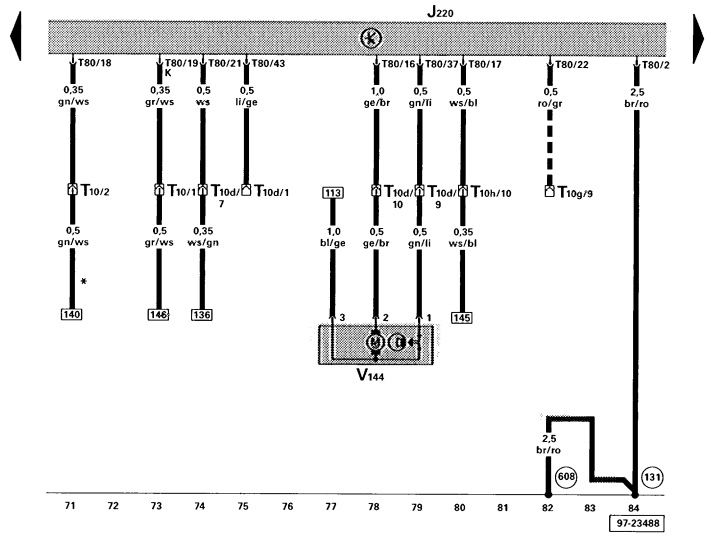
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N30 - Cylinder 1 Fuel Injector
N31 - Cylinder 2 Fuel Injector
N32 - Cylinder 3 Fuel Injector
N33 - Cylinder 4 Fuel Injector
S232 - Fuse 32 in fuse holder
T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
T80 - Connector, 80 point

(D95) - Wire connection (injectors), in engine compartment wiring harness
(A101) - Connector -3- (87a), in instrument panel wiring harness

Repair Manual page number 97-68

Repair Manual page number 97-69





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

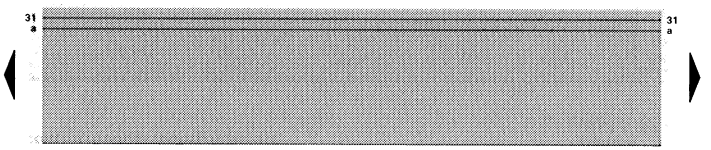
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10d - 10-Pin Connector, green, in protective housing for connectors, in plenum chamber, left
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
T80 - Connector, 80 point
V144 - Leak detection pump (LDP)

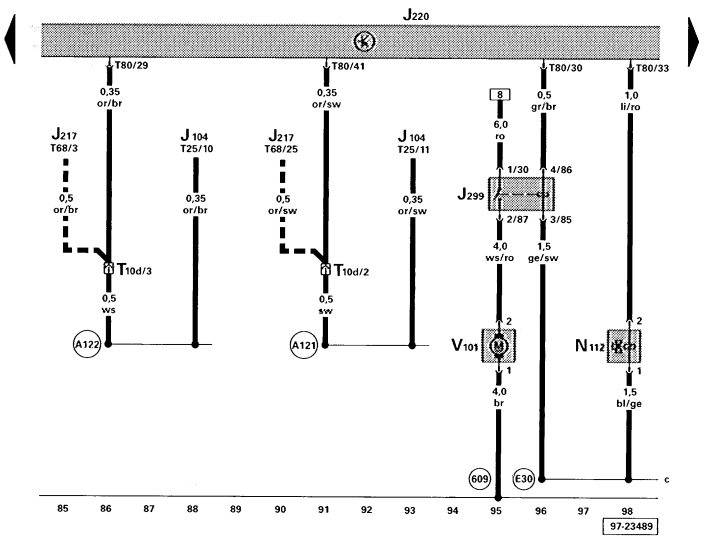
(608) - Ground Connection (in center plenum chamber)

(131) - Ground connection -2-, in engine compartment wiring harness

* - Vehicles with Multi-Function Indicator (MFI) only

--- Automatic transmission only





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

J104 - ABS Control Module (w/EDL), in engine compartment, left
J217 - Transmission Control Module (TCM), in plenum chamber, center
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J299 - Secondary Air Injection (AIR) Pump Relay, in protective housing, in engine compartment, left, production control number (100)
N112 - Secondary Air Injection (AIR) Solenoid Valve
T10d - 10-Pin Connector, green, in protective housing for connectors, in plenum chamber, left
T25 - 25-Pin Connector, on ABS Control Module (w/EDL)
T68 - 68-Pin Connector, on Transmission Control Module (TCM)
T80 - Connector, 80 point
V101 - Secondary Air Injection (AIR) Pump Motor

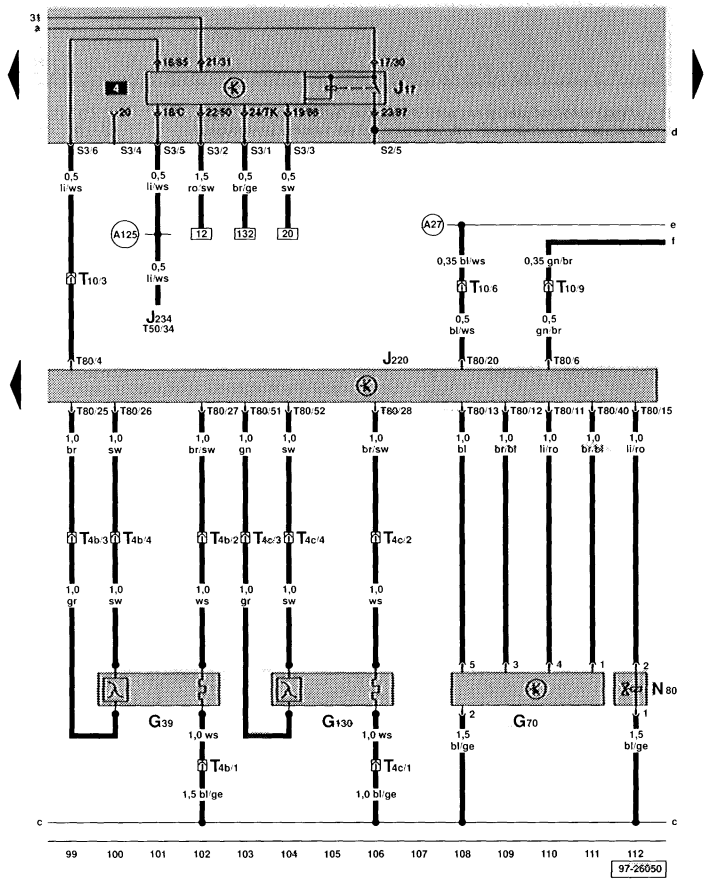
(609) - Ground Connection (in right plenum chamber)

(A121) - Connection (high bus), in instrument panel wiring harness

(A122) - Connection (low bus), in instrument panel wiring harness

(E30) - Connector (87a), in wiring harness engine

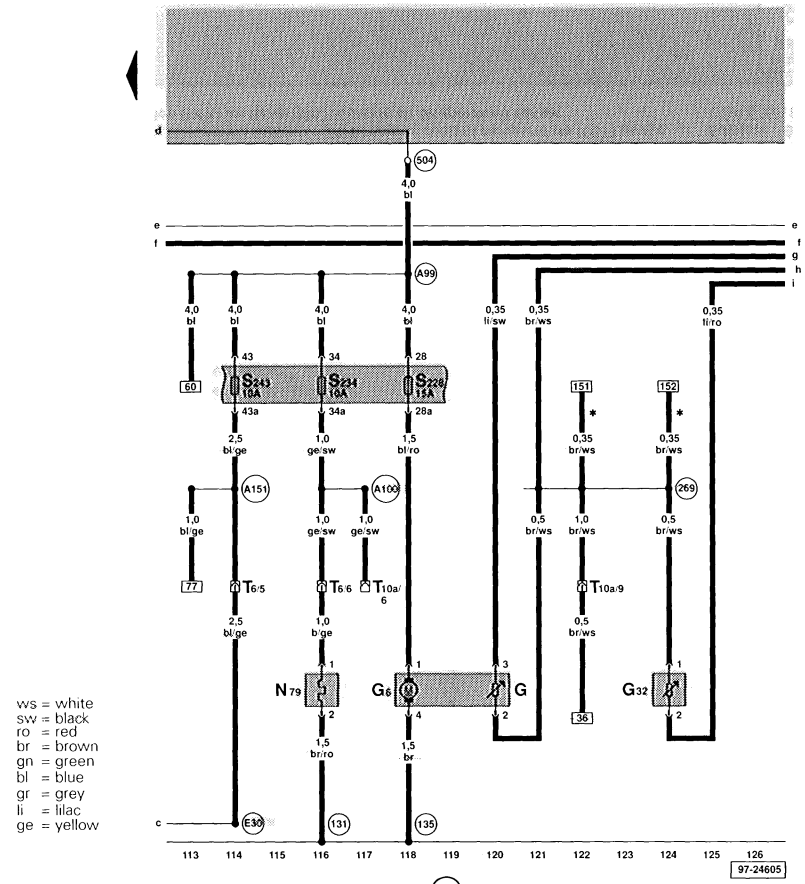
--- Automatic transmission only



G39 - Heated Oxygen Sensor (HO2S)
G70 - Mass Air Flow (MAF) Sensor
G130 - Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC)
J17 - Fuel Pump (FP) Relay
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J234 - Airbag Control Module
N80 - Evaporative Emission (EVAP) Canister Purge Regulator Valve
T4b - 4-Pin Connector, in protective housing for connectors under right floor
T4c - 4-Pin Connector, in protective housing for connectors under right floor
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T50 - 50-Pin Connector
T80 - Connector, 80 point
(A125) - Connection (crash signal) in instrument panel wiring harness
(A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness

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USA.5102.04.21

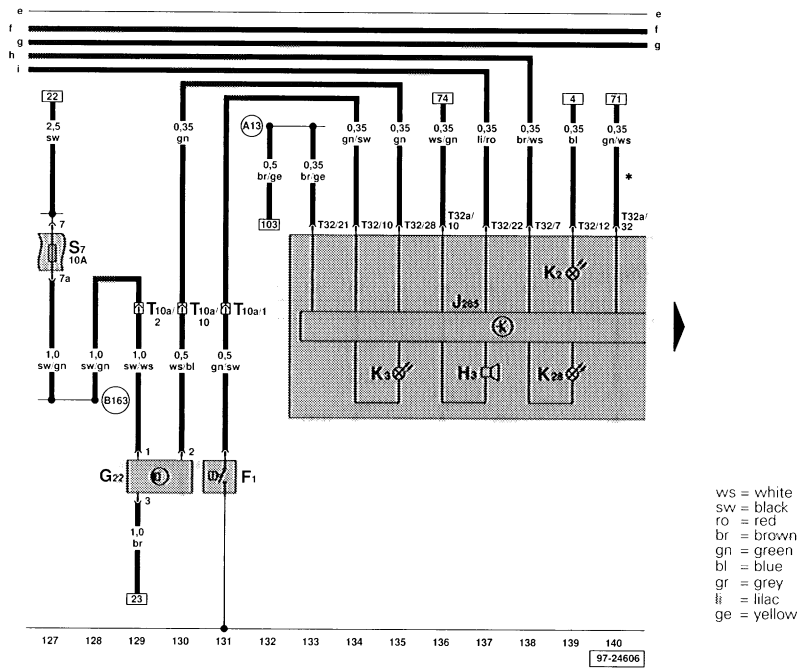
Motronic engine control module (ECM), mass air flow (MAF) sensor, heated oxygen sensor (HO2S), evaporative emission (EVAP) canister purge regulator valve



G - Fuel Level Sensor
G6 - Fuel Pump (FP)
G32 - Engine Coolant Level (ECL) Sensor
N79 - Positive Crankcase Ventilation (PCV) Heating Element
S228 - Fuse 28 in fuse holder
S234 - Fuse 34 in fuse holder
S243 - Fuse 43 in fuse holder
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
(131) - Ground connection -2-, in engine compartment wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
(504) - Threaded connection -1- (87) on the relay plate
(E30) - Connector (87a), in wiring harness engine
(A99) - Connector -1- (87), in instrument panel wiring harness
(A100) - Connector -2- (87), in instrument panel wiring harness
(A151) - Connector -4- (87), in instrument panel wiring harness
* - Vehicles with Multi-Function Indicator (MFI) only

Fuel pump (FP), fuel level sensor, positive crankcase ventilation (PCV) heating element, engine coolant level (ECL) sensor

Edition 08/99
USA.5102.04.21



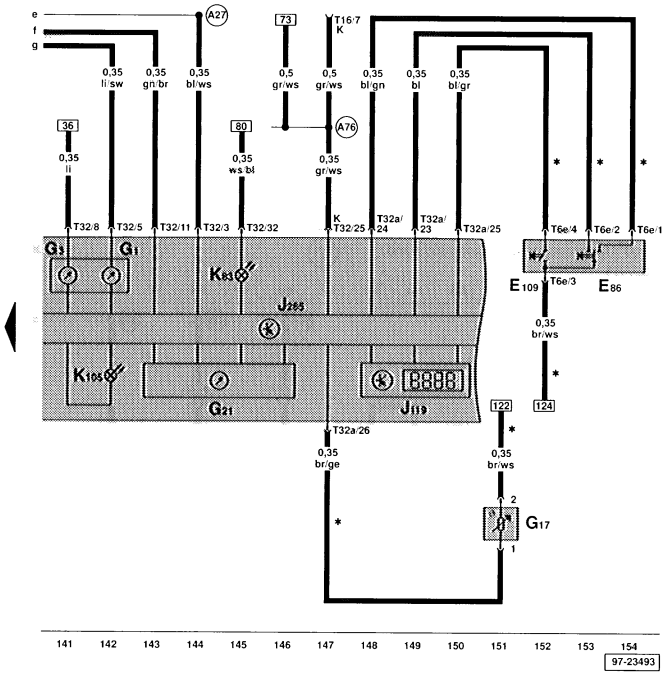
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

F1 - Oil Pressure Switch
G22 - Speedometer Vehicle Speed Sensor (VSS)
H3 - Warning Buzzer
J285 - Control module with indicator unit in instrument panel insert
K2 - Generator (GEN) Warning Light
K3 - Oil Pressure Warning Light
K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
S7 - Fuse 7 in fuse holder
T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(A13) - Wire connection (door contact switch) in instrument panel wiring harness
(B163) - Plus connector -1- (15) in wiring harness interior

* - Vehicles with Multi-Function Indicator (MFI) only

Instrument cluster, oil pressure switch, speedometer vehicle speed sensor, generator (GEN) warning light, engine coolant level/temperature (ECL/ECT) warning light



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E86 - Multi-Function Indicator Mode Select Switch*
E109 - Multi-Function Indicator Memory Switch*
G1 - Fuel gauge
G3 - Engine Coolant Temperature (ECT) Gauge
G17 - Outside Air Temperature Sensor*
G21 - Speedometer
J119 - Multi-function Indicator (MFI)
J285 - Control module with indicator unit in instrument panel insert
K83 - Malfunction Indicator Lamp (MIL)
K105 - Low Fuel Level Warning Light
T6e - 6-Pin Connector
T16 - Data Link Connector (DLC), below instrument panel, left
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness
(A76) - Connector (K-diagnosis wire), in instrument panel wiring harness

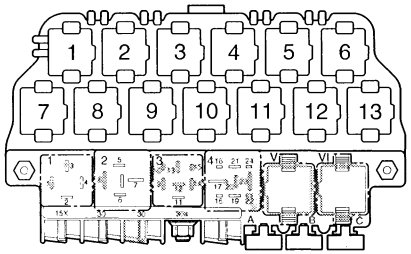
* - Vehicles with Multi-Function Indicator (MFI) only

Instrument cluster, multi-function indicator (MFI), engine coolant temperature (ECT) gauge, fuel gauge, malfunction indicator lamp (MIL), outside air temperature sensor

2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/130 kW, code AFP,

from December 1998

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

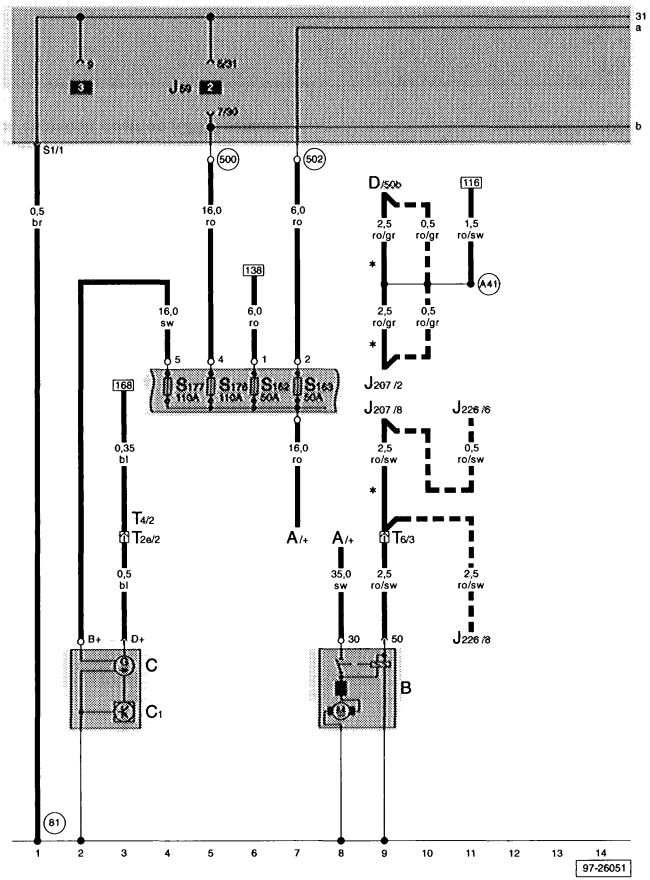
2 Load Reduction Relay (100)

4 Fuel Pump (FP) Relay (409)

Note: Number in parentheses indicates production control number stamped on relay housing.

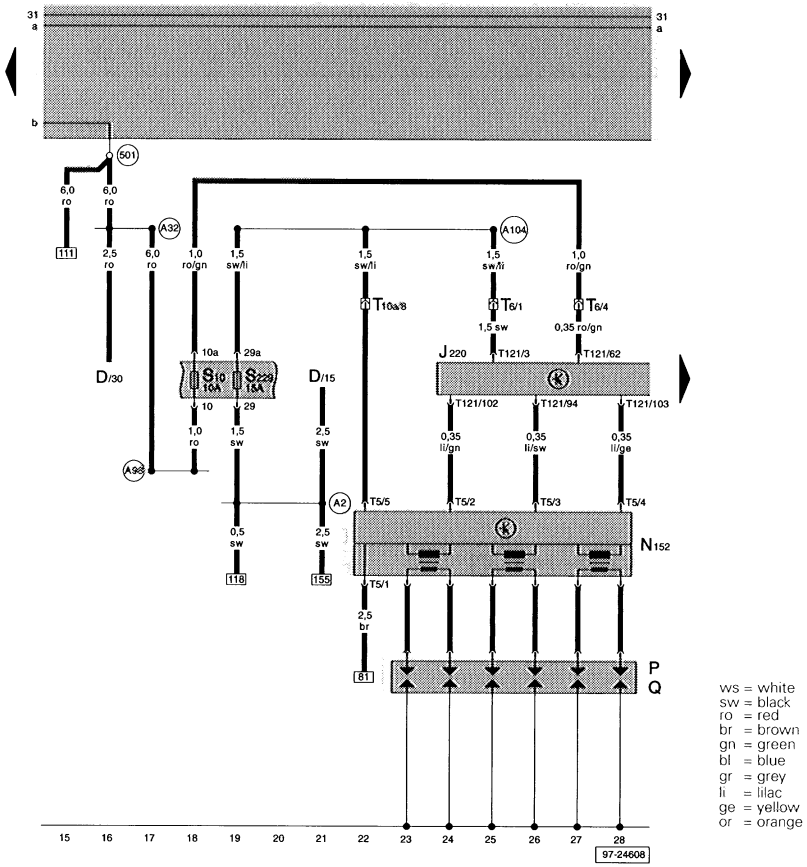
Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

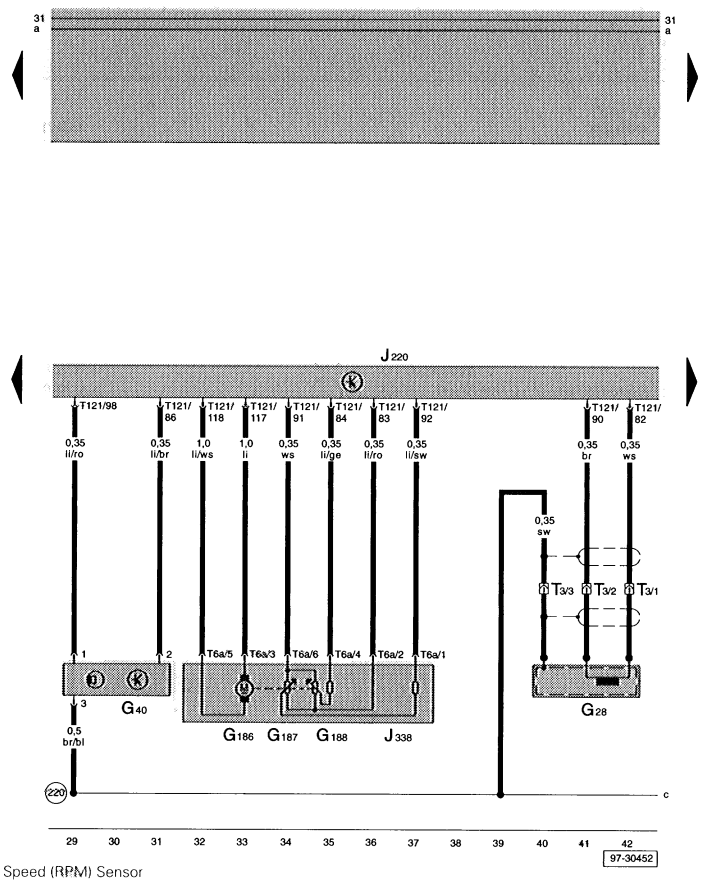
A - Battery
B - Starter
C - Generator (GEN)
C1 - Voltage Regulator (VR)
D - Ignition/Starter Switch
J59 - Load Reduction Relay
J207 - Starting Interlock Relay
J226 - Park/Neutral Position (PNP) Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
T2e - Double Connector, near starter (vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
(81) - Ground connection -1-, in instrument panel wiring harness
(500) - Threaded connection -1- (30) on the relay plate
(502) - Threaded connection -1- (30a) on the relay plate
(A41) - Plus connection (50), in instrument panel wiring harness
* - Manual transmission only
--- Automatic transmission only



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

D - Ignition/Starter Switch
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N152 - Ignition Coil
P - Spark Plug Connectors
Q - Spark Plugs
S10 - Fuse 10 in fuse holder
S229 - Fuse 29 in fuse holder
T5 - 5-Pin Connector
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
T121 - Connector, 121 point

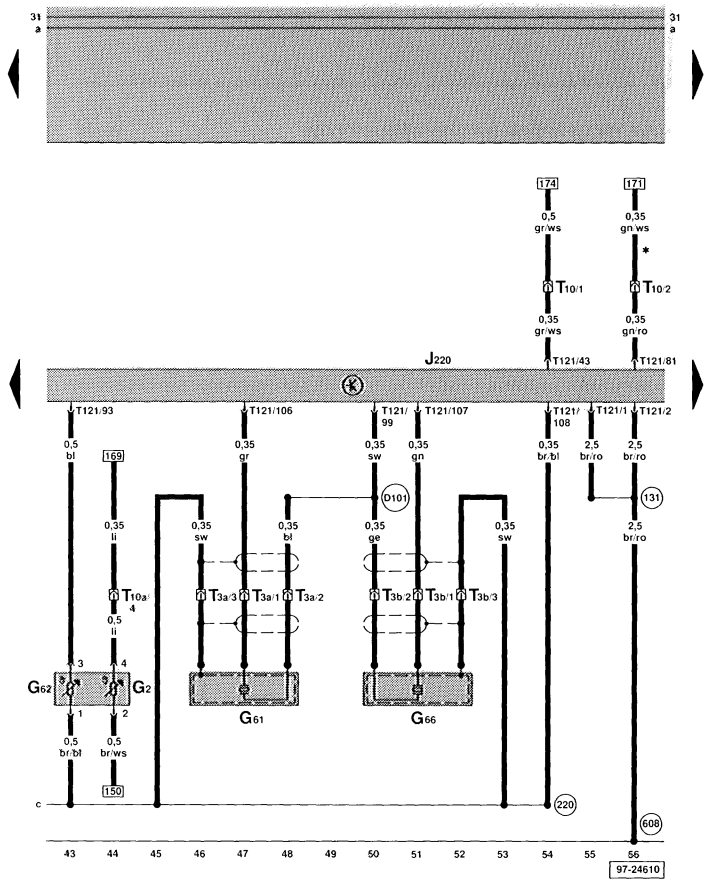
(501) - Threaded connection -2- (30) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness
(A104) - Plus connector -2- (15), in instrument panel wiring harness



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

G28 - Engine Speed (RPM) Sensor
G40 - Camshaft Position (CMP) Sensor
G186 - Throttle drive (power accelerator actuation)
G187 - Angle sensor -1- for throttle drive (power accelerator actuation)
G188 - Angle sensor -2- for throttle drive (power accelerator actuation)
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J338 - Throttle Valve Control Module
T3 - 3-Pin Connector, near intake manifold
T6a - 6-Pin Connector
T121 - Connector, 121 point

(220) - Ground connection (sensor ground), in engine compartment wiring harness



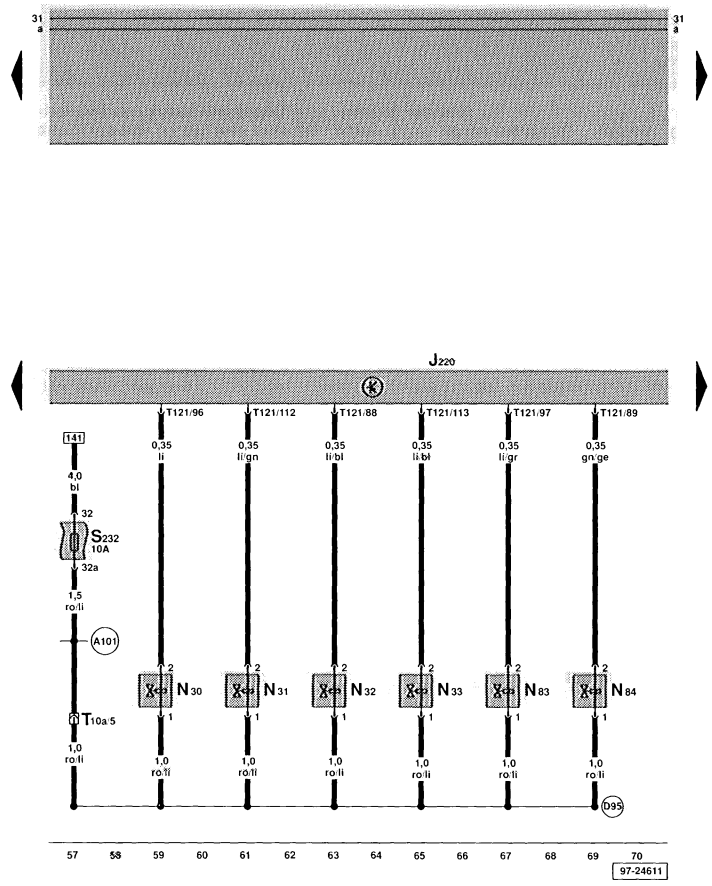
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

G2 - Engine Coolant Temperature (ECT) Sensor
G61 - Knock Sensor (KS) 1
G62 - Engine Coolant Temperature (ECT) Sensor
G66 - Knock Sensor (KS) 2
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
T3a - 3-Pin Connector, in engine compartment, rear
T3b - 3-Pin Connector, in engine compartment, front
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
T121 - Connector, 121 point

(608) - Ground connection (in center plenum chamber)
(220) - Ground connection (sensor ground), in engine compartment wiring harness
(131) - Ground connection -2-, in engine compartment wiring harness
(D101) - Wire connection -1-, in engine compartment wiring harness

* - Vehicles with Multi-Function Indicator (MFI) only

Motronic engine control module (ECM), knock sensor (KS) 1, knock sensor (KS) 2, engine coolant temperature (ECT) sensor

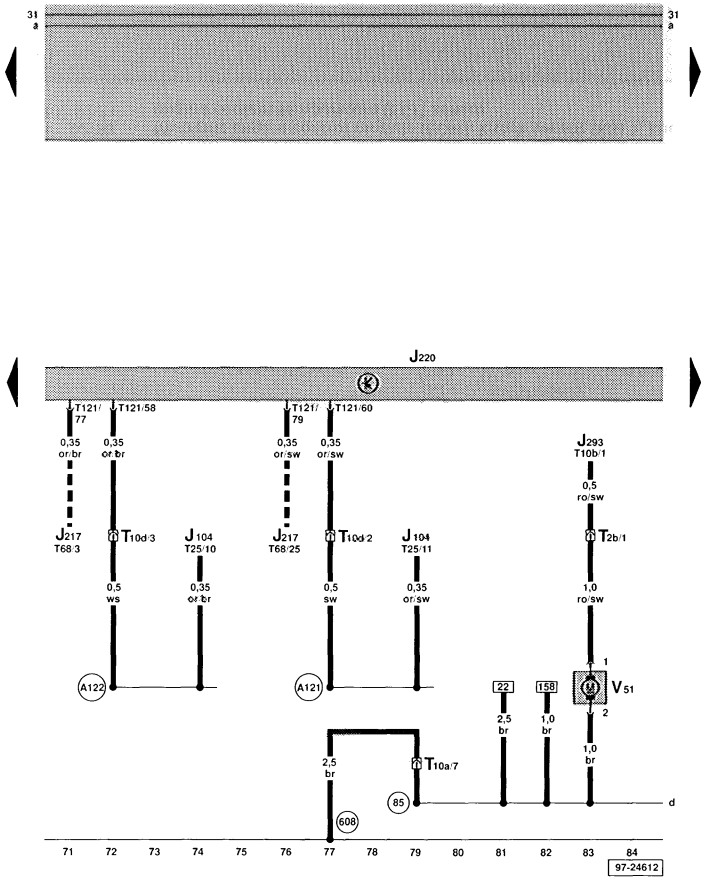


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N30 - Cylinder 1 Fuel Injector
N31 - Cylinder 2 Fuel Injector
N32 - Cylinder 3 Fuel Injector
N33 - Cylinder 4 Fuel Injector
N83 - Cylinder 5 Fuel Injector
N84 - Cylinder 6 Fuel Injector
S232 - Fuse 32 in fuse holder
T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
T121 - Connector, 121 point

(A101) - Connector -3- (87a), in instrument panel wiring harness
(D95) - Wire connection (injectors), in engine compartment wiring harness

Motronic engine control module (ECM), injectors

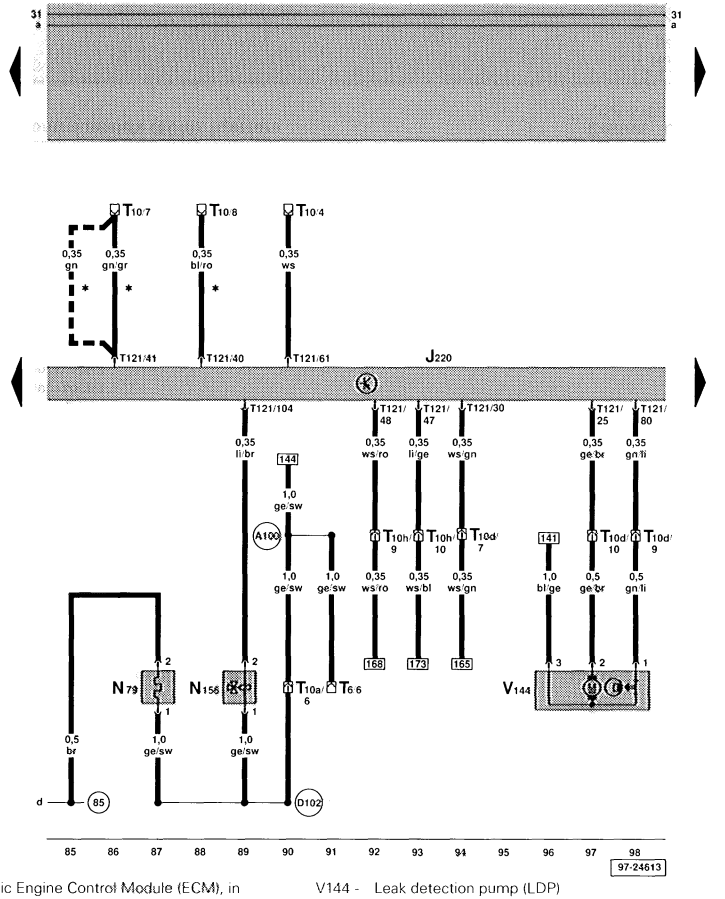


J104 - ABS Control Module (w/EDL)
J217 - Transmission Control Module (TCM), in plenum chamber, center
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J293 - Coolant FC (Fan Control) Control Module
T2b - Double Connector, in engine compartment, in wiring duct, left
T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
T10b - 10-Pin Connector, on Coolant FC (Fan Control) Control Module
T10d - 10-Pin Connector, green, in protective housing for connectors, in plenum chamber, left
T25 - 25-Pin Connector, on ABS Control Module (w/EDL)
T68 - 68-Pin Connector, on Transmission Control Module (TCM)
T121 - Connector, 121 point
V51 - After-Run Coolant Pump

(608) - Ground connection (in center plenum chamber)
(85) - Ground connection -1-, in engine compartment wiring harness
(A121) - Connection (high bus), in instrument panel wiring harness
(A122) - Connection (low bus), in instrument panel wiring harness

--- Automatic transmission only

Motronic engine control module (ECM), after-run coolant pump

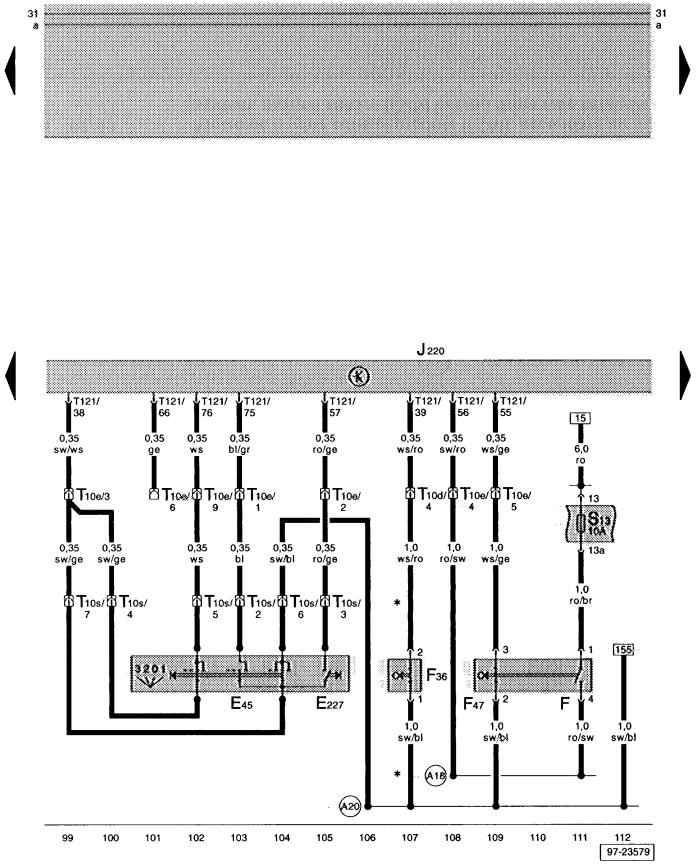


J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N79 - Positive Crankcase Ventilation (PCV) Heating Element
N156 - Intake Manifold Change-Over Valve
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
T10d - 10-Pin Connector, green, in protective housing for connectors, in plenum chamber, left
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T121 - Connector, 121 point
V144 - Leak detection pump (LDP)

(85) - Ground connection -1-, in engine compartment wiring harness
(A100) - Connector -2- (87), in instrument panel wiring harness
(D102) - Wire connection -2-, in engine compartment wiring harness

* - A/C connection
--- Automatic transmission only

Motronic engine control module (ECM), leak detection pump (LDP), intake manifold change-over valve, positive crankcase ventilation (PCV) heating element



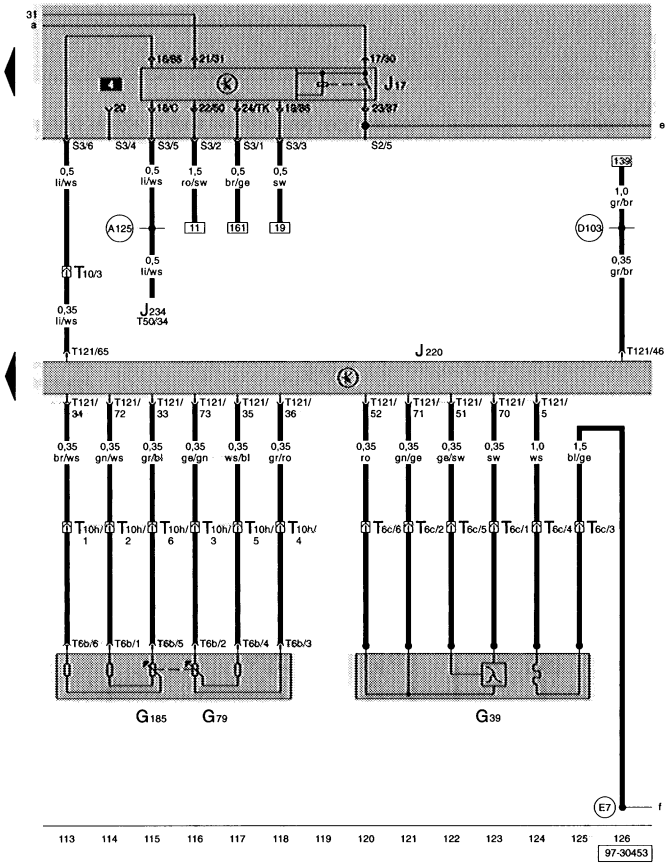
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E45 - Cruise Control Switch
E227 - Cruise Control Push Button (SET)
F - Brake Light Switch
F36 - Clutch Vacuum Vent Valve Switch
F47 - Brake Pedal Switch (cruise control/Diesel Direct Fuel Injection)
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
S13 - Fuse 13 in fuse holder
T10d - 10-Pin Connector, green, in protective housing for connectors, in plenum chamber, left
T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
T10s - 10-Pin Connector, near steering column
T121 - Connector, 121 point

(A18) - Wire connection (54), in instrument panel
(A20) - Wire connection (15a), in instrument panel wiring harness

* - Manual transmission only

Motronic engine control module (ECM), cruise control switch, brake light switch, clutch vacuum vent valve switch, brake pedal switch (cruise/DFI)

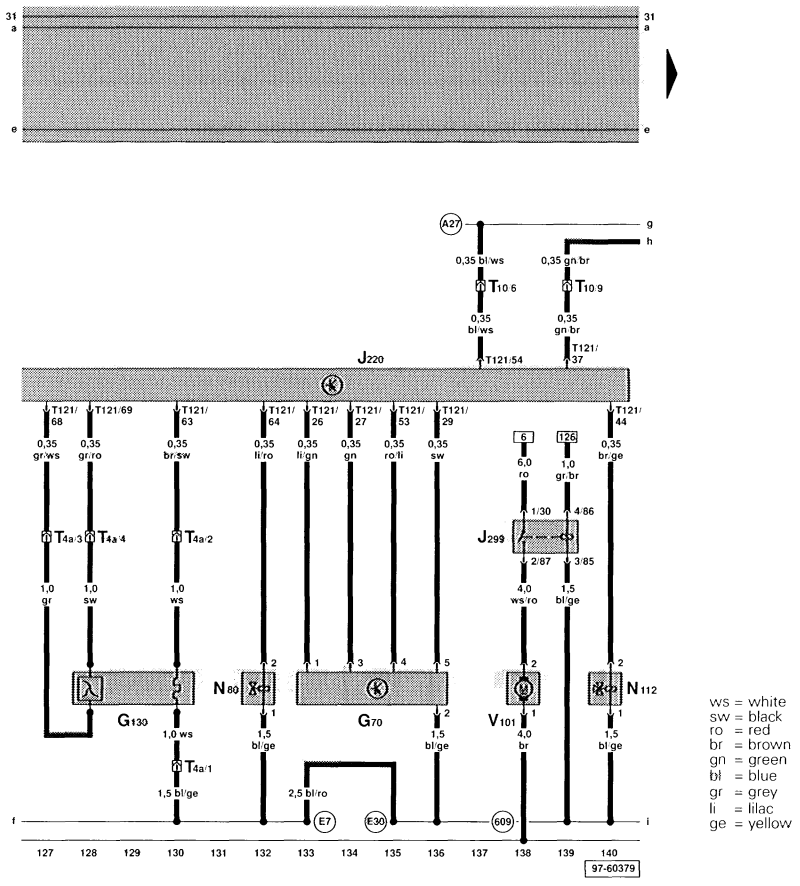


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

G39 - Heated Oxygen Sensor (HO2S)
G79 - Throttle Position (TP) Sensor
G185 - Sender -2- for accelerator pedal position
J17 - Fuel Pump (FP) Relay
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J234 - Airbag Control Module
T6b - 6-Pin Connector
T6c - 6-Pin Connector, in protective housing for connectors under right floor
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T50 - 50-Pin Connector
T121 - Connector, 121 point

(A125) - Connection (crash signal) in instrument panel wiring harness
(D103) - Wire connection -3-, in engine compartment wiring harness
(E7) - Plus connection (87a), in Motronic Multiport Fuel Injection (MFI) wiring harness

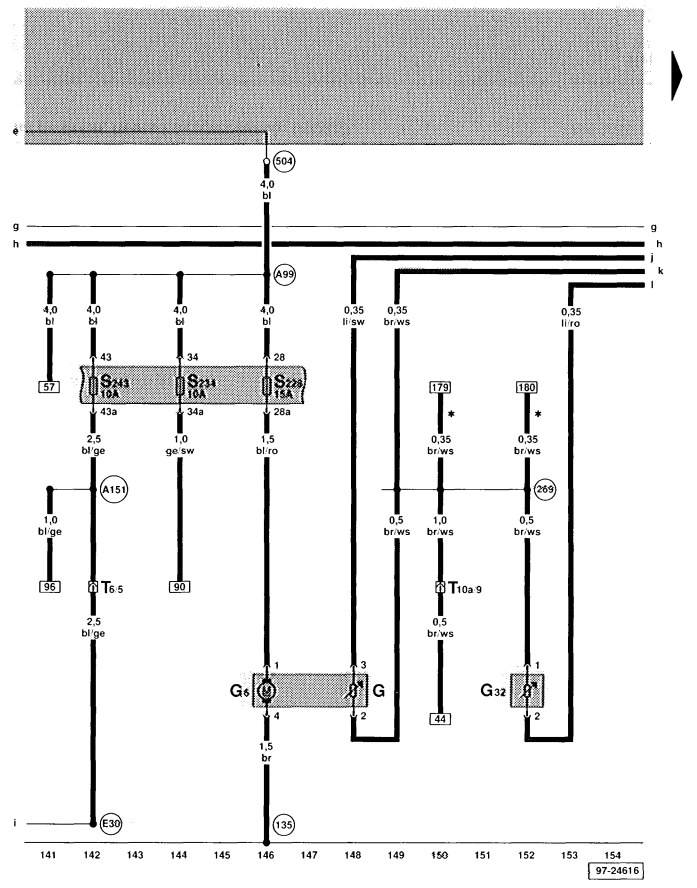
Motronic engine control module (ECM), throttle position (TP) sensor, sender -2- for accelerator pedal position, heated oxygen sensor (HO2S)



- G70 - Mass Air Flow (MAF) Sensor
- G130 - Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J299 - Secondary Air Injection (AIR) Pump Relay, in protective housing, in engine compartment, left, production control number (100)
- N80 - Evaporative Emission (EVAP) Canister Purge Regulator Valve
- N112 - Secondary Air Injection (AIR) Solenoid Valve
- T4a - 4-Pin Connector, in protective housing for connectors, in engine compartment, rear
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T121 - Connector, 121 point
- V101 - Secondary Air Injection (AIR) Pump Motor
- (609) - Ground connection (in right plenum chamber)
- (A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness
- (E7) - Plus connection (87a), in Motronic Multiport Fuel Injection (MFI) wiring harness
- (E30) - Connector (87a), in wiring harness engine

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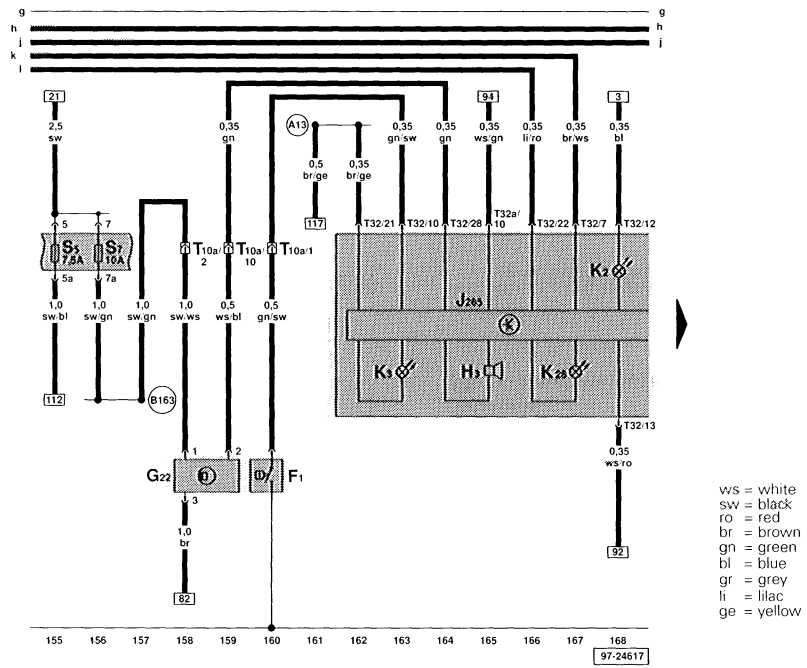
Motronic engine control module (ECM), secondary air injection (AIR) pump system, oxygen sensor (O2S) behind three way catalytic converter (TWC)



- G - Fuel Level Sensor
- G6 - Fuel Pump (FP)
- G32 - Engine Coolant Level (ECL) Sensor
- S228 - Fuse 28 in fuse holder
- S234 - Fuse 34 in fuse holder
- S243 - Fuse 43 in fuse holder
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
- (135) - Ground connection -2-, in instrument panel wiring harnes
- (269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
- (504) - Threaded connection -1- (87) on the relay plate
- (E30) - Connector (87a), in wiring harness engine
- (A99) - Connector -1- (87), in instrument panel wiring harness
- (A151) - Connector -4- (87), in instrument panel wiring harness
- * - Vehicles with Multi-Function Indicator (MFI) only

Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor

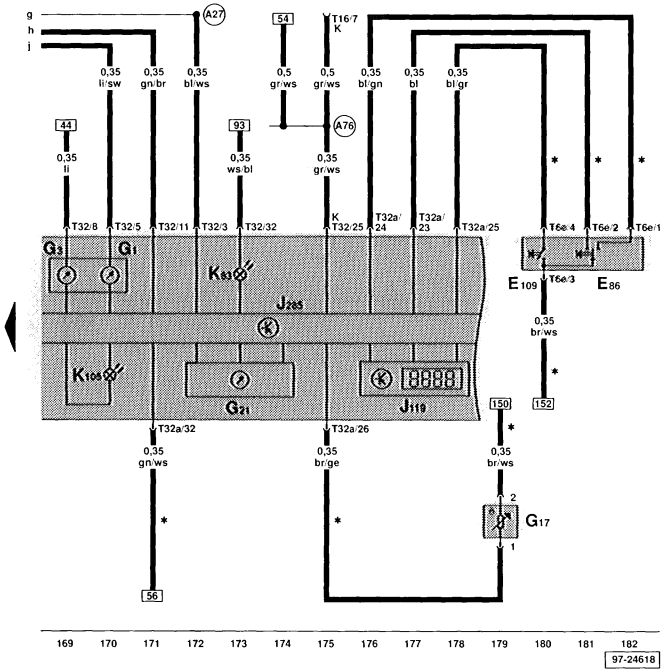
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F1 - Oil Pressure Switch
G22 - Speedometer Vehicle Speed Sensor (VSS)
H3 - Warning Buzzer
J285 - Control module with indicator unit in instrument panel insert
K2 - Generator (GEN) Warning Light
K3 - Oil Pressure Warning Light
K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
S5 - Fuse 5 in fuse holder
S7 - Fuse 7 in fuse holder
T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(A13) - Wire connection (door contact switch) in instrument panel wiring harness
(B163) - Plus connector -1- (15) in wiring harness interior

Instrument cluster, oil pressure switch, speedometer vehicle speed sensor, generator (GEN) warning light, engine coolant level/temperature ECL/ECT) warning light



E86 - Multi-Function Indicator Mode Select Switch*
E109 - Multi-Function Indicator Memory Switch*
G1 - Fuel gauge
G3 - Engine Coolant Temperature (ECT) Gauge
G17 - Outside Air Temperature Sensor*
G21 - Speedometer
J119 - Multi-function Indicator (MFI)
J285 - Control module with indicator unit in instrument panel insert
K83 - Malfunction Indicator Lamp (MIL)
K105 - Low Fuel Level Warning Light
T6e - 6-Pin Connector
T16 - Data Link Connector (DLC), below instrument panel, left
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness
(A76) - Connector (K-diagnosis wire), in instrument panel wiring harness

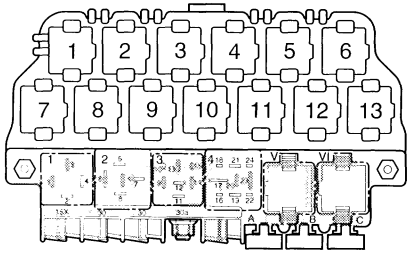
* - Vehicles with Multi-Function Indicator (MFI) only

Instrument cluster, multi-function indicator (MFI), engine coolant temperature (ECT) gauge, fuel gauge, malfunction indicator lamp (MIL), outside air temperature sensor

1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66KW, code ALH, (with manual transmission),

from September 1998

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

10 Glow Plug Relay (180)

12 Power Supply (Terminal 30, B+) Relay (109)

Relay panel:

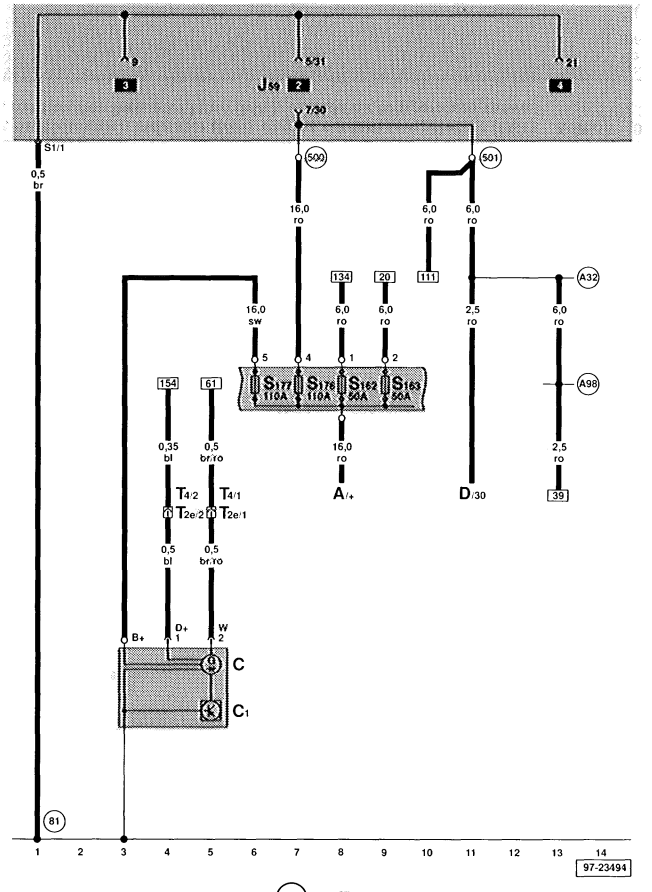
2 Load Reduction Relay (18)

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7.5 A - brown
5 A - beige
3 A - violet

Edition 12/98
USA.5102.01.21



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

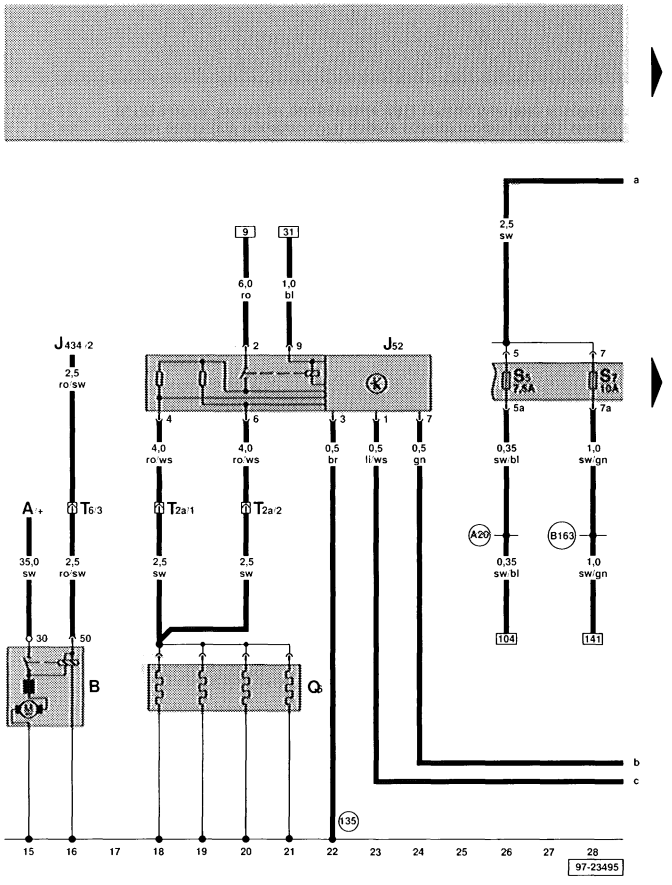
A - Battery
C - Generator (GEN)
C1 - Voltage Regulator (VR)
D - Ignition/Starter Switch
J59 - Load Reduction Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
T2e - Double Connector, near starter (vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)

(81) - Ground connection -1-, in instrument panel wiring harness

(500) - Threaded connection -1- (30) on the relay plate
(501) - Threaded connection -2- (30) on the relay plate
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness

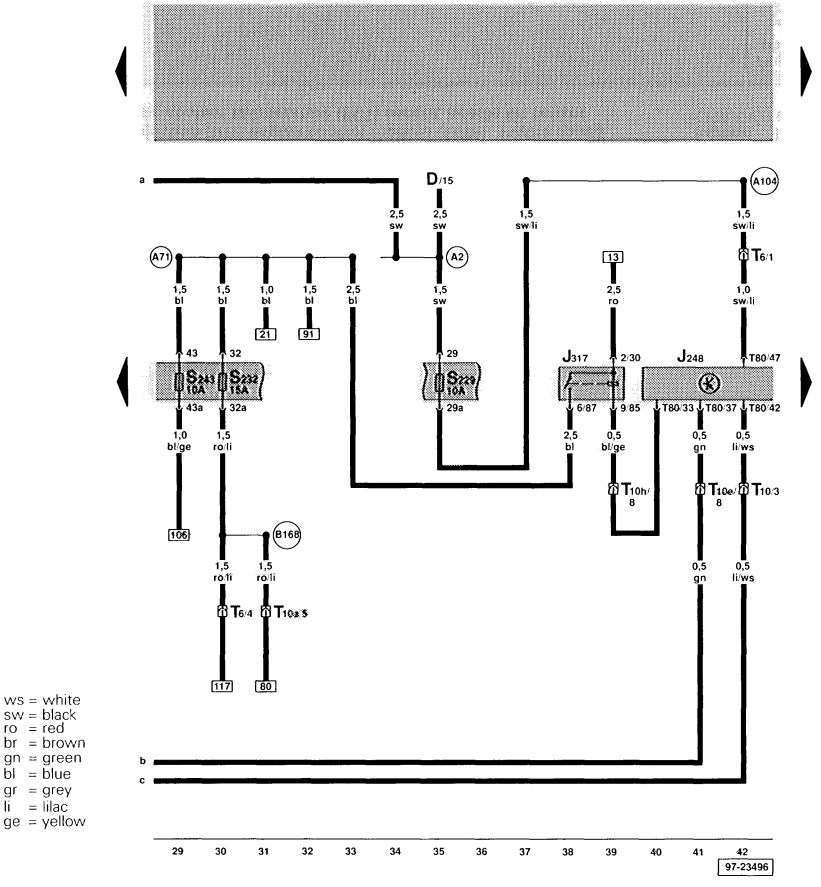
Generator (GEN)

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A - Battery
B - Starter
J52 - Glow Plug Relay, on the thirteenfold auxiliary relay panel, above relay panel
J434 - Locking relay for starter (clutch pedal switch), on the thirteenfold auxiliary relay panel, above relay panel
Q6 - Glow plugs (engine)
S5 - Fuse 5 in fuse holder
S7 - Fuse 7 in fuse holder
T2a - Double Connector, in engine compartment, in wiring duct, left
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left

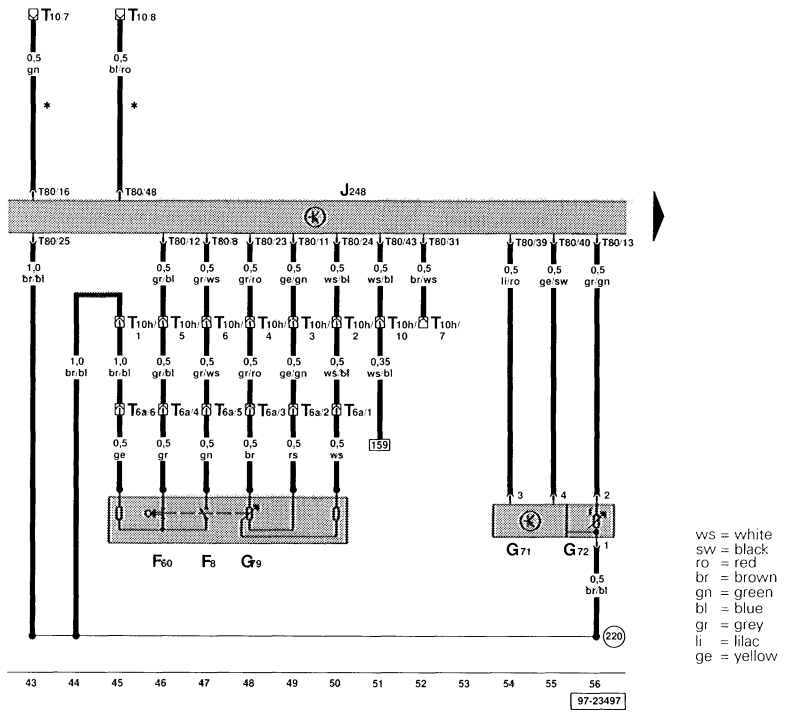
(135) - Ground connection -2-, in instrument panel wiring harness
(A20) - Wire connection (15a), in instrument panel wiring harness
(B163) - Plus connector -1- (15) in wiring harness interior



D - Ignition/Starter Switch
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
J317 - Power Supply (Terminal 30, B+) Relay, on the thirteenfold auxiliary relay panel, above relay panel
S229 - Fuse 29 in fuse holder
S232 - Fuse 32 in fuse holder
S243 - Fuse 43 in fuse holder
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T80 - Connector, 80 point

(A2) - Plus connection (15), in instrument panel wiring harness
(A71) - Connector (86), in instrument panel wiring harness
(A104) - Plus connector -2- (15), in instrument panel wiring harness
(B168) - Connection (86) in passenger compartment wiring harness

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Repair Manual page number 97-93



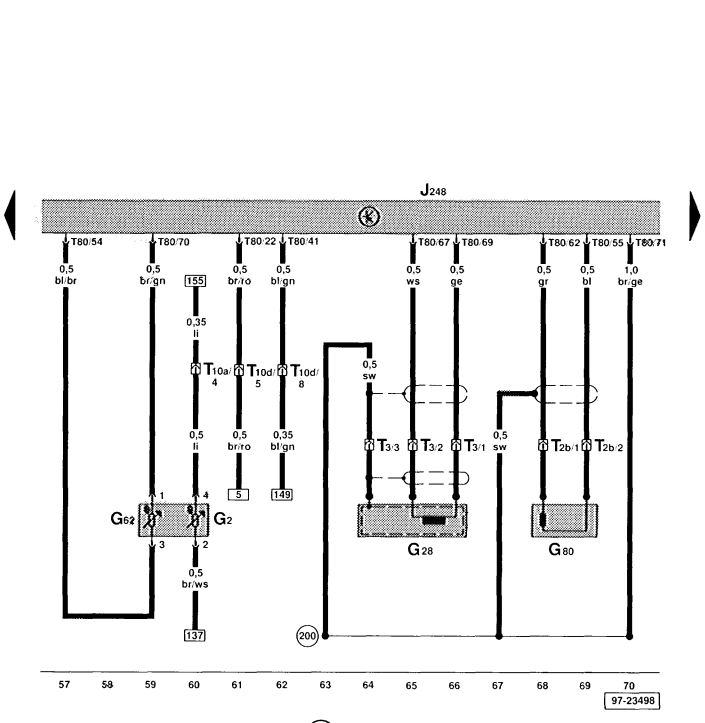
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

F8 - Kick Down Switch
F60 - Closed Throttle Position (CTP) Switch
G71 - Manifold Absolute Pressure (MAP) Sensor
G72 - Intake Air Temperature (IAT) Sensor
G79 - Throttle Position (TP) Sensor
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
T6a - 6-Pin Connector, behind instrument panel, left
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T80 - Connector, 80 point

(220) - Ground connection (sensor ground), in engine compartment wiring harness

* - A/C connection

Diesel direct fuel injection (DFI) engine control module (ECM), closed throttle position (CTP) switch, intake air temperature (IAT) sensor, manifold absolute pressure (MAP) sensor

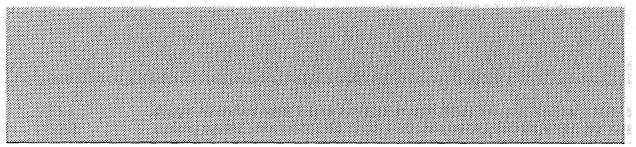


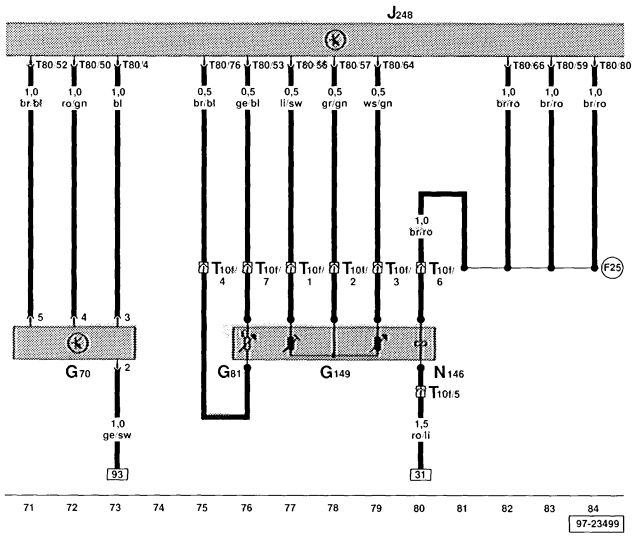
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

G2 - Engine Coolant Temperature (ECT) Sensor
G28 - Engine Speed (RPM) Sensor
G62 - Engine Coolant Temperature (ECT) Sensor
G80 - Needle Lift Sensor
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
T2b - Double Connector, in engine compartment, front
T3 - 3-Pin Connector, in engine compartment, front
T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
T10d - 10-Pin Connector, green, in protective housing for connectors, in plenum chamber, left
T80 - Connector, 80 point

(200) - Ground connection (shielding), in engine compartment wiring harness

Diesel direct fuel injection (DFI) engine control module (ECM), engine speed (RPM) sensor, engine coolant temperature (ECT) sensor, needle lift sensor



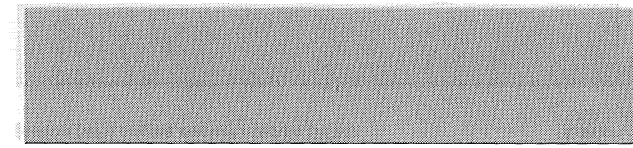


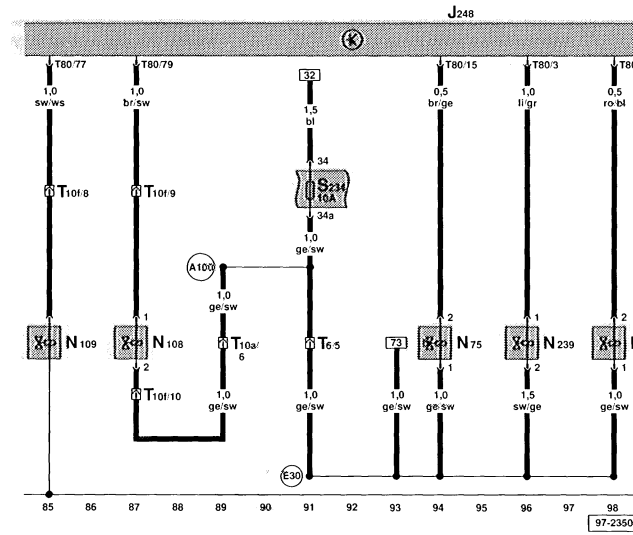
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

G70 - Mass Air Flow (MAF) Sensor
G81 - Fuel Temperature Sensor
G149 - Modulating Piston Displacement Sensor
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
N146 - Quantity Adjuster
T10f - 10-Pin Connector, in engine compartment, front
T80 - Connector, 80 point

(F25) - Wire connection -1-, in Diesel Direct Fuel Injection (DFI) system wiring harness

Diesel direct fuel injection (DFI) engine control module (ECM), quantity adjuster, mass air flow (MAF) sensor, fuel temperature sensor, modulating piston displacement sensor



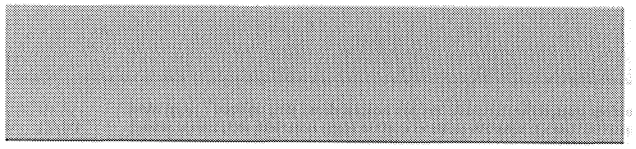


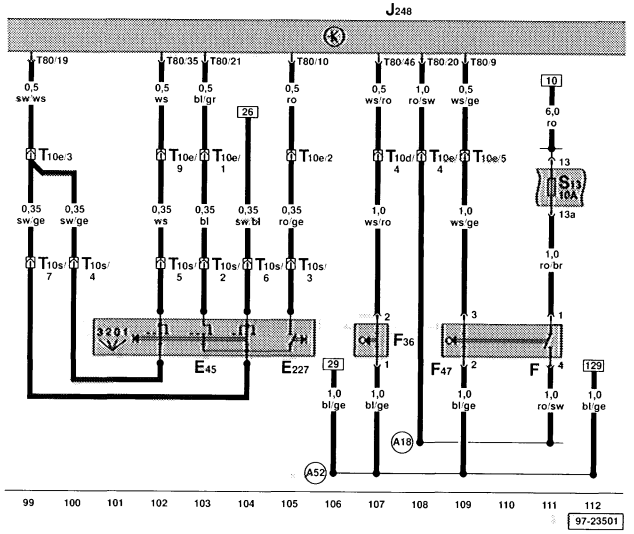
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
N18 - EGR Vacuum Regulator Solenoid Valve
N75 - Wastegate Bypass Regulator Valve
N108 - Cold Start Injector
N109 - Fuel Cut-off Valve
N239 - Change-over valve for intake manifold flap
S234 - Fuse 34 in fuse holder
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
T10f - 10-Pin Connector, in engine compartment, front
T80 - Connector, 80 point

(A100) - Connector -2- (87), in instrument panel wiring harness
(E30) - Connector (87a), in wiring harness engine

Diesel direct fuel injection (DFI) engine control module (ECM), cold start injector, fuel cut-off valve, wastegate bypass regulator valve, EGR vacuum regulator solenoid valve





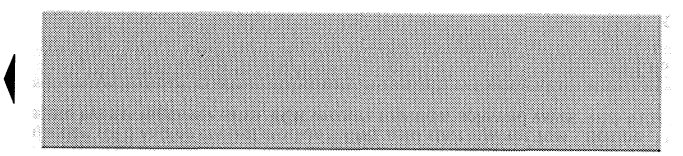
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gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

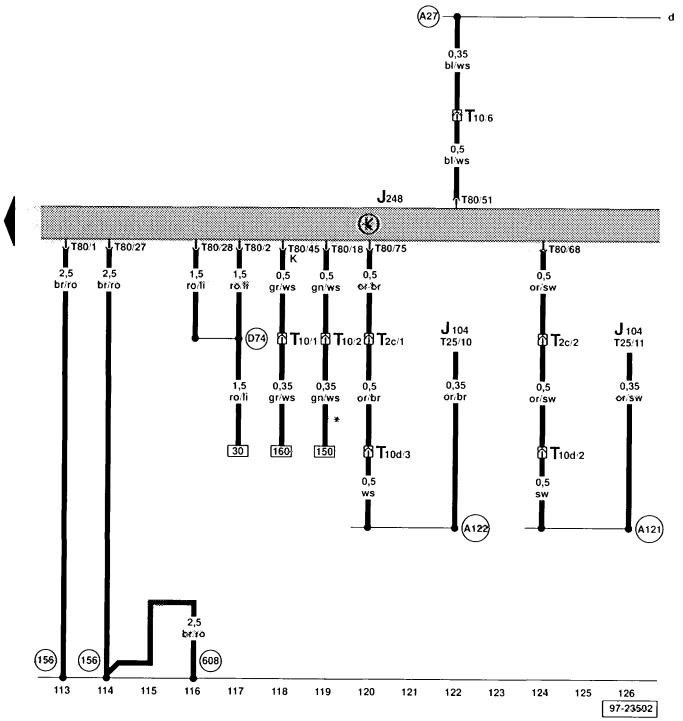
E45 - Cruise Control Switch**
E227 - Cruise Control Push Button (SET)**
F - Brake Light Switch
F36 - Clutch Vacuum Vent Valve Switch
F47 - Brake Vacuum Vent Valve Switch for cruise control/diesel
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
S13 - Fuse 13 in fuse holder
T10d - 10-Pin Connector, green, in protective housing for connectors, in plenum chamber, left
T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
T10s - 10-Pin Connector, near steering column**
T80 - Connector, 80 point

(A18) - Wire connection (54), in instrument panel wiring harness
(A52) - Plus connection (30), in instrument panel wiring harness

** - Vehicles with cruise control only

Diesel direct fuel injection (DFI) engine control module (ECM), cruise control switch, brake vacuum vent valve switch, brake light switch, clutch vacuum vent valve switch





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

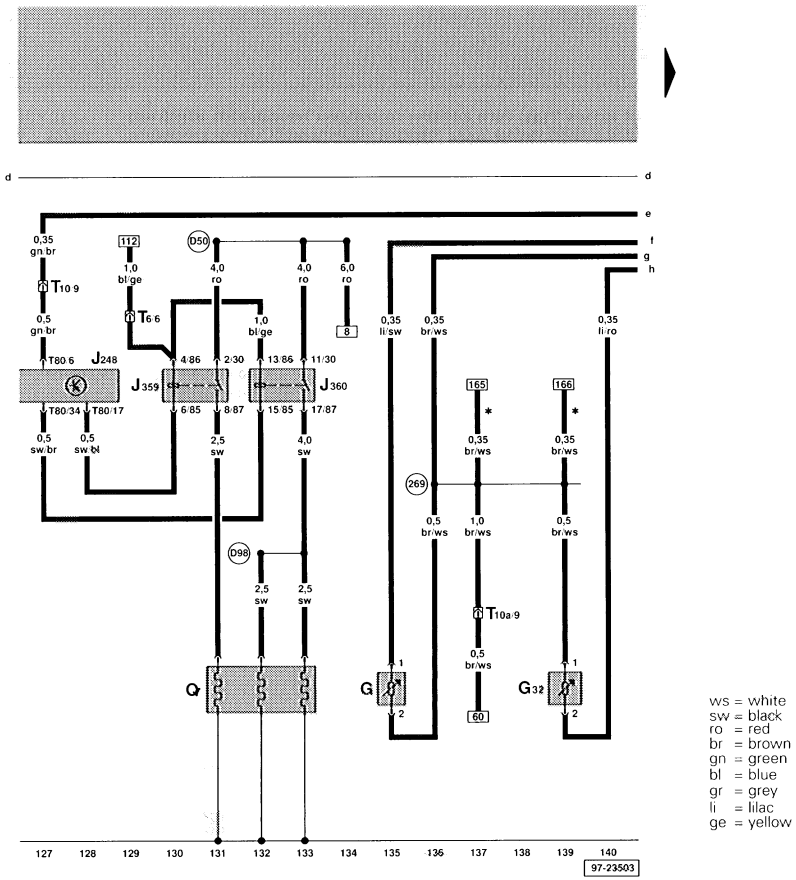
J104 - ABS Control Module (w/EDL), in engine compartment, left
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
T2c - Double Connector, in engine compartment, in wiring duct, left
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10d - 10-Pin Connector, green, in protective housing for connectors, in plenum chamber, left
T25 - 25-Pin Connector, on ABS Control Module (w/EDL)
T80 - Connector, 80 point

(156) - Ground connection, in Diesel Direct Fuel Injection (DFI) wiring harness
(A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness
(A121) - Connection (high bus), in instrument panel wiring harness
(A122) - Connection (low bus), in instrument panel wiring harness
(D74) - Wire connection (86), in engine compartment wiring harness

* - Vehicles with Multi-Function Indicator (MFI) only

(608) - Ground Connection (in center plenum chamber)

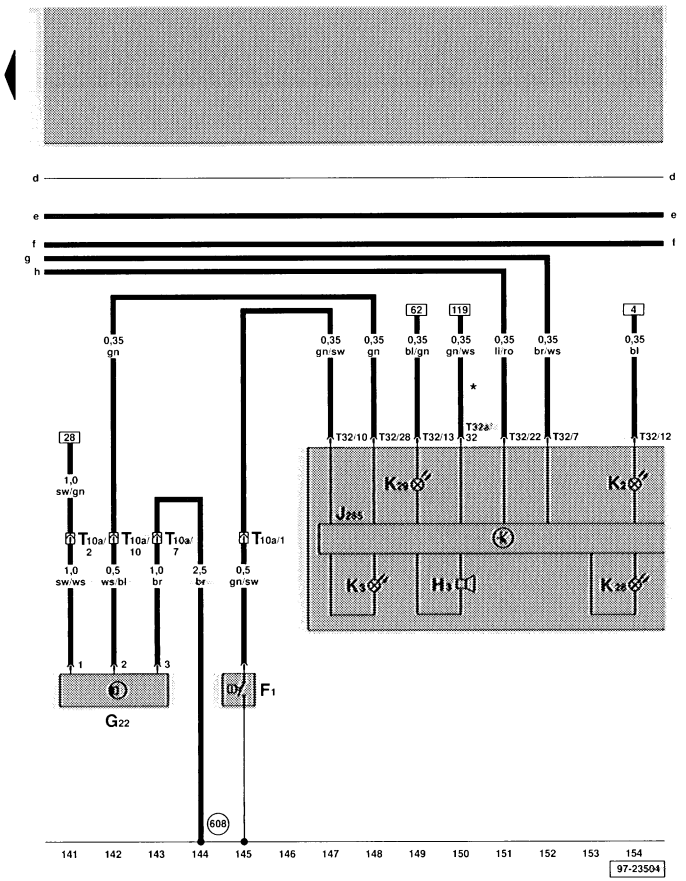
Diesel direct fuel injection (DFI) engine control module (ECM)



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

- G - Fuel Level Sensor
- G32 - Engine Coolant Level (ECL) Sensor
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- J359 - Relay for preheating coolant, low heat output, in protective housing, in engine compartment, left, production control number (53)
- J360 - Relay for preheating coolant, high heat output, in protective housing, in engine compartment, left, production control number (53)
- Q7 - Glow plugs (coolant)
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
- T80 - Connector, 80 point
- (269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
- (D50) - Plus connection (30), in engine compartment wiring harness
- (D98) - Wire connection (glow plugs), in engine compartment wiring harness
- * - Vehicles with Multi-Function Indicator (MFI) only

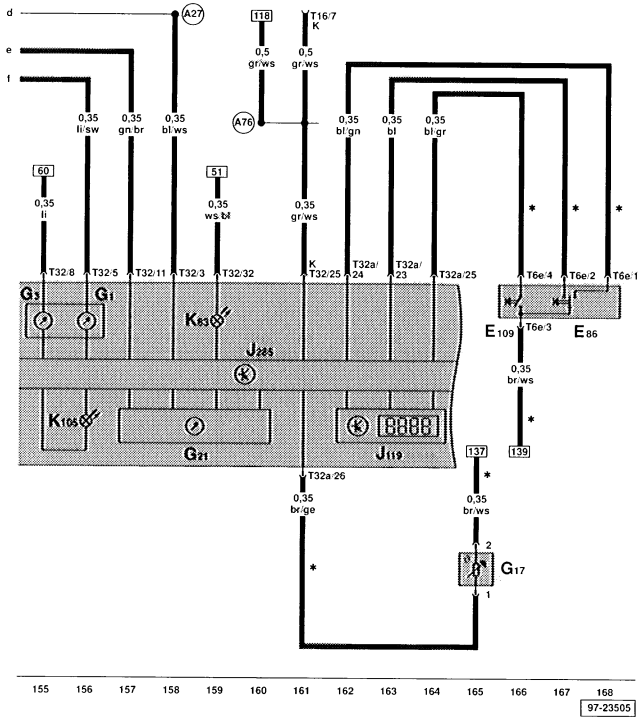
Diesel direct fuel Injection (DFI) engine control module (ECM), fuel level sensor, glow plugs (coolant), engine coolant level (ECL) sensor



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

- F1 - Oil Pressure Switch
- G22 - Speedometer Vehicle Speed Sensor (VSS)
- H3 - Warning Buzzer
- J285 - Control module with indicator unit in instrument panel insert
- K2 - Generator (GEN) Warning Light
- K3 - Oil Pressure Warning Light
- K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
- K29 - Glow Plug Indicator Light
- T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green
- (608) - Ground Connection (in center plenum chamber)
- * - Vehicles with Multi-Function Indicator (MFI) only

Instrument cluster, oil pressure switch, speedometer vehicle speed sensor, engine coolant level/temperature (ECL/ECT) warning light, glow plug indicator light



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E86 - Multi-Function Indicator Mode Select Switch
E109 - Multi-Function Indicator Memory Switch
G1 - Fuel gauge
G3 - Engine Coolant Temperature (ECT) Gauge
G17 - Outside Air Temperature Sensor
G21 - Speedometer
J119 - Multi-function Indicator (MFI)
J285 - Control module with indicator unit in instrument panel insert
K83 - Malfunction Indicator Lamp (MIL)
K105 - Low Fuel Level Warning Light
T6e - 6-Pin Connector
T16 - Data Link Connector (DLC), below instrument panel, center
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness
(A76) - Connector (K-diagnosis wire), in instrument panel wiring harness

* - Vehicles with Multi-Function Indicator (MFI) only

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Instrument cluster, multi-function indicator (MFI), engine coolant temperature (ECT) gauge, fuel gauge, speedometer, malfunction indicator lamp (MIL), outside air temperature sensor

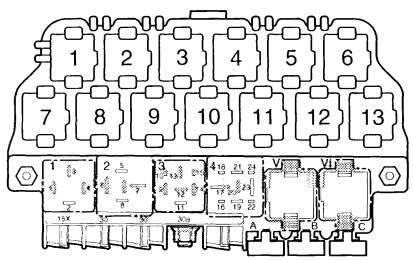
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1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66KW, code ALH, (with automatic transmission),

from September 1998

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

10 Glow Plug Relay (180)

12 Power Supply (Terminal 30, B+) Relay (109)

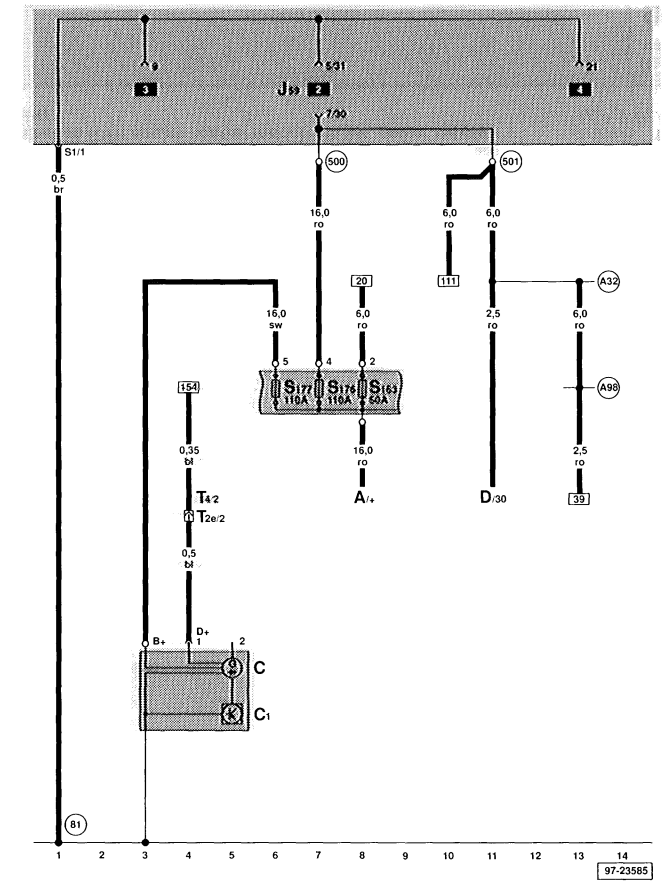
Relay panel:

2 Load Reduction Relay (18)

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

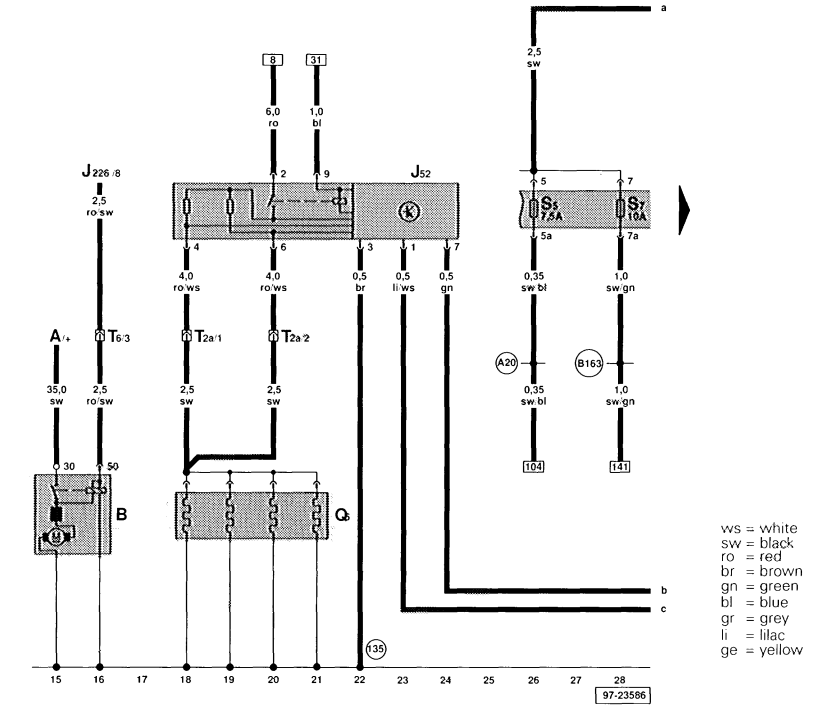


A - Battery
C - Generator (GEN)
C1 - Voltage Regulator (VR)
D - Ignition/Starter Switch
J59 - Load Reduction Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
T2e - Double Connector, near starter (vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)

(81) - Ground connection -1-, in instrument panel wiring harness

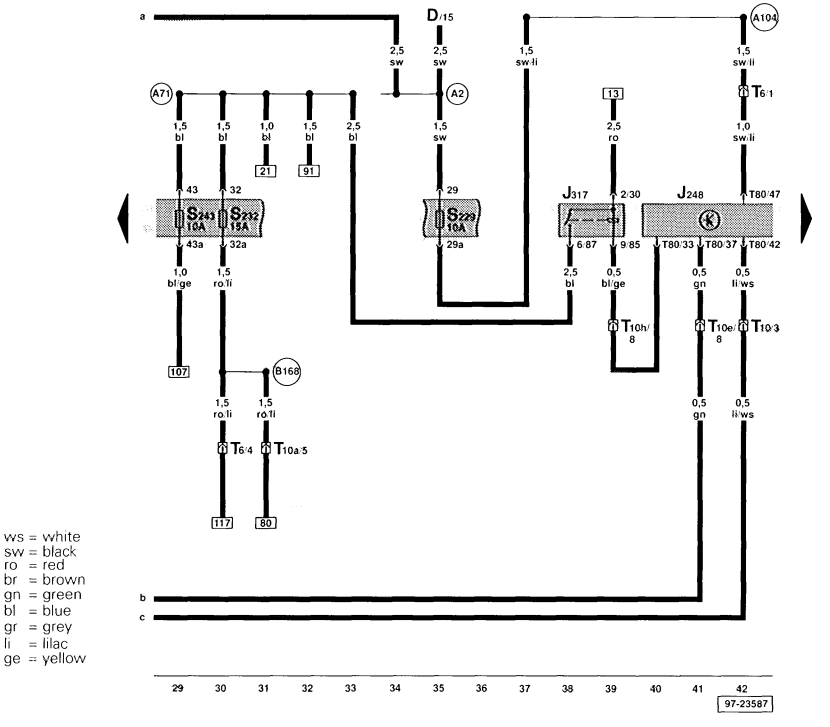
(500) - Threaded connection -1- (30) on the relay plate
(501) - Threaded connection -2- (30) on the relay plate
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness

Generator (GEN)



A - Battery
B - Starter
J52 - Glow Plug Relay, on the thirteenfold auxiliary relay panel, above relay panel
J226 - Park/Neutral Position (PNP) Relay, on the thirteenfold auxiliary relay panel, above relay panel
Q6 - Glow plugs (engine)
S5 - Fuse 5 in fuse holder
S7 - Fuse 7 in fuse holder
T2a - Double Connector, in engine compartment, in wiring duct, left
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left

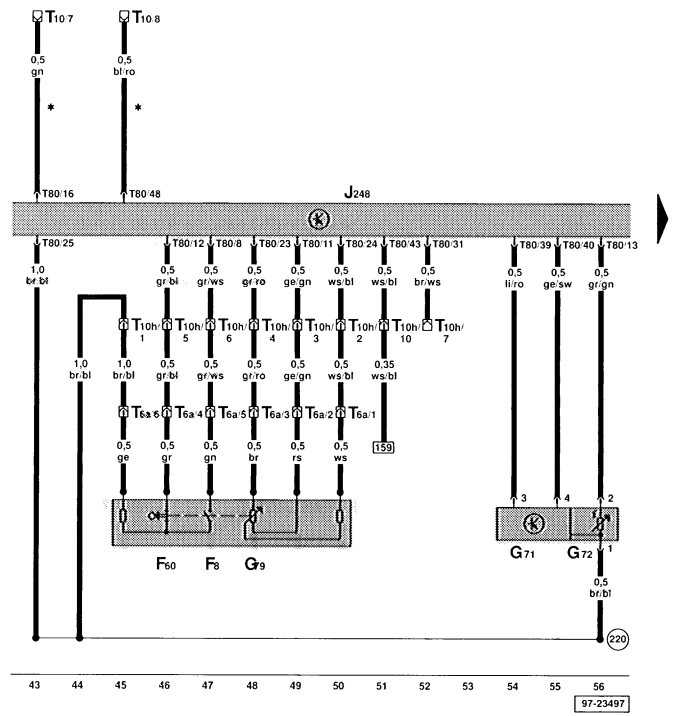
(135) - Ground connection -2-, in instrument panel wiring harness
(A20) - Wire connection (15a), in instrument panel wiring harness
(B163) - Plus connector -1- (15) in wiring harness interior



D - Ignition/Starter Switch
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
J317 - Power Supply (Terminal 30, B+) Relay, on the thirteenfold auxiliary relay panel, above relay panel
S229 - Fuse 29 in fuse holder
S232 - Fuse 32 in fuse holder
S243 - Fuse 43 in fuse holder
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T80 - Connector, 80 point

(A2) - Plus connection (15), in instrument panel wiring harness
(A71) - Connector (86), in instrument panel wiring harness
(A104) - Plus connector -2- (15), in instrument panel wiring harness
(B168) - Connection (86) in passenger compartment wiring harness

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Repair Manual page number 97-107



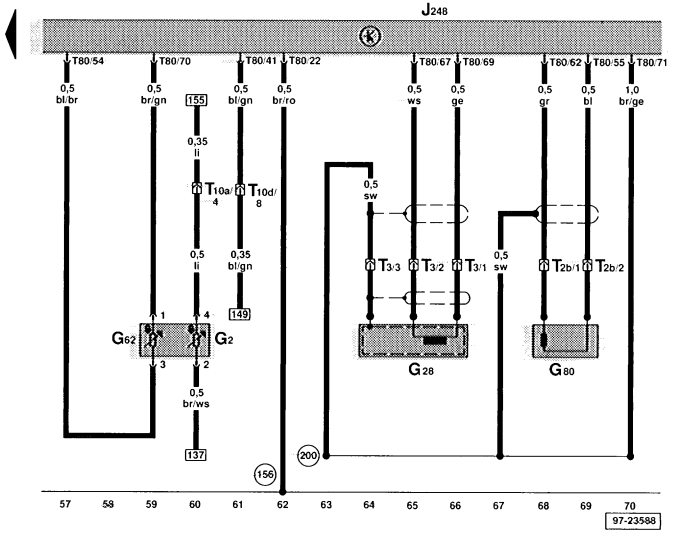
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sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

F8 - Kick Down Switch
F60 - Closed Throttle Position (CTP) Switch
G71 - Manifold Absolute Pressure (MAP) Sensor
G72 - Intake Air Temperature (IAT) Sensor
G79 - Throttle Position (TP) Sensor
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
T6a - 6-Pin Connector, behind instrument panel, left
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T80 - Connector, 80 point

(220) - Ground connection (sensor ground), in engine compartment wiring harness

* - A/C connection

Diesel direct fuel injection (DFI) engine control module (ECM), closed throttle position (CTP) switch, intake air temperature (IAT) sensor, manifold absolute pressure (MAP) sensor

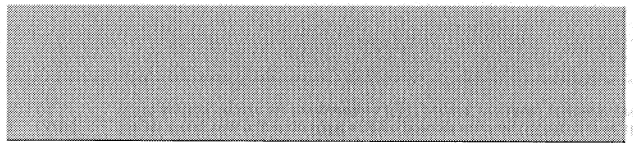


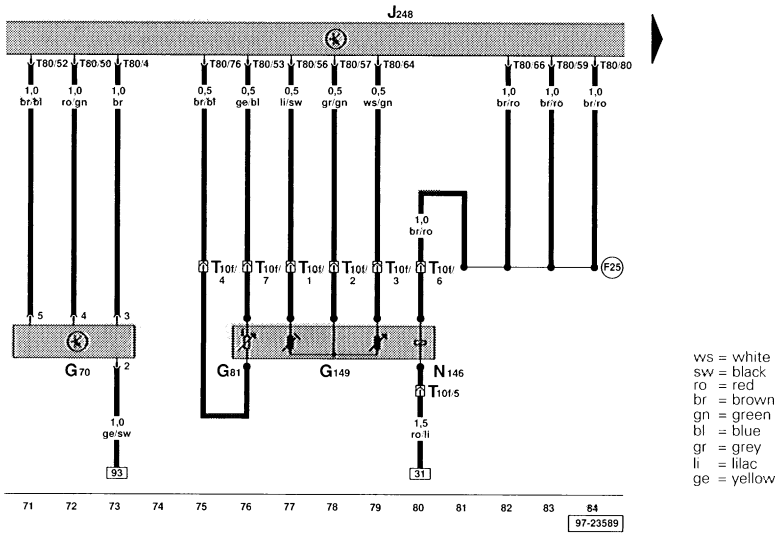
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

G2 - Engine Coolant Temperature (ECT) Sensor
G28 - Engine Speed (RPM) Sensor
G62 - Engine Coolant Temperature (ECT) Sensor
G80 - Needle Lift Sensor
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
T2b - Double Connector, in engine compartment, front
T3 - 3-Pin Connector, in engine compartment, front
T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
T10d - 10-Pin Connector, green, in protective housing for connectors, in plenum chamber, left
T80 - Connector, 80 point

(156) - Ground connection, in Diesel Direct Fuel Injection (DFI) wiring harness
(200) - Ground connection (shielding), in engine compartment wiring harness

Diesel direct fuel injection (DFI) engine control module (ECM), engine speed (RPM) sensor, engine coolant temperature (ECT) sensor, needle lift sensor





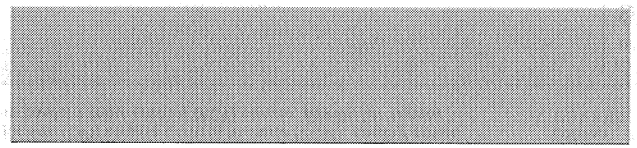
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br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

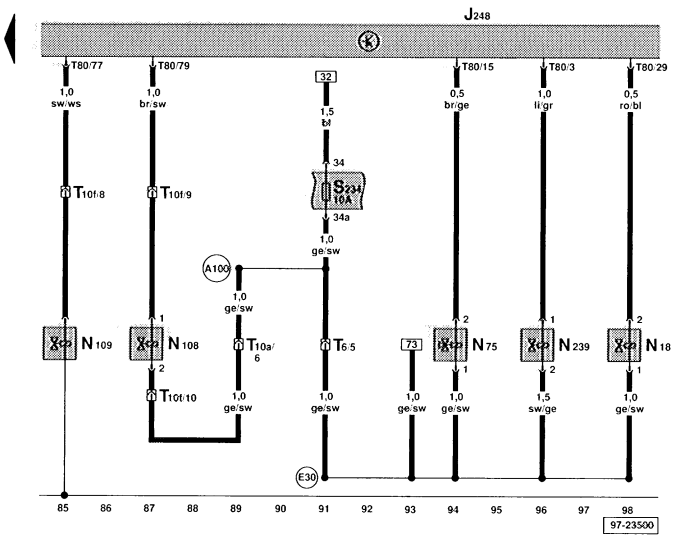
G70 - Mass Air Flow (MAF) Sensor
G81 - Fuel Temperature Sensor
G149 - Modulating Piston Displacement Sensor
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
N146 - Quantity Adjuster
T10f - 10-Pin Connector, in engine compartment, front
T80 - Connector, 80 point

(F25) - Wire connection -1-, in Diesel Direct Fuel Injection (DFI) system wiring harness

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Diesel direct fuel injection (DFI) engine control module (ECM), quantity adjuster, mass air flow (MAF) sensor, fuel temperature sensor, modulating piston displacement sensor





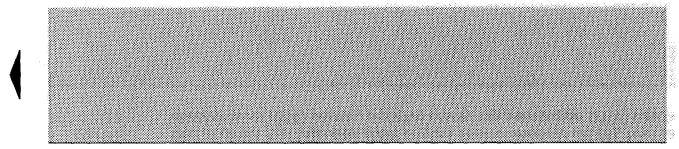
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sw = black
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gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

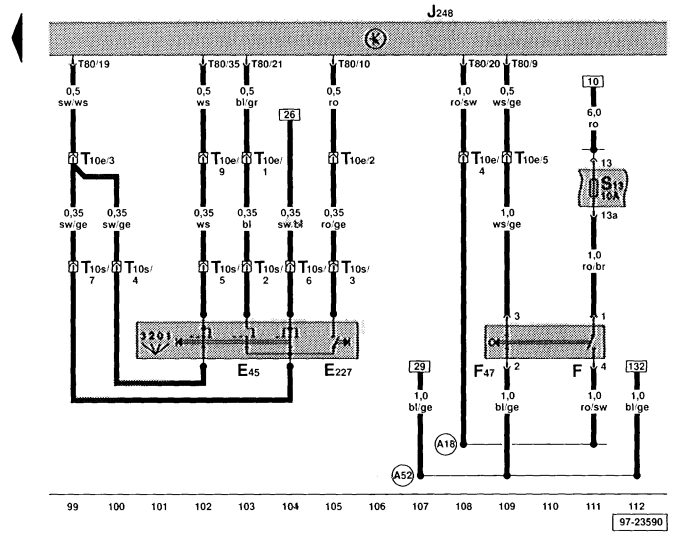
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
N18 - EGR Vacuum Regulator Solenoid Valve
N75 - Wastegate Bypass Regulator Valve
N108 - Cold Start Injector
N109 - Fuel Cut-off Valve
N239 - Change-over valve for intake manifold flap
S234 - Fuse 34 in fuse holder
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
T10f - 10-Pin Connector, in engine compartment, front
T80 - Connector, 80 point

(A100) - Connector -2- (87), in instrument panel wiring harness
(E30) - Connector (87a), in wiring harness engine

Diesel direct fuel injection (DFI) engine control module (ECM), cold start injector, fuel cut-off valve, wastegate bypass regulator valve, EGR vacuum regulator solenoid valve

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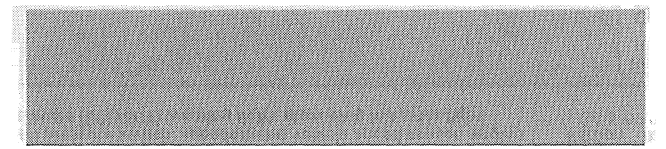
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sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

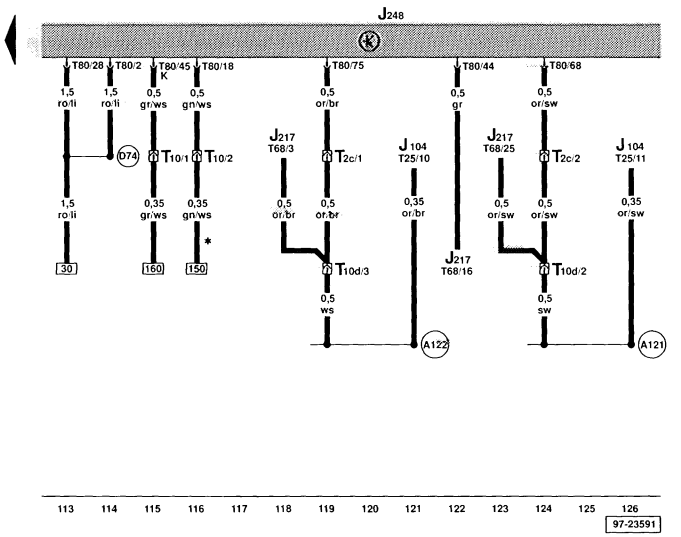
E45 - Cruise Control Switch**
E227 - Cruise Control Push Button (SET)**
F - Brake Light Switch
F47 - Brake Vacuum Vent Valve Switch for cruise control/diesel
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
S13 - Fuse 13 in fuse holder
T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
T10s - 10-Pin Connector, near steering column**
T80 - Connector, 80 point

(A18) - Wire connection (54), in instrument panel wiring harness
(A52) - Plus connection (30), in instrument panel wiring harness

** - Vehicles with cruise control only

Diesel direct fuel injection (DFI) engine control module (ECM), cruise control switch, brake vacuum vent valve switch, brake light switch





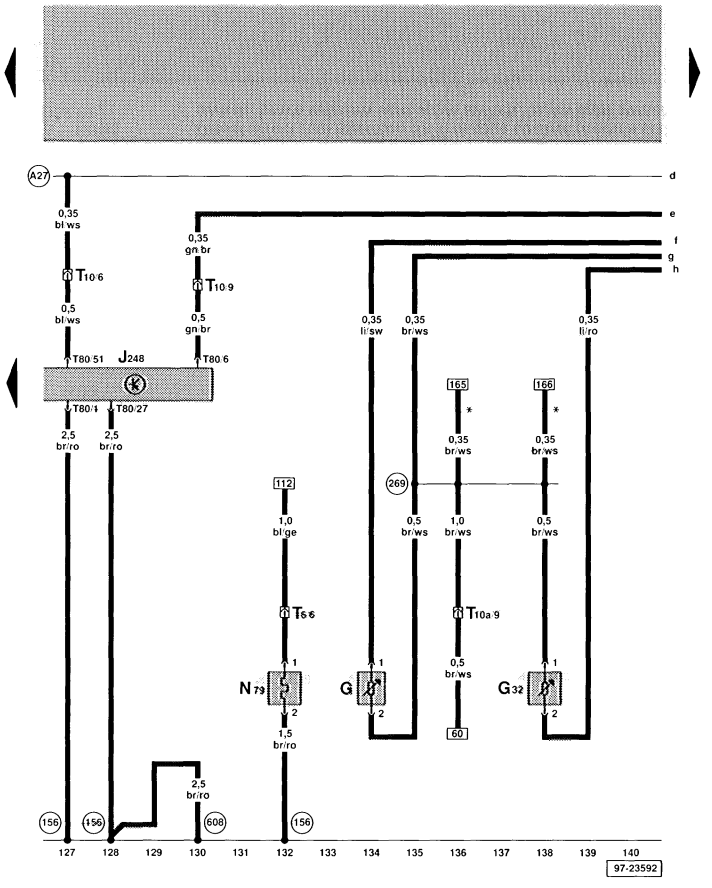
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

J104 - ABS Control Module (w/EDL), in engine compartment, left
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
J217 - Transmission Control Module (TCM), in plenum chamber, center
T2c - Double Connector, in engine compartment, in wiring duct, left
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10d - 10-Pin Connector, green, in protective housing for connectors, in plenum chamber, left
T25 - 25-Pin Connector, on ABS Control Module (w/EDL)
T68 - 68-Pin Connector
T80 - Connector, 80 point

(A121) - Connection (high bus), in instrument panel wiring harness
(A122) - Connection (low bus), in instrument panel wiring harness
(D74) - Wire connection (86), in engine compartment wiring harness

* - Vehicles with Multi-Function Indicator (MFI) only

Diesel direct fuel injection (DFI) engine control module (ECM)



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

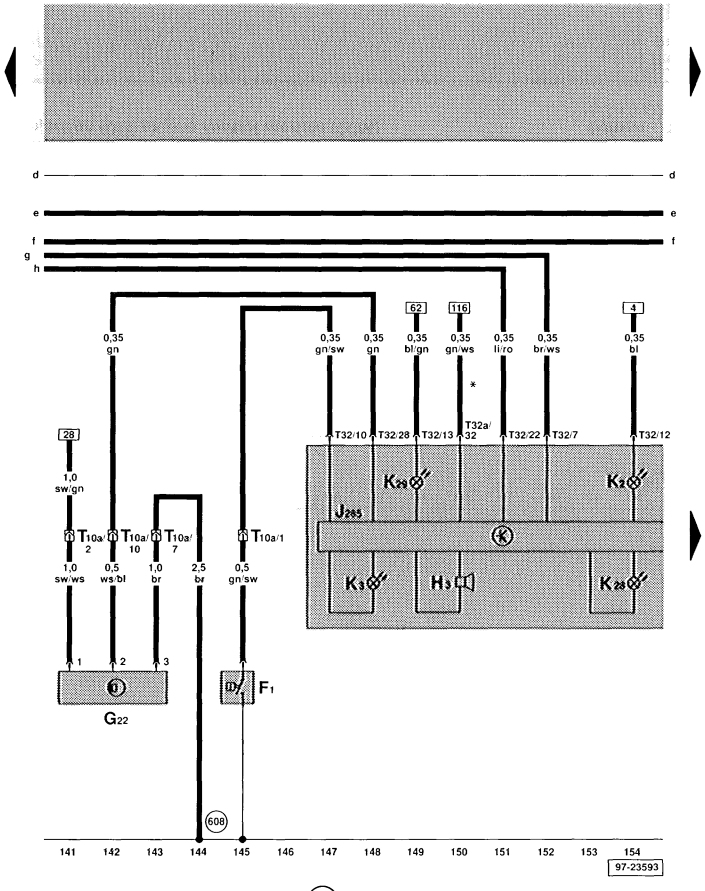
G - Fuel Level Sensor
G32 - Engine Coolant Level (ECL) Sensor
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
N79 - Positive Crankcase Ventilation (PCV) Heating Element
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
T80 - Connector, 80 point

(608) - Ground Connection (in center plenum chamber)

(156) - Ground connection, in Diesel Direct Fuel Injection (DFI) wiring harness
(269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
(A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness
(D50) - Plus connection (30), in engine compartment wiring harness
(D98) - Wire connection (glow plugs), in engine compartment wiring harness

* - Vehicles with Multi-Function Indicator (MFI) only

Diesel direct fuel Injection (DFI) engine control module (ECM), fuel level sensor, engine coolant level (ECL) sensor, positive crankcase ventilation (PCV) heating element



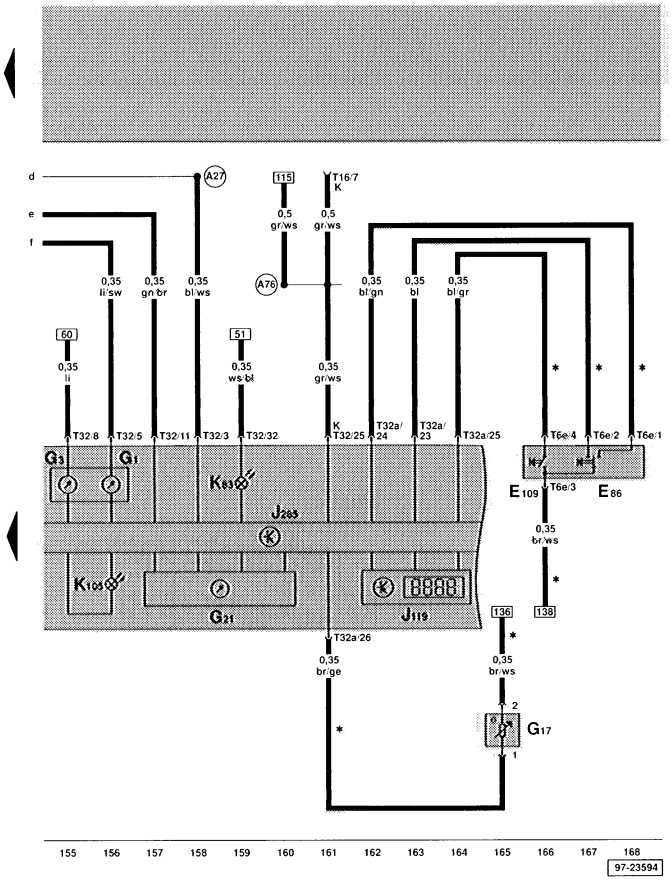
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

F1 - Oil Pressure Switch
G22 - Speedometer Vehicle Speed Sensor (VSS)
H3 - Warning Buzzer
J285 - Control module with indicator unit in instrument panel insert
K2 - Generator (GEN) Warning Light
K3 - Oil Pressure Warning Light
K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
K29 - Glow Plug Indicator Light
T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(608) - Ground Connection (in center plenum chamber)

* - Vehicles with Multi-Function Indicator (MFI) only

Instrument cluster, oil pressure switch, speedometer vehicle speed sensor, engine coolant level/temperature (ECL/ECT) warning light, glow plug indicator light



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E86 - Multi-Function Indicator Mode Select Switch
E109 - Multi-Function Indicator Memory Switch
G1 - Fuel gauge
G3 - Engine Coolant Temperature (ECT) Gauge
G17 - Outside Air Temperature Sensor
G21 - Speedometer
J119 - Multi-function Indicator (MFI)
J285 - Control module with indicator unit in instrument panel insert
K83 - Malfunction Indicator Lamp (MIL)
K105 - Low Fuel Level Warning Light
T6e - 6-Pin Connector
T16 - Data Link Connector (DLC), below instrument panel, center
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness
(A76) - Connector (K-diagnosis wire), in instrument panel wiring harness

* - Vehicles with Multi-Function Indicator (MFI) only

Edition 12/98
USA.5102.01.21

Instrument cluster, multi-function indicator (MFI), engine coolant temperature (ECT) gauge, fuel gauge, speedometer, malfunction indicator lamp (MIL), outside air temperature sensor

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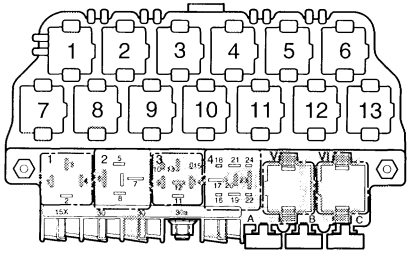
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Automatic transmission, 4 speed automatic,

from September 1998

- **2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code AEG**
- **2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/130 kW, code AFP**

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97-14163

Relay location on the thirteenfold auxiliary relay panel, above relay panel:

11 Park/Neutral Position (PNP) Relay (175)

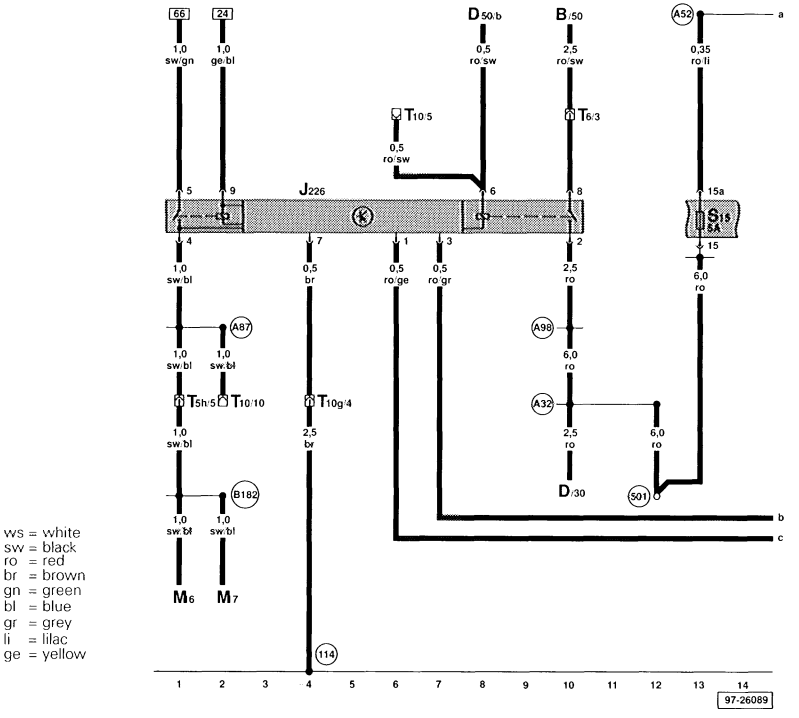
Relay panel:

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

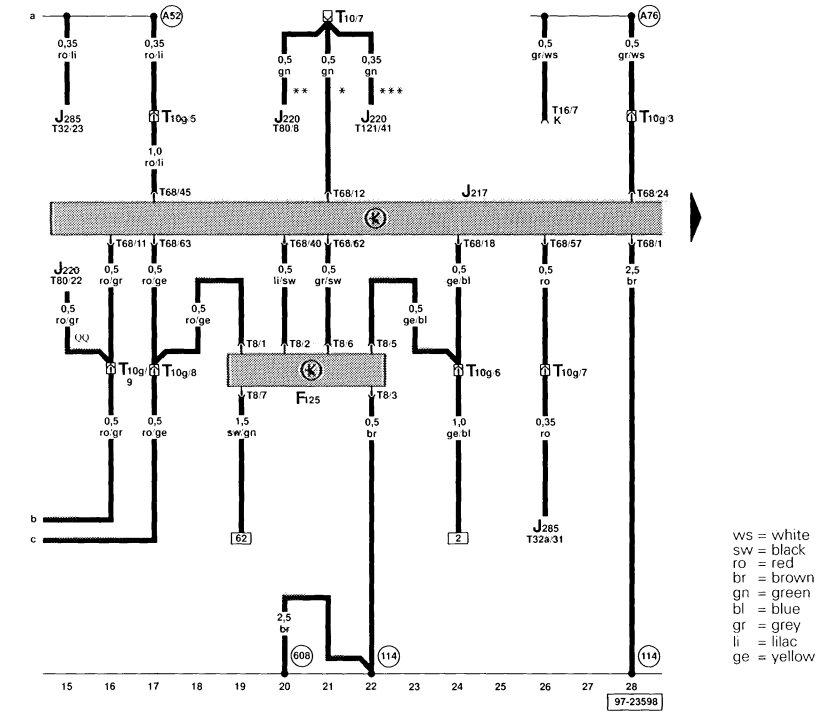
Repair Manual page number 97-118



B - Starter
D - Ignition/Starter Switch
J226 - Park/Neutral Position (PNP) Relay, on the thirteenfold auxiliary relay panel, above relay panel
M16 - Left Back-Up Light
M17 - Right Back-Up Light
S15 - Fuse 15 in fuse holder
T5h - 5-Pin Connector, near left A-pillar, lower part, in harness
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
(114) - Ground connection, in automatic transmission wiring harness
(501) - Threaded connection -2- (30) on the relay plate
(A32) - Plus connection (30), in instrument panel wiring harness
(A52) - Plus connection (30a), in instrument panel wiring harness
(A87) - Connector (RF), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness
(B182) - Connection (RF), in passenger compartment wiring harness

Park/neutral position (PNP) relay

Repair Manual page number 97-119



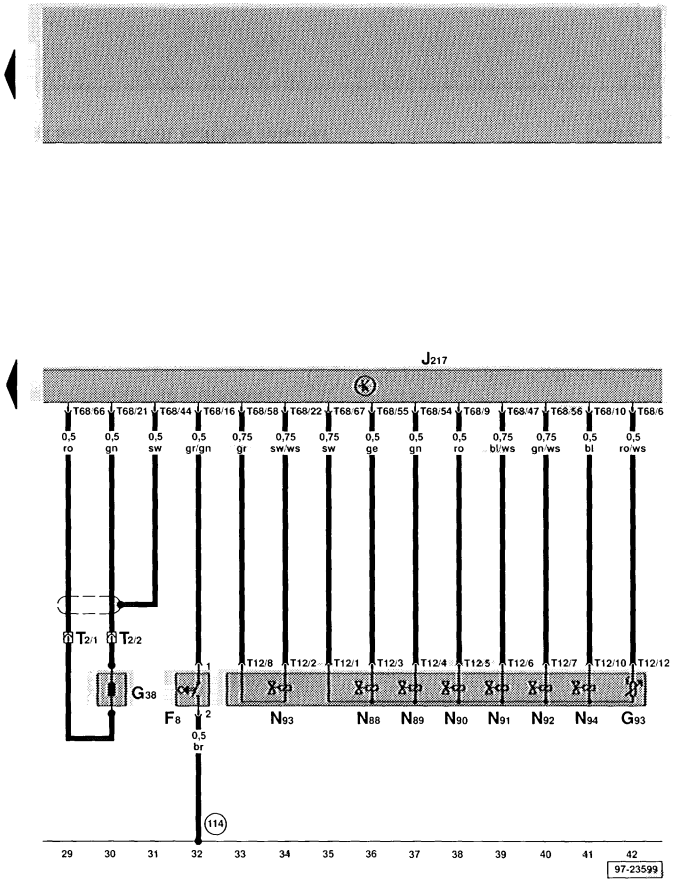
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

F125 - Multi-Function Transmission Range (TR) Switch
J217 - Transmission Control Module (TCM), in plenum chamber, center
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J285 - Control module with indicator unit in instrument panel insert
T8 - 8-Pin Connector
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
T16 - Data Link Connector (DLC), below instrument panel, left
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green
T68 - 68-Pin Connector
T80 - 80-Pin Connector
T121 - 121-Pin Connector

(608) - Ground Connection (in center plenum chamber)
(114) - Ground connection, in automatic transmission wiring harness
(A52) - Plus connection (30a), in instrument panel wiring harness
(A76) - Connector (K-diagnosis wire) in instrument panel wiring harness

* - A/C connection
** - Code AEG only
*** - Code AFP only

Transmission control module (TCM), multi-function transmission range (TR) switch

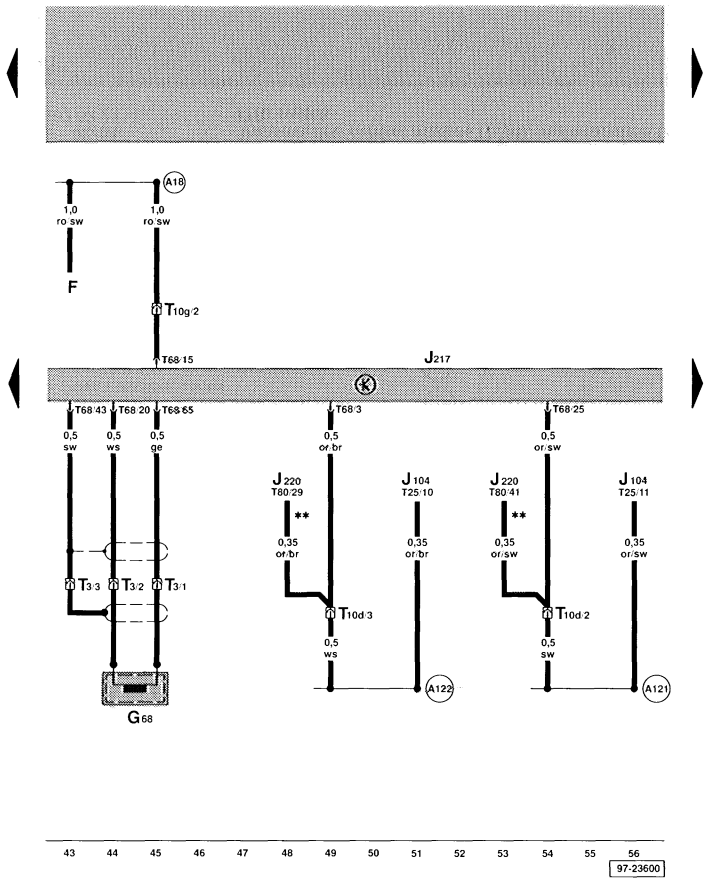


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

F8 - Kick Down Switch
G38 - Transmission Vehicle Speed Sensor (VSS)
G93 - Transmission Fluid Temperature Sensor
J217 - Transmission Control Module (TCM), in plenum chamber, center
N88 - Solenoid Valve 1
N89 - Solenoid Valve 2
N90 - Solenoid Valve 3
N91 - Solenoid Valve 4
N92 - Solenoid Valve 5
N93 - Solenoid Valve 6
N94 - Solenoid Valve 7
T2 - Double Connector, on transmission
T12 - 12-Pin Connector
T68 - 68-Pin Connector

(114) - Ground connection, in automatic transmission wiring harness

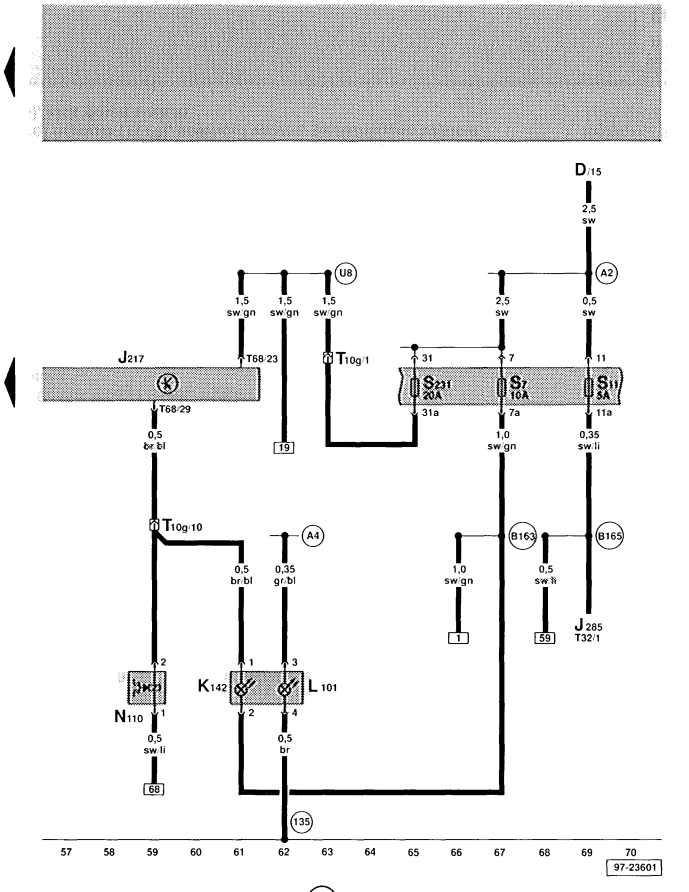
Transmission control module (TCM), solenoid valves, transmission vehicle speed sensor (VSS), kick down switch



F - Brake Light Switch
G68 - Vehicle Speed Sensor (VSS)
J104 - ABS Control Module (w/EDL), in engine compartment, left
J217 - Transmission Control Module (TCM), in plenum chamber, center
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
T3 - 3-Pin Connector, on transmission
T10d - 10-Pin Connector, green, in protective housing for connectors, in plenum chamber, left
T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
T25 - 25-Pin Connector, on ABS Control Module (w/EDL)
T68 - 68-Pin Connector
T80 - 80-Pin Connector

(A18) - Wire connection (54), in instrument panel wiring harness
(A121) - Connection (high bus), in instrument panel wiring harness
(A122) - Connection (low bus), in instrument panel wiring harness

** - Code AEG only



D - Ignition/Starter Switch
J217 - Transmission Control Module (TCM), in plenum chamber, center
J285 - Control module with indicator unit in instrument panel insert
K142 - Warning light for selector lever position P/N
L101 - Illumination for selector lever scale
N110 - Shift Lock Solenoid
S7 - Fuse 7 in fuse holder
S11 - Fuse 11 in fuse holder
S231 - Fuse 31 in fuse holder
T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
T32 - 32-Pin Connector, blue
T68 - 68-Pin Connector

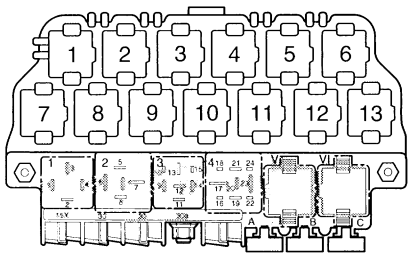
(135) - Ground connection -2-, in instrument panel wiring harness
(A2) - Plus connection (15), in instrument panel wiring harness
(A4) - Plus connection (58b), in instrument panel wiring harness
(B163) - Plus connector -1- (15) in wiring harness interior
(B165) - Plus connector -2- (15) in wiring harness interior
(U8) - Positive connection (15a) in automatic transmission wiring harness

Automatic transmission, 4 speed automatic,

from September 1998

- **1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66 kW, code ALH**

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

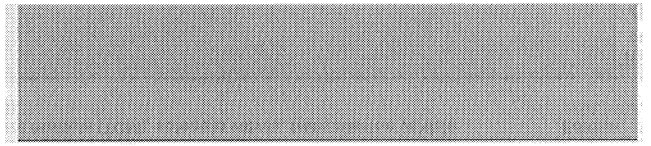
11 Park/Neutral Position (PNP) Relay (175)

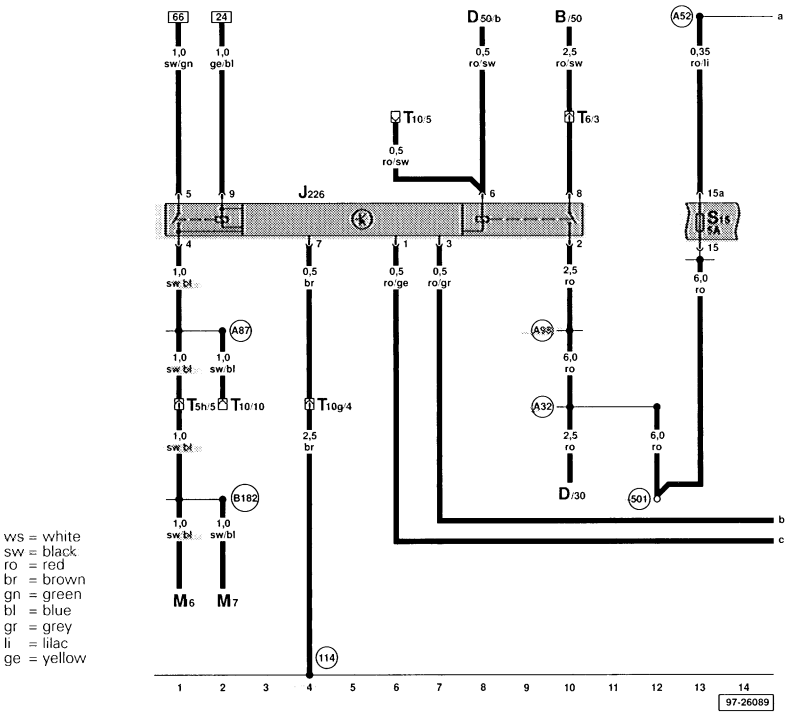
Relay panel:

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



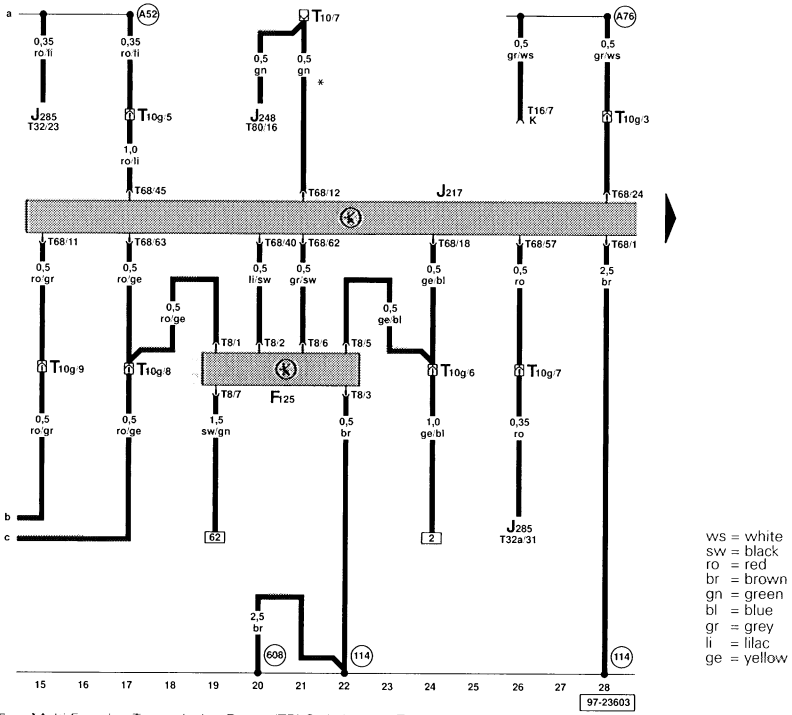


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

B - Starter
D - Ignition/Starter Switch
J226 - Park/Neutral Position (PNP) Relay, on the thirteenfold auxiliary relay panel, above relay panel
M16 - Left Back-Up Light
M17 - Right Back-Up Light
S15 - Fuse 15 in fuse holder
T5h - 5-Pin Connector, near left A-pillar, lower part, in harness
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left

(114) - Ground connection, in automatic transmission wiring harness
(501) - Threaded connection -2- (30) on the relay plate
(A32) - Plus connection (30), in instrument panel wiring harness
(A52) - Plus connection (30a), in instrument panel wiring harness
(A87) - Connector (RF), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness
(B182) - Connection (RF), in passenger compartment wiring harness

Park/neutral position (PNP) relay



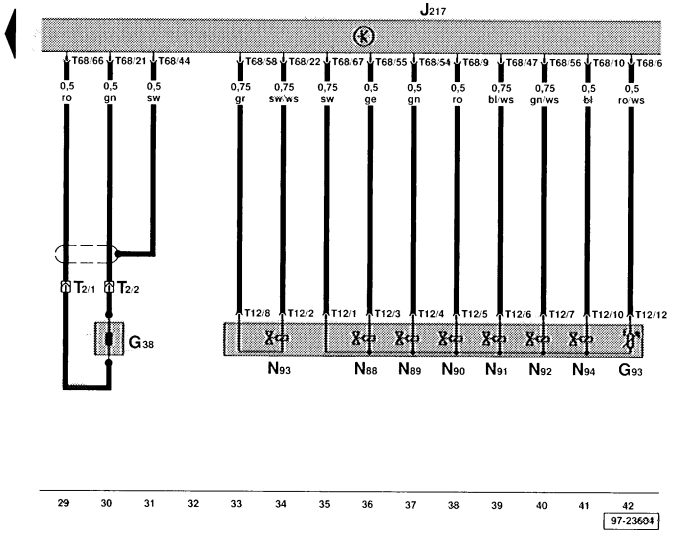
F125 - Multi-Function Transmission Range (TR) Switch
J217 - Transmission Control Module (TCM), in plenum chamber, center
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
J285 - Control module with indicator unit in instrument panel insert
T8 - 8-Pin Connector
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
T16 - Data Link Connector (DLC), below instrument panel, left
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green
T68 - 68-Pin Connector
T80 - 80-Pin Connector

(608) - Ground Connection (in center plenum chamber)
(114) - Ground connection, in automatic transmission wiring harness
(A52) - Plus connection (30a), in instrument panel wiring harness
(A76) - Connector (K-diagnosis wire) in instrument panel wiring harness

* - A/C connection

Edition 02/99
USA.5102.02.21

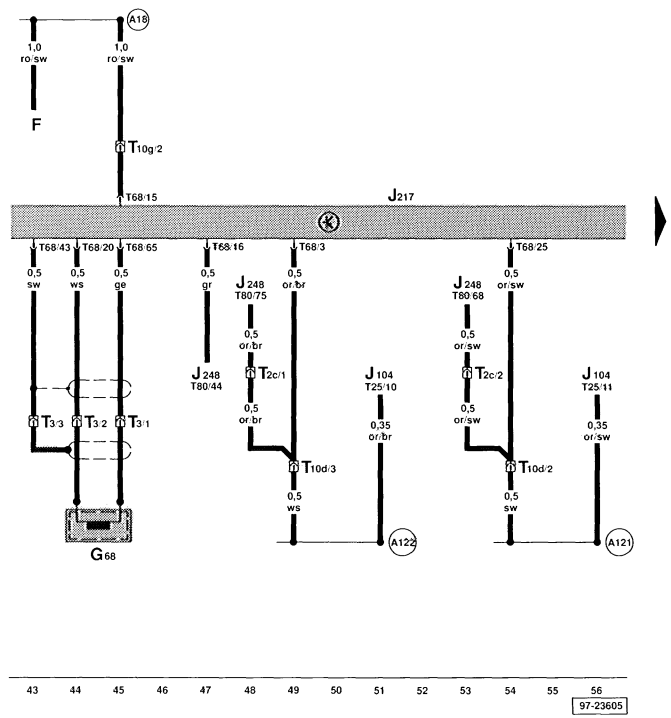
Transmission control module (TCM), multi-function transmission range (TR) switch



G38 - Transmission Vehicle Speed Sensor (VSS)
G93 - Transmission Fluid Temperature Sensor
J217 - Transmission Control Module (TCM), in plenum chamber, center
N88 - Solenoid Valve 1
N89 - Solenoid Valve 2
N90 - Solenoid Valve 3
N91 - Solenoid Valve 4
N92 - Solenoid Valve 5
N93 - Solenoid Valve 6
N94 - Solenoid Valve 7
T2 - Double Connector, on transmission
T12 - 12-Pin Connector
T68 - 68-Pin Connector

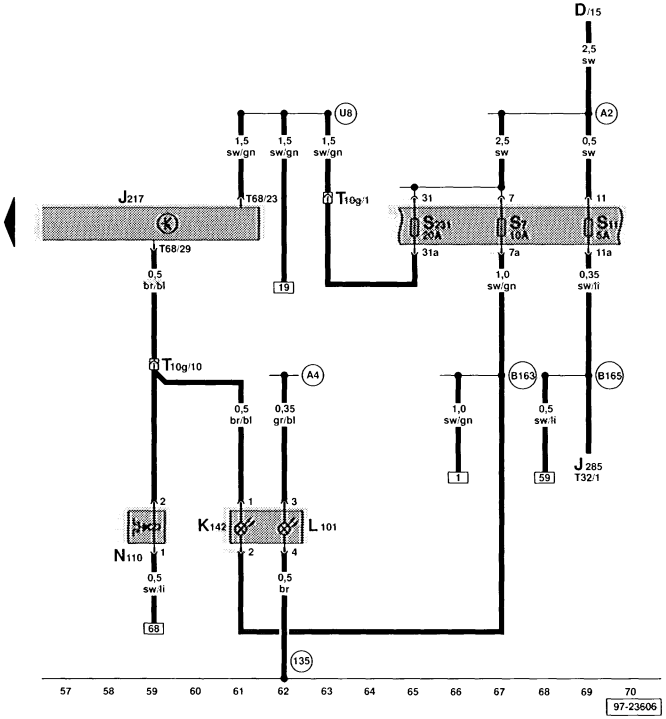
Transmission control module (TCM), solenoid valves, transmission vehicle speed sensor (VSS)

Edition 12/98
USA.5102.01.21



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F - Brake Light Switch
G68 - Vehicle Speed Sensor (VSS)
J104 - ABS Control Module (w/EDL), in engine compartment, left
J217 - Transmission Control Module (TCM), in plenum chamber, center
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
T2c - Double Connector, in engine compartment, in wiring duct, left
T3 - 3-Pin Connector, on transmission
T10d - 10-Pin Connector, green, in protective housing for connectors, in plenum chamber, left
T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
T25 - 25-Pin Connector, on ABS Control Module (w/EDL)
T68 - 68-Pin Connector
T80 - 80-Pin Connector
(A18) - Wire connection (54), in instrument panel wiring harness
(A121) - Connection (high bus), in instrument panel wiring harness
(A122) - Connection (low bus), in instrument panel wiring harness



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

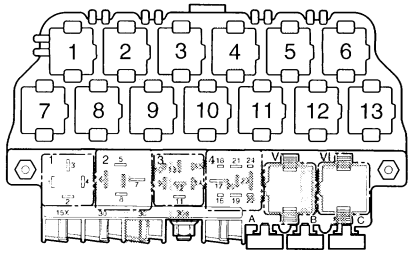
D - Ignition/Starter Switch
J217 - Transmission Control Module (TCM), in plenum chamber, center
J285 - Control module with indicator unit in instrument panel insert
K142 - Warning light for selector lever position P/N
L101 - Illumination for selector lever scale
N110 - Shift Lock Solenoid
S7 - Fuse 7 in fuse holder
S11 - Fuse 11 in fuse holder
S231 - Fuse 31 in fuse holder
T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
T32 - 32-Pin Connector, blue
T68 - 68-Pin Connector
(135) - Ground connection -2-, in instrument panel wiring harness
(A2) - Plus connection (15), in instrument panel wiring harness
(A4) - Plus connection (58b), in instrument panel wiring harness
(B163) - Plus connector -1- (15) in wiring harness interior
(B165) - Plus connector -2- (15) in wiring harness interior
(U8) - Positive connection (15a) in automatic transmission wiring harness

Cruise control,

from September 1998

● 2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code AEG

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

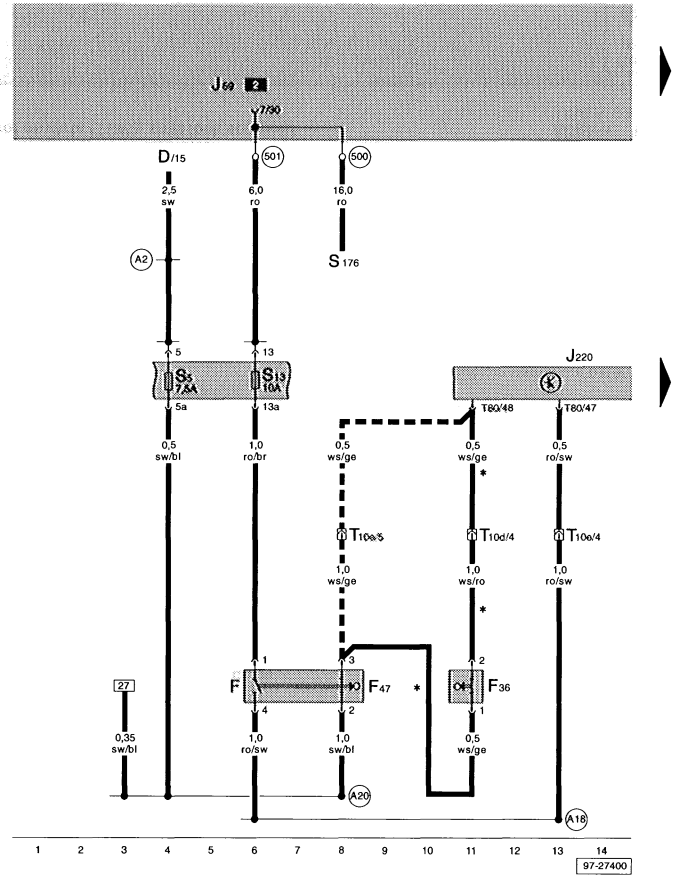
Relay panel:

2 Load Reduction Relay (100)

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

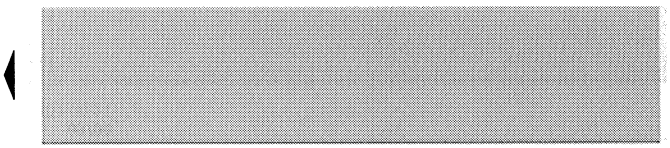


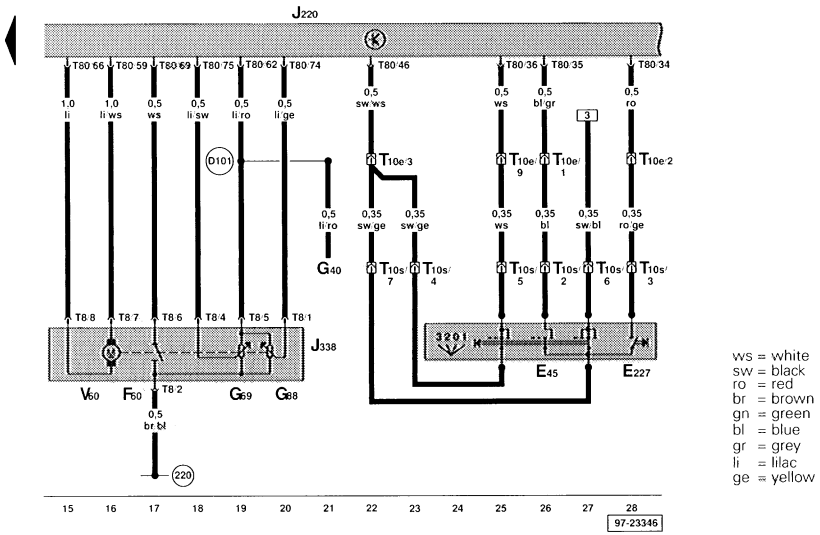
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

D - Ignition/Starter Switch
F - Brake Light Switch
F36 - Clutch Vacuum Vent Valve Switch
F47 - Brake Vacuum Vent Valve Switch for cruise control
J59 - Load Reduction Relay
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
S5 - Fuse 5 in fuse holder
S13 - Fuse 13 in fuse holder
S176 - Fuse -4- (30) in fuse bracket/battery
T10d - 10-Pin Connector, green, in protective housing for connectors, in plenum chamber, left
T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
T80 - 80-Pin Connector

(500) - Threaded connection -1- (30) on the relay plate
(501) - Threaded connection -2- (30) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A18) - Wire connection (54), in instrument panel wiring harness
(A20) - Wire connection (15a), in instrument panel wiring harness
* - Manual transmission only
--- Automatic transmission only

Motronic engine control module (ECM), brake light switch, clutch vacuum vent valve switch, brake vacuum vent valve switch for cruise control





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E45 - Cruise Control Switch
E227 - Cruise Control Push Button (SET)
F60 - Closed Throttle Position (CTP) Switch
G40 - Camshaft Position (CMP) Sensor
G69 - Throttle Position (TP) Sensor
G88 - Throttle Position (TP) Sensor
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J338 - Throttle Valve Control Module
T8 - 8-Pin Connector
T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
T10s - 10-Pin Connector, near steering column
T80 - 80-Pin Connector
V60 - Throttle Position (TP) Actuator

(220) - Ground connection (sensor ground), in engine compartment wiring harness
(D101) - Wire connection -1-, in engine compartment wiring harness

Edition 12/98
USA.5102.01.21

Motronic engine control module (ECM), cruise control switch, throttle valve control module

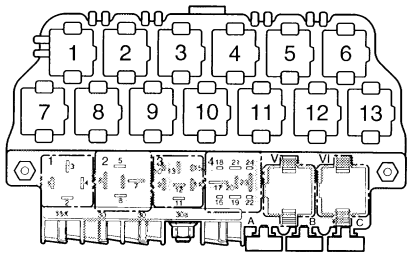
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Anti-lock brake system (ABS), Anti-lock brake system (ABS) with electronic differential lock (EDL) and anti-slip control (ASC),

from September 1998

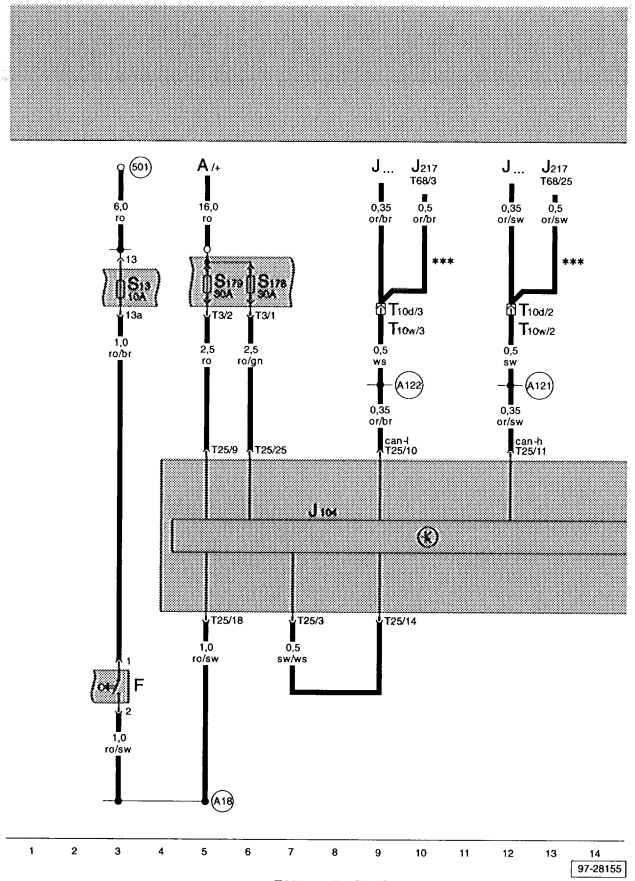
Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97-14163

Fuse colors

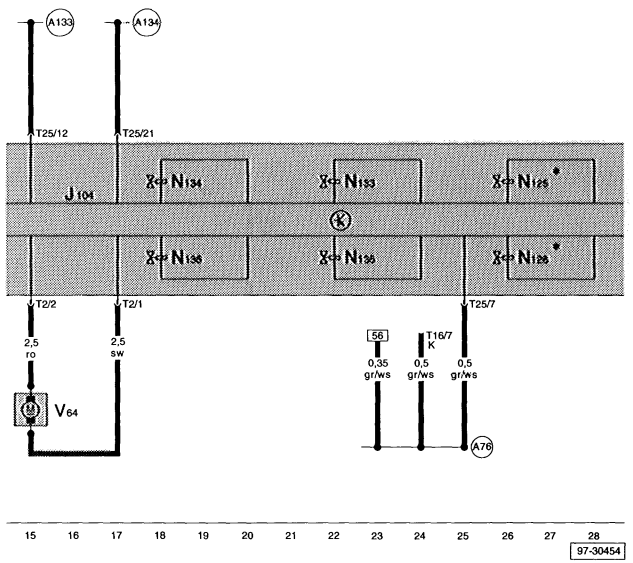
30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

A - Battery
F - Brake Light Switch
J104 - ABS Control Module (w/EDL), in engine compartment, left
J217 - Transmission Control Module (TCM), in plenum chamber, center***
J... - Engine Control Module (ECM)
S13 - Fuse 13 in fuse holder
S178 - Fuse -6- (30) in fuse bracket/battery
S179 - Fuse -7- (30) in fuse bracket/battery
T3 - 3-Pin Connector
T10d - 10-Pin Connector, green, in protective housing for connectors, in plenum chamber, left (through April 1999)
T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left (beginning May 1999)
T25 - 25-Pin Connector
T68 - 68-Pin Connector***
(501) - Threaded connection -2- (30) on the relay plate
(A18) - Wire connection (54), in instrument panel wiring harness
(A121) - Connection (high bus) in instrument panel wiring harness
(A122) - Connection (low bus) in instrument panel wiring harness
*** - Automatic transmission only

ABS control module (w/EDL), brake light switch

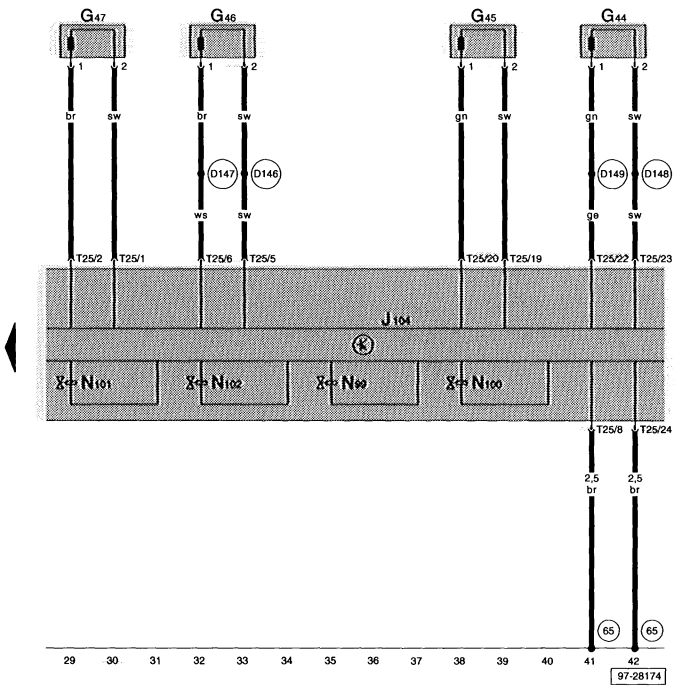


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

J104 - ABS Control Module (w/EDL), in engine compartment, left
N125 - Differential lock valve 1*
N126 - Differential Lock Valve 2*
N133 - Right Rear ABS Inlet Valve
N134 - Left Rear ABS Inlet Valve
N135 - Right Rear ABS Outlet Valve
N136 - Left Rear ABS Outlet Valve
T2 - Double Connector
T16 - Data Link Connector (DLC), below instrument panel, left
T25 - 25-Pin Connector
V64 - ABS Hydraulic Pump

(A76) - Connector (K-diagnosis wire) in instrument panel wiring harness
(A133) - Connection (ABS-signal left) in instrument panel wiring harness
(A134) - Connection (ABS-signal right) in instrument panel wiring harness

* - Vehicles with Electronic Differential Lock (EDL) or Anti-Slip Control (ASC) only

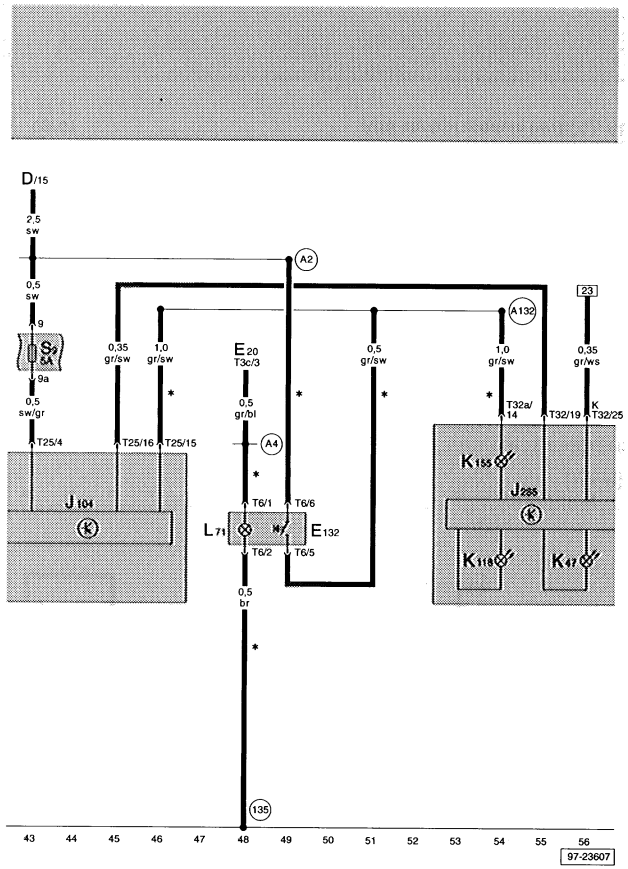


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

G44 - Right Rear ABS Wheel Speed Sensor
G45 - Right Front ABS Wheel Speed Sensor
G46 - Left Rear ABS Wheel Speed Sensor
G47 - Left Front ABS Wheel Speed Sensor
J104 - ABS Control Module (w/EDL), in engine compartment, left
N99 - Right Front ABS Inlet Valve
N100 - Right Front ABS Outlet Valve
N101 - Left Front ABS Inlet Valve
N102 - Left Front ABS Outlet Valve
T25 - 25-Pin Connector

(65) - Ground connection, on chassis side member, front left
(D146) - Connector (speed sensor rear, left +), in wiring harness engine compartment
(D147) - Connector (speed sensor rear, left -), in wiring harness engine compartment
(D148) - Connector (speed sensor rear, right +), in wiring harness engine compartment
(D149) - Connector (speed sensor rear, right -), in wiring harness engine compartment

Repair Manual page number 97-136
Repair Manual page number 97-137



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

D - Ignition/Starter Switch
E20 - Instrument Panel Light Dimmer Switch
*E132 - Anti-Slip Control Switch**
J104 - ABS Control Module (w/EDL), in engine compartment, left
J285 - Control module with indicator unit in instrument panel insert
K47 - ABS Warning Light
K118 - Warning light for brake system
*K155 - ASR Control Lamp**
*L71 - Anti-Slip Control Switch Illumination**
S9 - Fuse 9 in fuse holder
T3c - 3-Pin Connector
*T6 - 6-Pin Connector**
T25 - 25-Pin Connector
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(135) - Ground connection -2-, in instrument panel wiring harness
(A2) - Plus connection (15), in instrument panel wiring harness
(A4) - Plus connection (58b), in instrument panel wiring harness
(A132) - Connection (ASC), in instrument panel wiring harness

** - Vehicles with Anti-Slip Control (ASC) only*

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USA.5102.12.21

ABS control module (w/EDL), anti-slip control switch, ABS warning light, warning light for brake system, ASR control lamp

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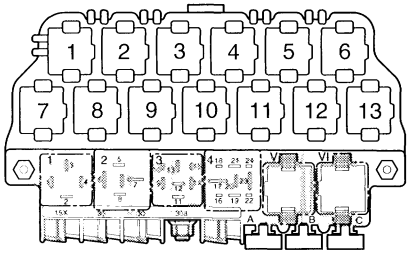
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Airbag systems,

from September 1998

- Driver- and front passsenger airbag
- Side airbag
- Seat belt tensioner
- Seat belt control

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



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Relay location on the thirteenfold auxiliary relay panel, above relay panel:

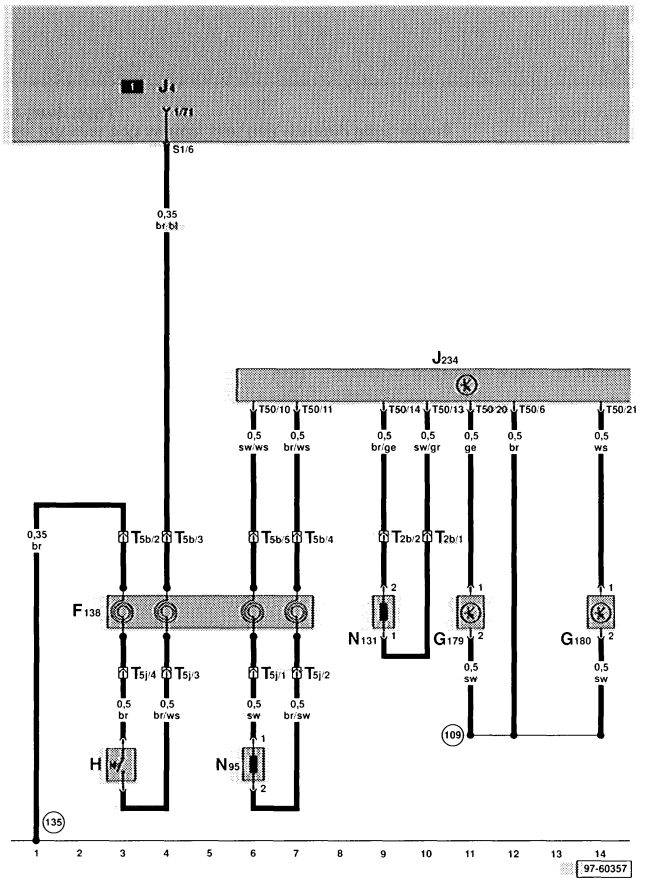
Relay panel:

1 Dual Horn Relay (53)

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

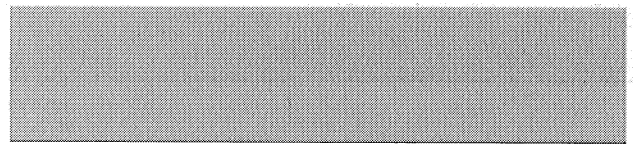


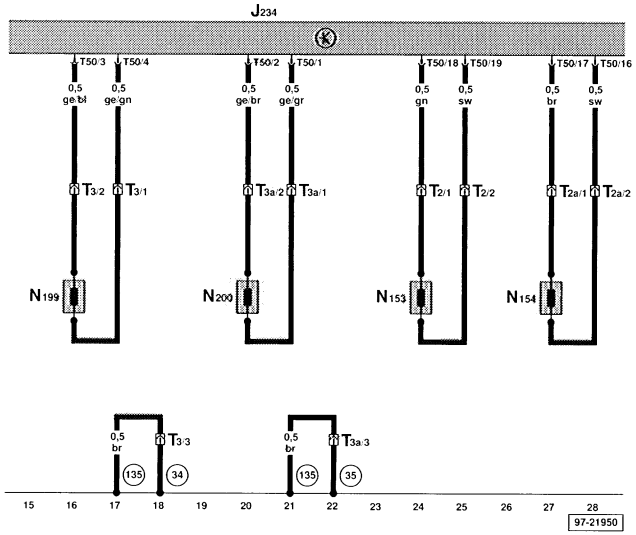
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

F138 - Airbag Spiral Spring/Return Spring With Slip Ring
G179 - Crash sensor for side airbag, driver's side
G180 - Crash sensor for side airbag, passenger side
H - Signal horn activation
J4 - Dual Horn Relay
J234 - Airbag Control Module, behind console, lower part
N95 - Driver's Side Airbag Igniter
N131 - Passenger's Side Airbag Igniter 1
T2b - 2-Pin Connector, on passenger's side airbag igniter 1
T5b - 5-Pin Connector, beside steering column
T5j - 5-Pin Connector, behind driver's airbag
T50 - 50-Pin Connector

(109) - Ground connection, in airbag wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness

Airbag control module, airbag spiral spring/return spring with slip ring, crash sensor for side airbag, airbag igniter



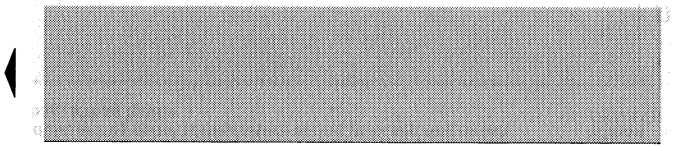


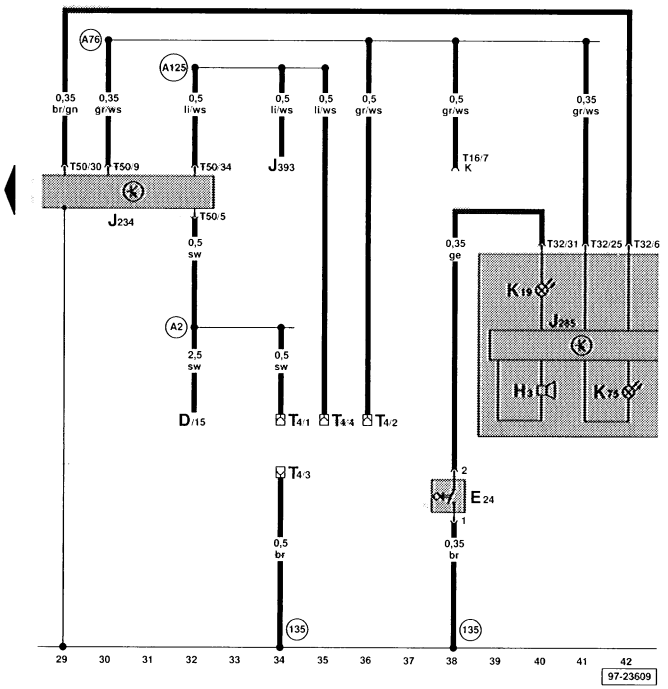
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

J234 - Airbag Control Module, behind console, lower part
N153 - Left Seat Belt Tensioner Igniter
N154 - Right Seat Belt Tensioner Igniter
N199 - Igniter for side airbag, driver's side
N200 - Igniter for side airbag, passenger side
T2 - Double Connector, below driver's seat
T2a - Double Connector, below driver's seat
T3 - 3-Pin Connector, below driver's seat
T3a - 3-Pin Connector, below passenger's seat
T50 - 50-Pin Connector

(34) - Ground connection, below driver's seat
(35) - Ground connection, below passenger's seat
(135) - Ground connection -2-, in instrument panel wiring harness

Airbag control module, seat belt tensioner igniter, igniter for side airbag





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

D - Ignition/Starter Switch
E24 - Left Seat Belt Switch
H3 - Warning Buzzer
J234 - Airbag Control Module, behind console, lower part
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
K19 - Seat Belt Warning Light
K75 - Airbag Malfunction Indicator Lamp (MIL)
T4 - 4-Pin Connector, behind instrument panel, right
T16 - Data Link Connector (DLC), below instrument panel, left
T32 - 32-Pin Connector, blue
T50 - 50-Pin Connector

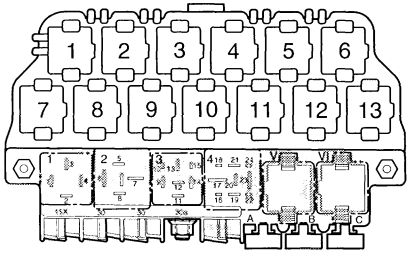
(135) - Ground connection -2-, in instrument panel wiring harness
(A2) - Plus connection (15), in instrument panel wiring harness
(A76) - Connector (K-diagnosis wire) in instrument panel wiring harness
(A125) - Connection (crash signal) in instrument panel wiring harness

Airbag control module, left seat belt switch, seat belt warning light, airbag malfunction indicator lamp (MIL)

Coolant Fan (single speed),

from September 1998

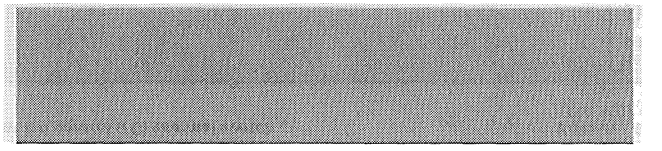
Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".

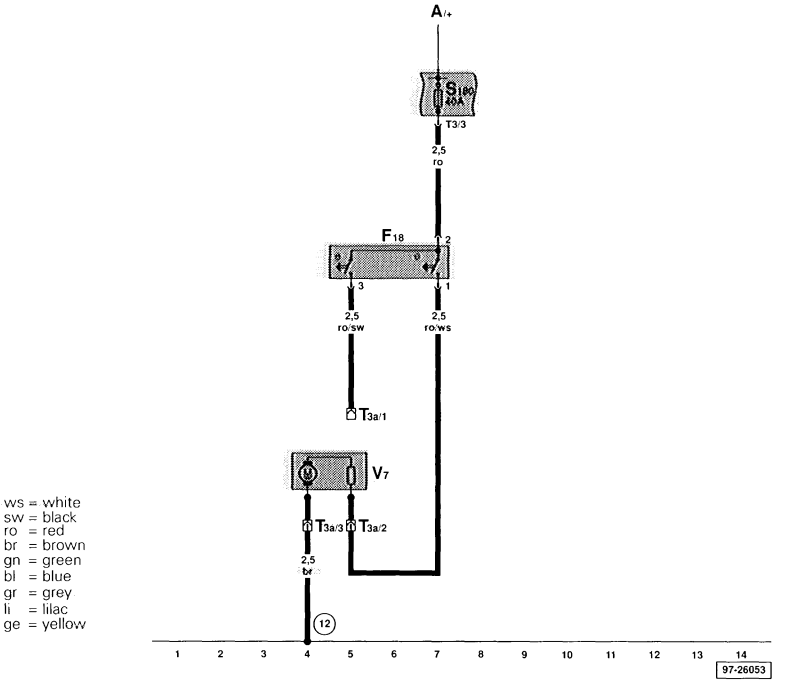


97-14163

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

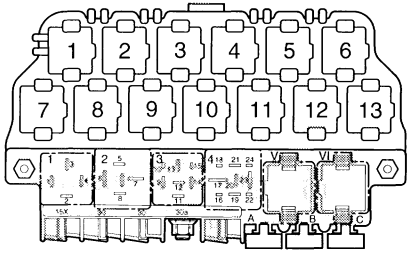
A - Battery
F18 - Coolant Fan Control (FC) Thermal Switch
S180 - Fuse -8- (30) in fuse bracket/battery
T3 - 3-Pin Connector
T3a - 3-Pin Connector, in engine compartment, left front
V7 - Coolant Fan

(12) - Ground connection, in engine compartment, left

Coolant Fan (two speeds),

from September 1998

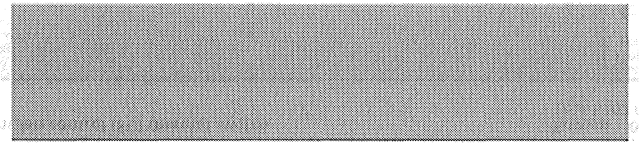
Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".

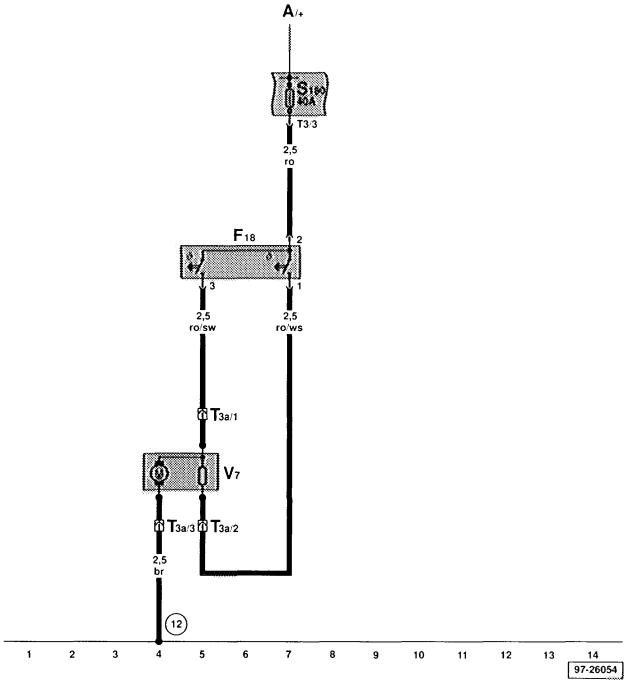


97-14163

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

A - Battery
F18 - Coolant Fan Control (FC) Thermal Switch
S180 - Fuse -8- (30) in fuse bracket/battery
T3 - 3-Pin Connector
T3a - 3-Pin Connector, in engine compartment, left front
V7 - Coolant Fan

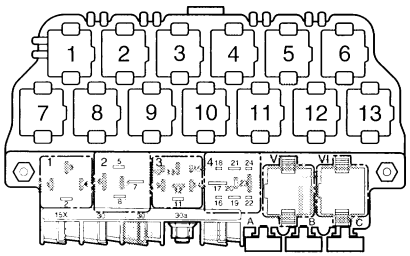
(12) - Ground connection, in engine compartment, left

Coolant Fans,

from December 1998

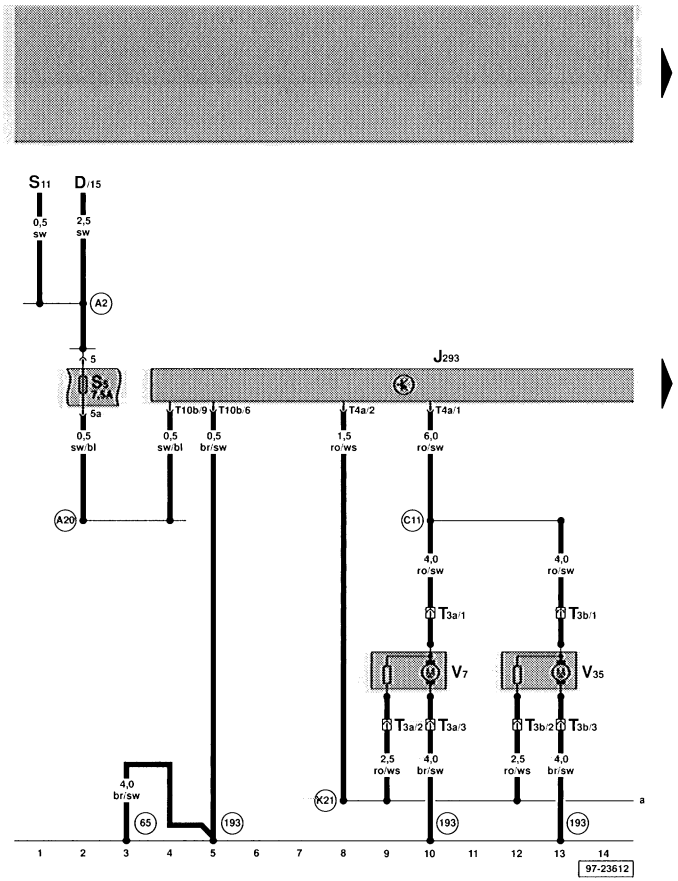
- **2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/130 kW, code AFP**

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



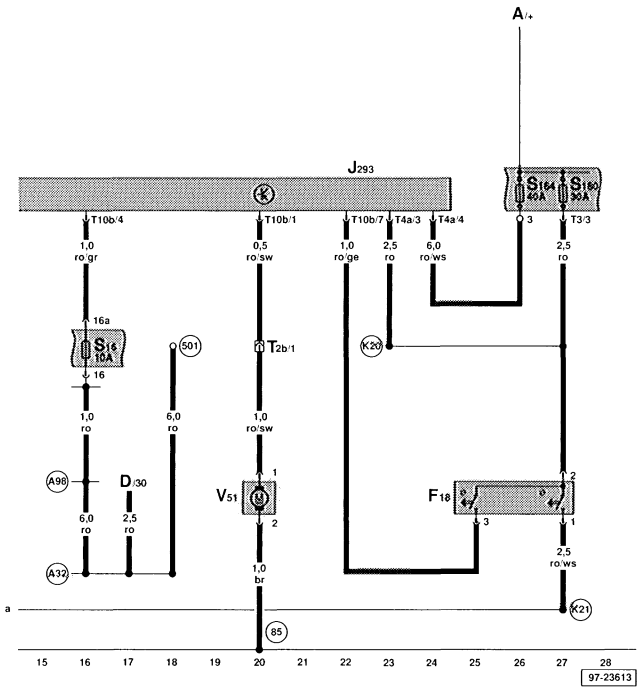
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

D - Ignition/Starter Switch
J293 - Coolant Fan Control (FC) Control Module, in engine compartment, left
S5 - Fuse 5 in fuse holder
S11 - Fuse 11 in fuse holder
T3a - 3-Pin Connector, in engine compartment, left
T3b - 3-Pin Connector, in engine compartment, left
T4a - 4-Pin Connector
T10b - 10-Pin Connector
V7 - Left Coolant Fan
V35 - Right Coolant Fan

(65) - Ground connection, on chassis side member, front left
(193) - Ground connection -1-, in coolant fan wiring harness

(A2) - Plus connection (15), in instrument panel wiring harness
(A20) - Wire connection (15a), in instrument panel wiring harness
(C11) - Wire connection, in coolant fan wiring harness
(K21) - Wire connection -1-, in coolant fan wiring harness

Coolant fan control (FC) control module, coolant fan



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

A - Battery
D - Ignition/Starter Switch
F18 - Coolant Fan Control (FC) Thermal Switch
J293 - Coolant Fan Control (FC) Control Module, in engine compartment, left
S16 - Fuse 16 in fuse holder
S164 - Fuse -3- (30) in fuse bracket/battery
S180 - Fuse -8- (30) in fuse bracket/battery
T2b - Double Connector, in engine compartment, in wiring duct, left
T3 - 3-Pin Connector
T4a - 4-Pin Connector
T10b - 10-Pin Connector
V51 - After-Run Coolant Pump

(85) - Ground connection -1-, in engine compartment wiring harness
(501) - Threaded connection -2- (30) on the relay plate
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness
(K20) - Plus connection -1- (30), in coolant fan wiring harness
(K21) - Wire connection -1-, in coolant fan wiring harness

Edition 12/98
USA.5102.01.21

Coolant fan control (FC) control module, coolant fan control (FC) thermal switch, after-run coolant pump

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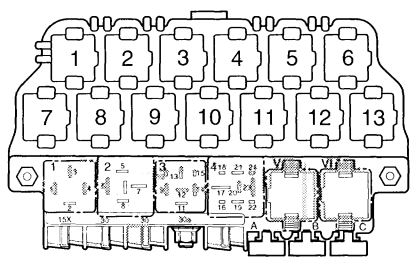
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Air conditioning (manual control),

from September 1998

- 1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66 kW, code ALH
- 2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code AEG

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".

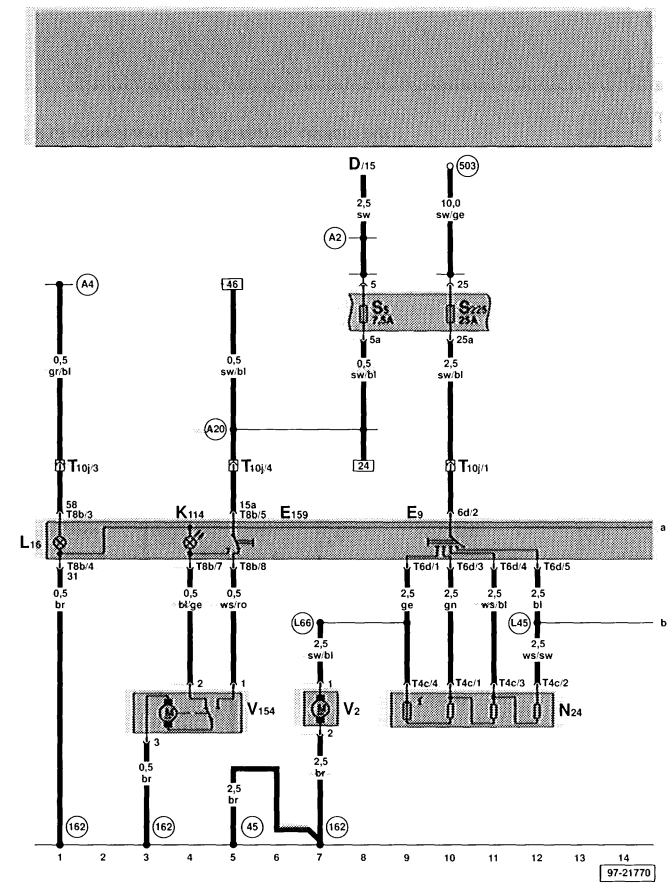


97-14163

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

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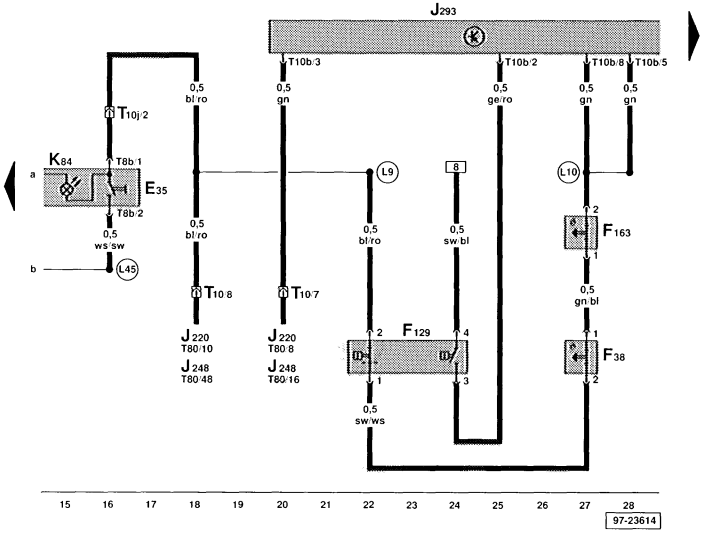
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

D - Ignition/Starter Switch
E9 - Fresh Air Blower Switch
E159 - Fresh Air/Recirculating Flap Switch
K114 - Fresh Air and Recirculating Air Mode Indicator Light
L16 - Fresh Air Control Lever Light
N24 - Fresh Air Blower Series Resistance with Fuse
S5 - Fuse 5 in fuse holder
S225 - Fuse 25 in fuse holder
T4c - 4-Pin Connector
T6d - 6-Pin Connector
T8b - 8-Pin Connector
T10j - 10-Pin Connector, behind instrument panel, center
V2 - Fresh Air Blower
V154 - Servo motor for fresh-/recirculating air flap

(45) - Ground connection, behind instrument panel, center
(162) - Ground connection, in blower motor wiring harness
(503) - Threaded connection -2- (75x) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A4) - Plus connection (58b), in instrument panel wiring harness
(A20) - Wire connection (15a), in instrument panel wiring harness
(L45) - Wire connection, in A/C system wiring harness
(L66) - Connector, in wiring harness heater blower

Fresh air blower switch, fresh air/recirculating flap switch, fresh air blower, servo motor for fresh-/recirculating air flap

Repair Manual page number 97-153

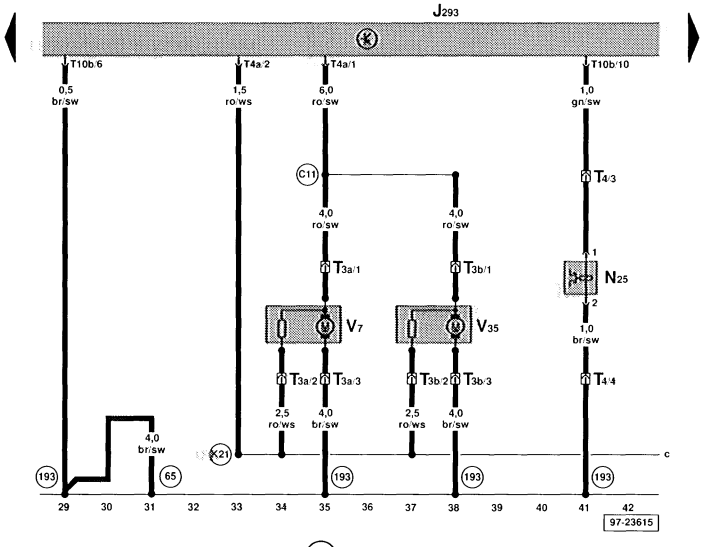


E35 - A/C Switch
F38 - Ambient Temperature Switch
F129 - A/C Pressure Switch
F163 - A/C Cut-Out Thermal Switch
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
J293 - Coolant Fan Control (FC) Control Module, in engine compartment, left
K84 - A/C Indicator Light
T8b - 8-Pin Connector
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10b - 10-Pin Connector
T10j - 10-Pin Connector, behind instrument panel, center
T80 - Connector, 80 point

(L9) - Wire connection -1-, in A/C wiring harness
(L10) - Wire connection -2-, in A/C wiring harness
(L45) - Wire connection, in A/C system wiring harness

Edition 12/98
USA.5102.01.21

Coolant fan control (FC) control module, A/C switch, ambient temperature switch, A/C pressure switch, A/C cut-out thermal switch

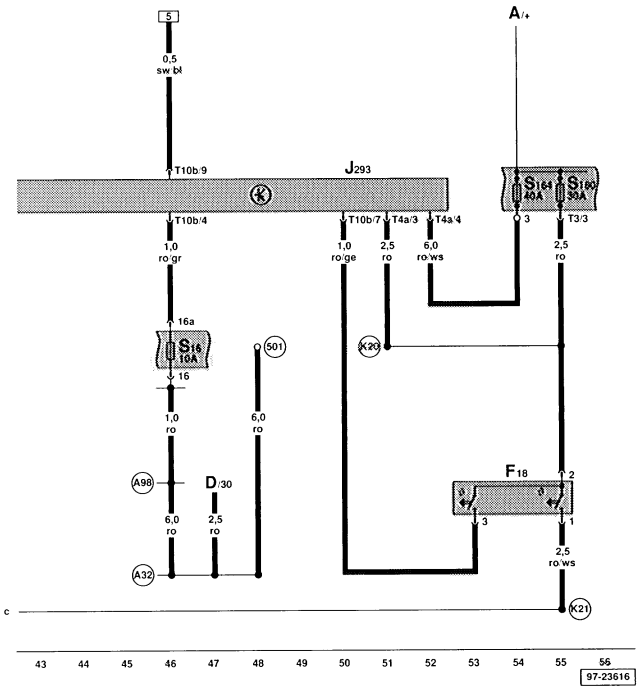


J293 - Coolant Fan Control (FC) Control Module, in engine compartment, left
N25 - A/C Clutch
T3a - 3-Pin Connector, in engine compartment, left
T3b - 3-Pin Connector, in engine compartment, left
T4 - 4-Pin Connector, near starter
T4a - 4-Pin Connector
T10b - 10-Pin Connector
V7 - Left Coolant Fan
V35 - Right Coolant Fan

(65) - Ground connection, on chassis side member, front left
(193) - Ground connection -1-, in coolant fan wiring harness
(C11) - Wire connection, in coolant fan wiring harness
(K21) - Wire connection -1-, in coolant fan wiring harness

Coolant fan control (FC) control module, A/C clutch, coolant fan

Edition 12/98
USA.5102.01.21



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

A - Battery
D - Ignition/Starter Switch
F18 - Coolant Fan Control (FC) Thermal Switch
J293 - Coolant Fan Control (FC) Control Module, in engine compartment, left
S16 - Fuse 16 in fuse holder
S164 - Fuse -3- (30) in fuse bracket/battery
S180 - Fuse -8- (30) in fuse bracket/battery
T3 - 3-Pin Connector
T4a - 4-Pin Connector
T10b - 10-Pin Connector

(501) - Threaded connection -2- (30) on the relay plate

(A32) - Plus connection (30), in instrument panel wiring harness

(A98) - Plus connector -4- (30), in instrument panel wiring harness

(K20) - Plus connection -1- (30), in coolant fan wiring harness

(K21) - Wire connection -1-, in coolant fan wiring harness

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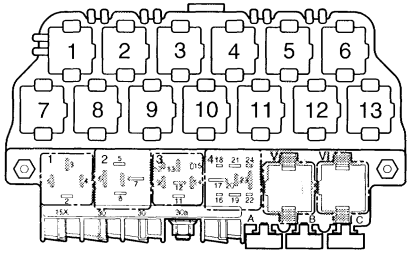
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Air conditioning (manual control),

from December 1998

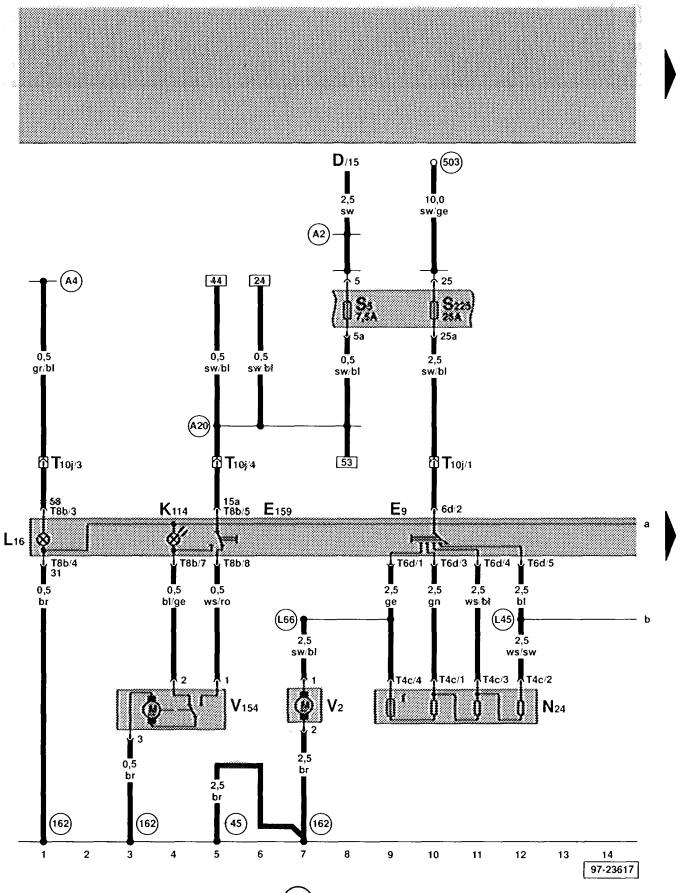
- **2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/130 kW, code AFP**

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

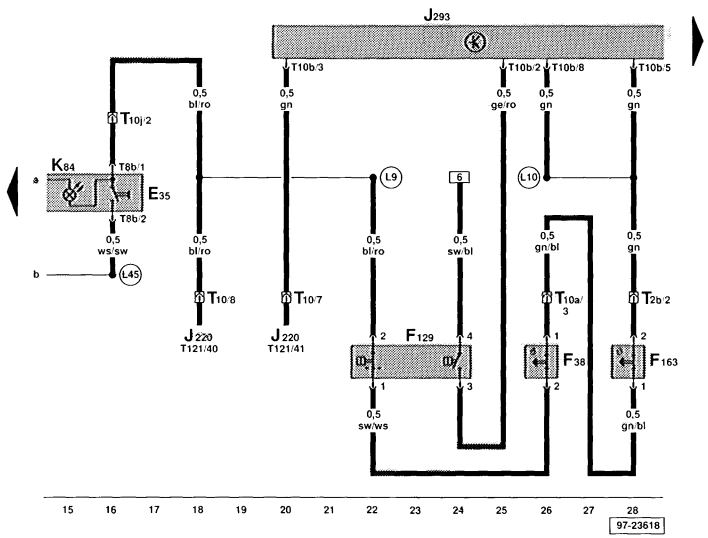


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

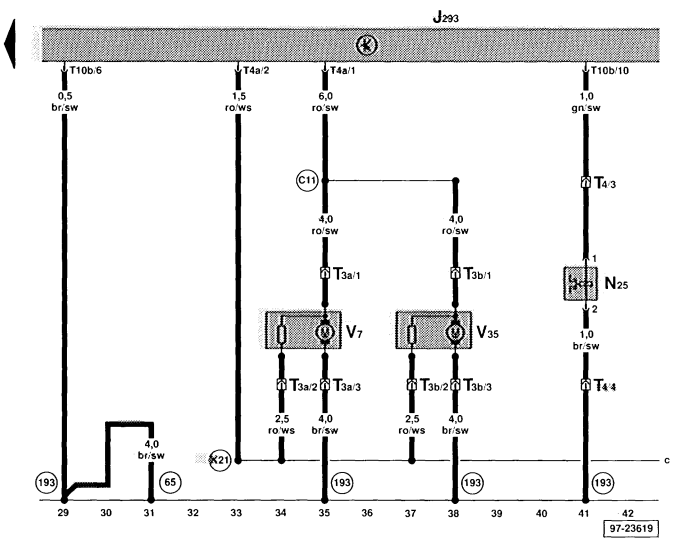
D - Ignition/Starter Switch
E9 - Fresh Air Blower Switch
E159 - Fresh Air/Recirculating Flap Switch
K114 - Fresh Air and Recirculating Air Mode Indicator Light
L16 - Fresh Air Control Lever Light
N24 - Fresh Air Blower Series Resistance with Fuse
S5 - Fuse 5 in fuse holder
S225 - Fuse 25 in fuse holder
T4c - 4-Pin Connector
T6d - 6-Pin Connector
T8b - 8-Pin Connector
T10j - 10-Pin Connector, behind instrument panel, center
V2 - Fresh Air Blower
V154 - Servo motor for fresh-/recirculating air flap

(45) - Ground connection, behind instrument panel, center
(162) - Ground connection, in blower motor wiring harness
(503) - Threaded connection -2- (75x) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A4) - Plus connection (58b), in instrument panel wiring harness
(A20) - Wire connection (15a), in instrument panel wiring harness
(L45) - Wire connection, in A/C system wiring harness
(L66) - Connector, in wiring harness heater blower

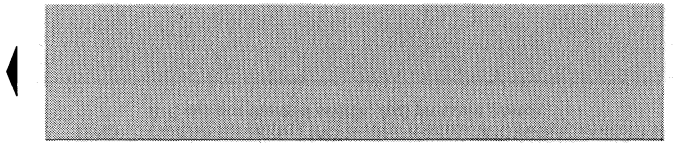
Fresh air blower switch, fresh air/recirculating flap switch, fresh air blower, servo motor for fresh-/recirculating air flap

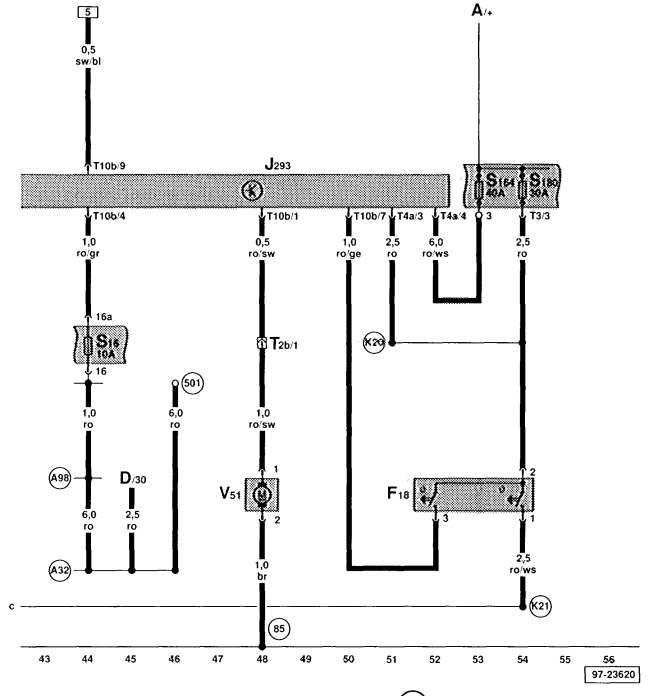


E35 - A/C Switch
F38 - Ambient Temperature Switch
F129 - A/C Pressure Switch
F163 - A/C Cut-Out Thermal Switch
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J293 - Coolant Fan Control (FC) Control Module, in engine compartment, left
K84 - A/C Indicator Light
T2b - Double Connector, in engine compartment, in wiring duct, left
T8b - 8-Pin Connector
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
T10b - 10-Pin Connector
T10j - 10-Pin Connector, behind instrument panel, center
T121 - Connector, 121 point
(L9) - Wire connection -1-, in A/C wiring harness
(L10) - Wire connection -2-, in A/C wiring harness
(L45) - Wire connection, in A/C system wiring harness



J293 - Coolant Fan Control (FC) Control Module, in engine compartment, left
N25 - A/C Clutch
T3a - 3-Pin Connector, in engine compartment, left
T3b - 3-Pin Connector, in engine compartment, left
T4 - 4-Pin Connector, near starter
T4a - 4-Pin Connector
T10b - 10-Pin Connector
V7 - Left Coolant Fan
V35 - Right Coolant Fan
(65) - Ground connection, on chassis side member, front left
(193) - Ground connection -1-, in coolant fan wiring harness
(C11) - Wire connection, in coolant fan wiring harness
(K21) - Wire connection -1-, in coolant fan wiring harness





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

A - Battery
D - Ignition/Starter Switch
F18 - Coolant Fan Control (FC) Thermal Switch
J293 - Coolant Fan Control (FC) Control Module, in engine compartment, left
S16 - Fuse 16 in fuse holder
S164 - Fuse -3- (30) in fuse bracket/battery
S180 - Fuse -8- (30) in fuse bracket/battery
T2b - Double Connector, in engine compartment, in wiring duct, left
T3 - 3-Pin Connector
T4a - 4-Pin Connector
T10b - 10-Pin Connector
V51 - After-Run Coolant Pump

(85) - Ground connection -1-, in engine compartment wiring harness
(501) - Threaded connection -2- (30) on the relay plate
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness
(K20) - Plus connection -1- (30), in coolant fan wiring harness
(K21) - Wire connection -1-, in coolant fan wiring harness

Edition 12/98
USA.5102.01.21

Coolant fan control (FC) control module, coolant fan control (FC) thermal switch, after-run coolant pump

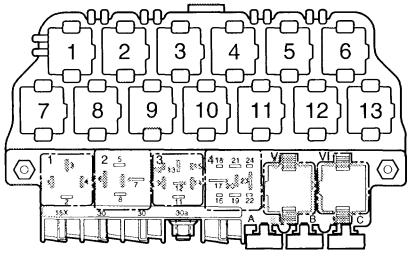
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Daytime running lights,

from September 1998

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97–14163

Relay location on the thirteenfold auxiliary relay panel, above relay panel:

7 Daytime Running Lights Change-over Relay (173), from April 1999

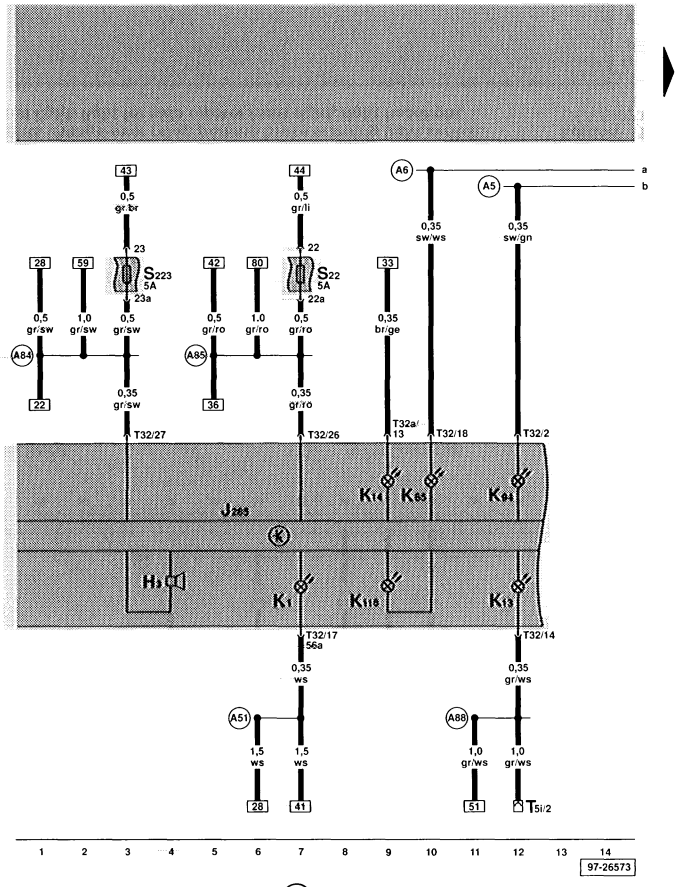
8 Daytime Running Lights Change-over Relay (173), trough March 1999

Relay panel:

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

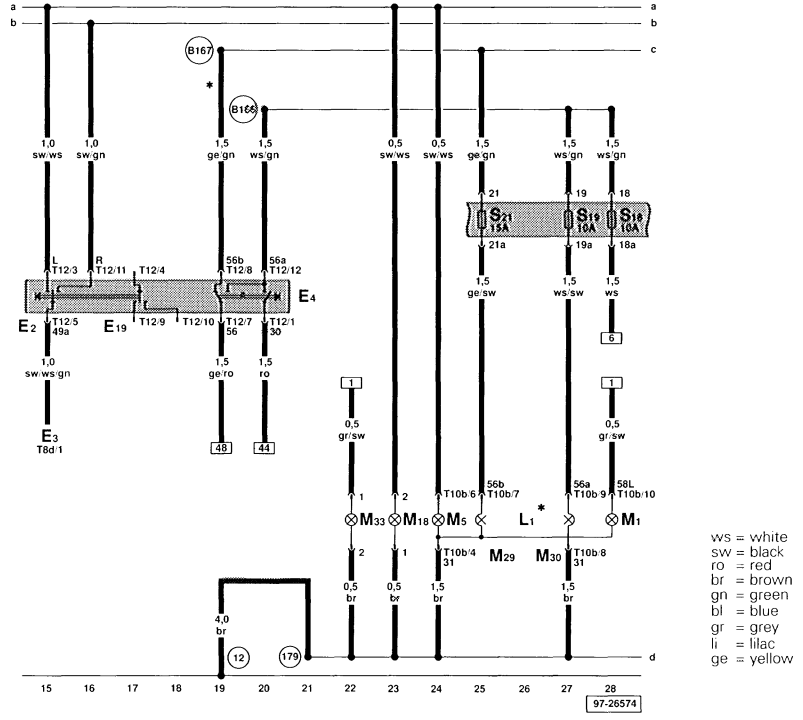


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

H3 - Warning buzzer
J285 - Control module with indicator unit in instrument panel insert
K1 - Headlight High Beam Indicator Light
K13 - Rear Fog Light Indicator Light
K14 - Parking Brake Indicator Light
K65 - Left Turn Signal Indicator Light
K94 - Right Turn Signal Indicator Light
K118 - Warning light for brake system
S22 - Fuse 22 in fuse holder
S223 - Fuse 23 in fuse holder
T5i - 5-Pin Connector, near left A-pillar, lower part, in harness
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(A5) - Plus connection (right turn signal), in instrument panel wiring harness
(A6) - Plus connection (left turn signal), in instrument panel wiring harness
(A51) - Wire connection (56), in instrument panel wiring harness
(A84) - Connector (58L) in instrument panel wiring harness
(A85) - Connector (58R) in instrument panel wiring harness
(A88) - Connector fog light, in instrument panel wiring harness

Instrument cluster, left and right turn signal indicator lights, parking brake indicator light, warning light for brake system, headlight high beam indicator light

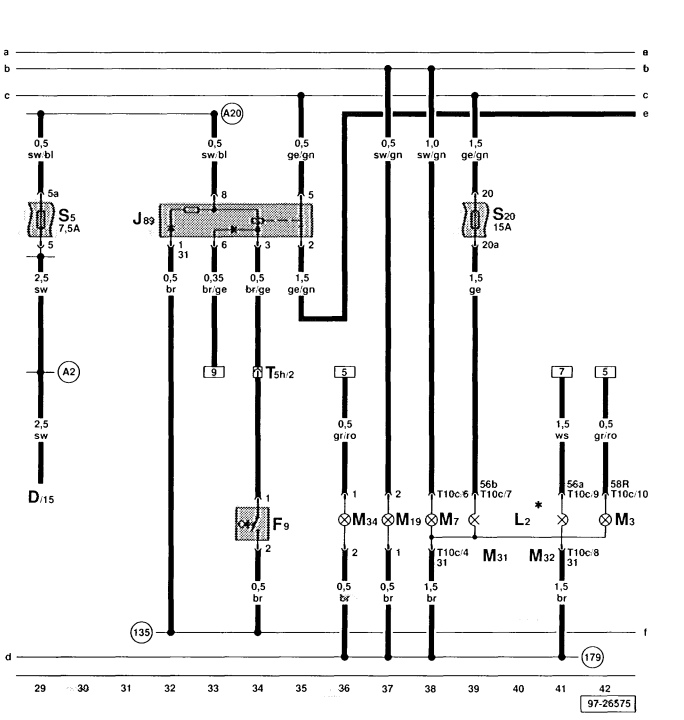


E2 - Turn signal switch
E3 - Emergency Flasher Switch
E4 - Headlight Dimmer/Flasher Switch
E19 - Park Light Switch
L1 - Left Headlight*
M1 - Left Parking Light
M5 - Left Front Turn Signal Light
M18 - Left, Side Turn Signal Light
M29 - Left Low Beam Headlight (Golf only)
M30 - Left High Beam Headlight (Golf only)
M33 - Light for side marker front left
S18 - Fuse 18 in fuse holder
S19 - Fuse 19 in fuse holder
S21 - Fuse 21 in fuse holder
T8d - 8-Pin Connector
T10b - 10-Pin Connector
T12 - 12-Pin Connector

(12) - Ground connection, in engine compartment, left
(179) - Ground connection, in left headlight wiring harness
(B166) - Connection (56a) in passenger compartment wiring harness
(B167) - Connection (56b) in passenger compartment wiring harness

* - Jetta only

Turn signal switch, headlight dimmer/flasher switch, left front turn signal light, light for side marker front left, left headlight

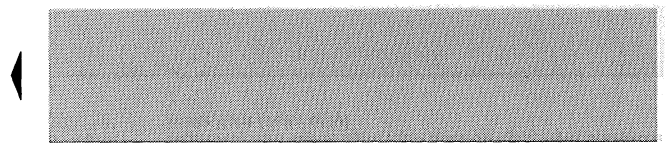


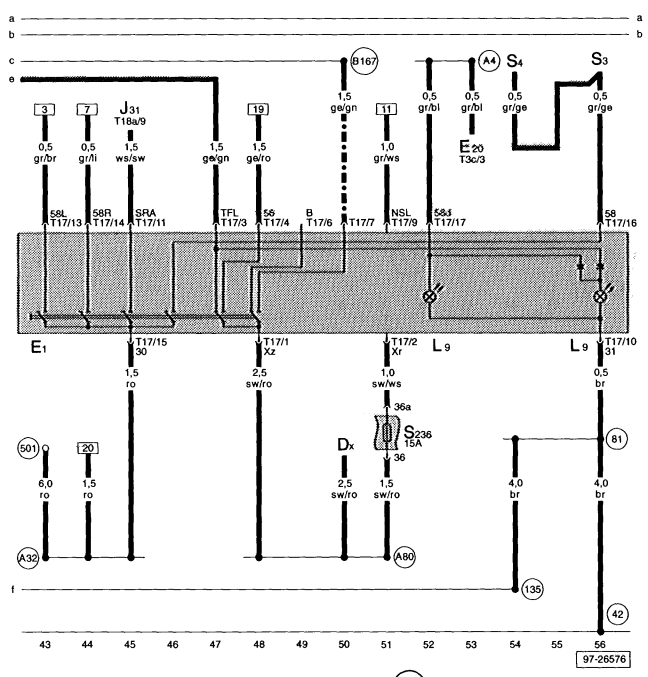
D - Ignition/Starter Switch
F9 - Parking Brake Warning Light Switch
J89 - Daytime Running Lights Change-over Relay, on the thirteenfold auxiliary relay panel, above relay panel
L2 - Right Headlight*
M3 - Right Parking Light
M7 - Right Front Turn Signal Light
M19 - Right, Side Turn Signal Light
M31 - Right Low Beam Headlight (Golf only)
M32 - Right High Beam Headlight (Golf only)
M34 - Light for side marker front right
S5 - Fuse 5 in fuse holder
S20 - Fuse 20 in fuse holder
T5h - 5-Pin Connector, near left A-pillar, lower part, in harness
T10c - 10-Pin Connector

(135) - Ground connection -2-, in instrument panel wiring harness
(179) - Ground connection, in left headlight wiring harness
(A2) - Plus connection (15), in instrument panel wiring harness
(A20) - Wire connection (15a), in instrument panel wiring harness

* - Jetta only

Daytime running lights change-over relay, parking brake warning light switch, right front turn signal light, light for side marker front right, right headlight



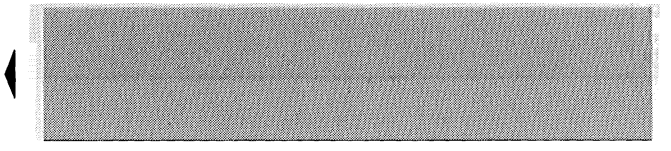


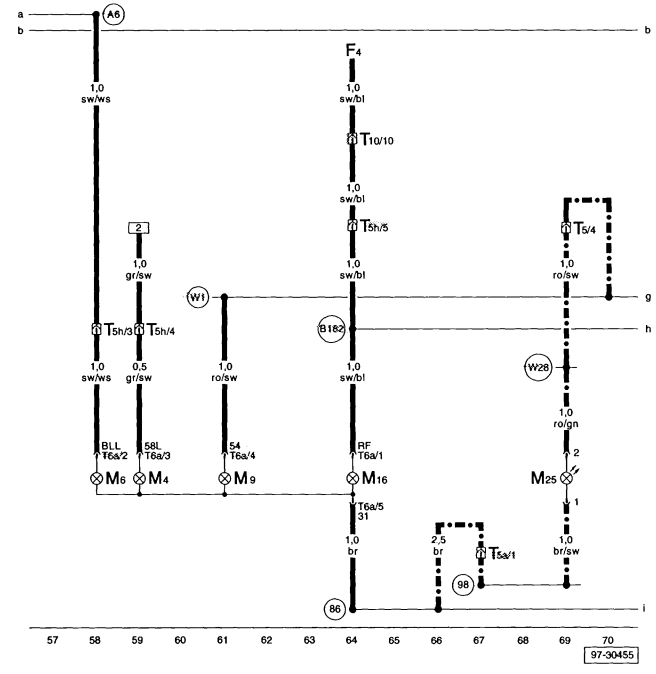
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

D - Ignition/Starter Switch
E1 - Light switch
E20 - Instrument Panel Light Dimmer Switch
J31 - Wiper/Washer Intermittent Relay
L9 - Headlight Switch Light
S3 - Fuse 3 in fuse holder
S4 - Fuse 4 in fuse holder
S236 - Fuse 36 in fuse holder
T3c - 3-Pin Connector
T17 - 17-Pin Connector
T18a - 18-Pin Connector

(42) - Ground connection, beside steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(501) - Threaded connection -2- (30) on the relay plate
(A4) - Plus connection (58b), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A80) - Connector -1- (X) in instrument panel wiring harness
(B167) - Connection (56b) in passenger compartment wiring harness

-•-•- Golf only



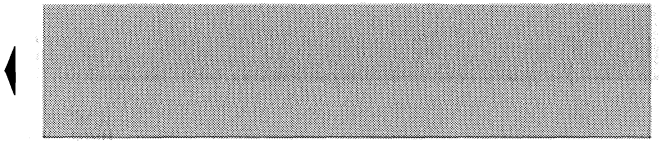


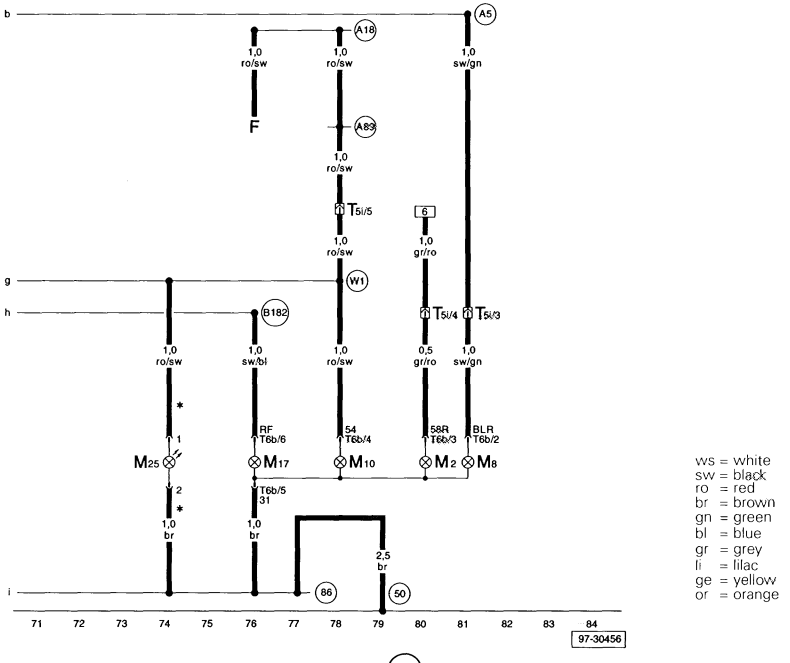
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F4 - Back-Up Light Switch
M4 - Left Tail Light
M6 - Left Rear Turn Signal Light
M9 - Left Brake Light
M16 - Left Back-Up Light
M25 - High-mount Brake Light (32 light emitting diodes)
T5 - 5-Pin Connector, black, connector station C-pillar, left
T5a - 5-Pin Connector, lilac, connector station C-pillar, left (Golf only)
T5h - 5-Pin Connector, near left A-pillar, lower part, in harness
T6a - 6-Pin Connector
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left

(86) - Ground connection -1-, in rear wiring harness
(98) - Ground connection, in rear lid wiring harness
(A6) - Plus connection (left turn signal), in instrument panel wiring harness
(B182) - Connection (RF), in passenger compartment wiring harness
(W1) - Plus connection (54), in rear wiring harness
(W28) - Plus connector -2- (54), in wiring harness taillight assembly

-•-•- Golf only





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F - Brake Light Switch
M2 - Right Tail Light
M8 - Right Rear Turn Signal Light
M10 - Right Brake Light
M17 - Right Back-Up Light
M25 - High-mount Brake Light (18 light emitting diodes)*
T5i - 5-Pin Connector, near left A-pillar, lower part, in harness
T6b - 6-Pin Connector

(50) - Ground connection, in luggage compartment, left
(86) - Ground connection -1-, in rear wiring harness

(A5) - Plus connection (right turn signal), in instrument panel wiring harness
(A18) - Wire connection (54), in instrument panel wiring harness
(A89) - Connector (54), in instrument panel wiring harness
(B182) - Connection (RF), in passenger compartment wiring harness
(W1) - Plus connection (54), in rear wiring harness

* - Jetta only

Edition 09/01
USA.5102.11.21

Right rear turn signal light, right back-up light, right brake/tail light, high-mount brake light (Jetta only)

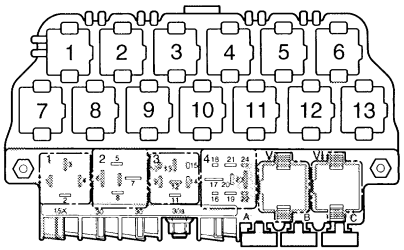
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Fog lights,

from September 1998

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97-14163

Relay location on the thirteenfold auxiliary relay panel, above relay panel:

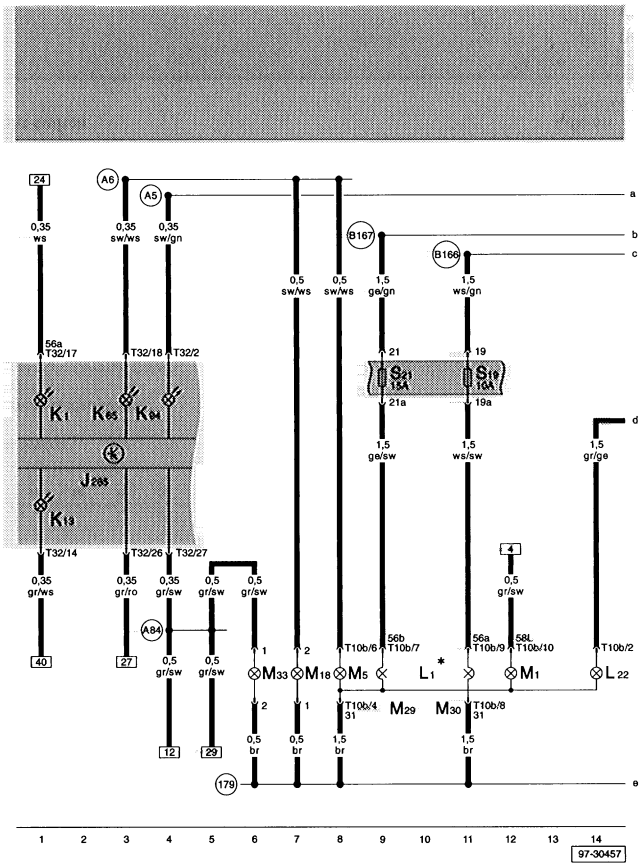
4 Fog Light Relay (53)

Relay panel:

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



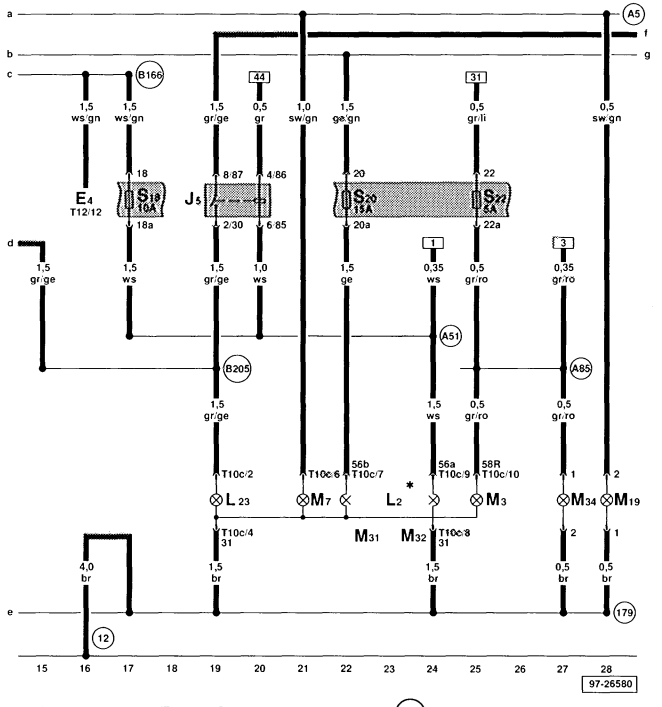
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

J285 - Control module with indicator unit in instrument panel insert
K1 - Headlight High Beam Indicator Light
K13 - Rear Fog Light Indicator Light
K65 - Left Turn Signal Indicator Light
K94 - Right Turn Signal Indicator Light
L1 - Left Headlight*
L22 - Left Front Fog Light
M1 - Left Parking Light
M5 - Left Front Turn Signal Light
M18 - Left, Side Turn Signal Light
M29 - Left Low Beam Headlight (Golf only)
M30 - Left High Beam Headlight (Golf only)
M33 - Light for side marker front left
S19 - Fuse 19 in fuse holder
S21 - Fuse 21 in fuse holder
T10b - 10-Pin Connector
T32 - 32-Pin Connector, blue
(179) - Ground connection, in left headlight wiring harness
(A5) - Plus connection (right turn signal), in instrument panel wiring harness
(A6) - Plus connection (left turn signal), in instrument panel wiring harness
(A84) - Connector (58L), in instrument panel wiring harness
(B166) - Connection (56a), in passenger compartment wiring harness
(B167) - Connection (56b), in passenger compartment wiring harness
* - Jetta only

Instrument cluster, headlight high beam indicator light, turn signal indicator lights, left headlight light, light for side marker front left, left front fog light

Repair Manual page number 97-172

Repair Manual page number 97-173



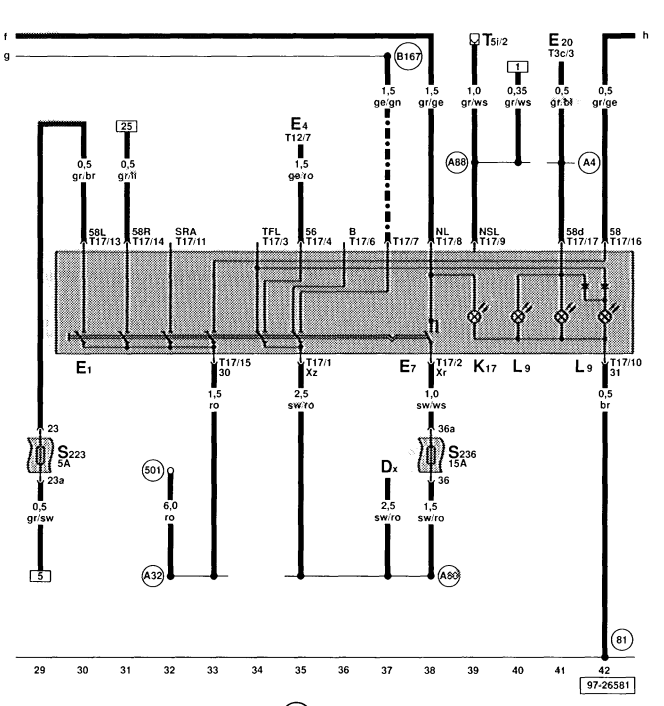
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E4 - Headlight Dimmer/Flasher Switch
J5 - Fog Light Relay
L2 - Right Headlight*
L23 - Right Front Fog Light
M3 - Right Parking Light
M7 - Right Front Turn Signal Light
M19 - Right, Side Turn Signal Light
M31 - Right Low Beam Headlight (Golf only)
M32 - Right High Beam Headlight (Golf only)
M34 - Light for side marker front right
S18 - Fuse 18 in fuse holder
S20 - Fuse 20 in fuse holder
S22 - Fuse 22 in fuse holder
T10c - 10-Pin Connector
T12 - 12-Pin Connector

(12) - Ground connection, in engine compartment, left
(179) - Ground connection, in left headlight wiring harness
(A5) - Plus connection (right turn signal), in instrument panel wiring harness
(A51) - Wire connection (56), in instrument panel wiring harness
(A85) - Connector (58R) in instrument panel wiring harness
(B166) - Connection (56a), in passenger compartment wiring harness
(B205) - Connection (fog light), in passenger compartment wiring harness

* - Jetta only

Right front turn signal light, light for side marker front right, right headlight, right front fog light, fog light relay



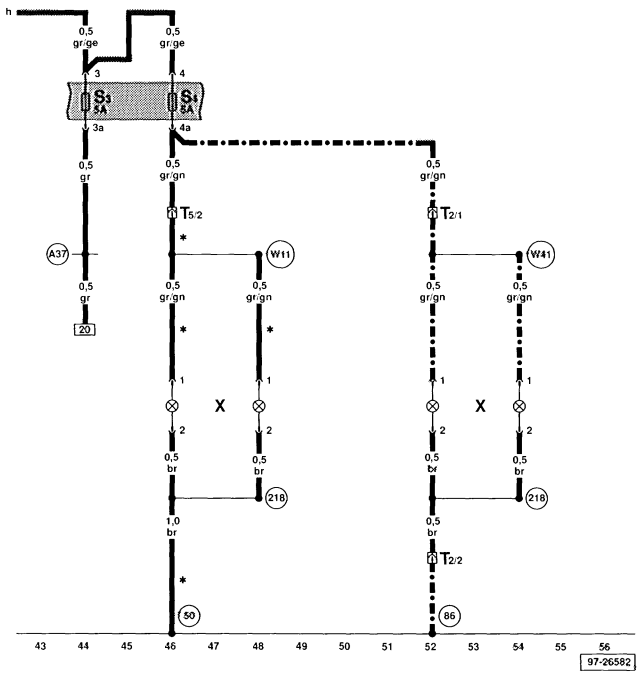
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

D - Ignition/Starter Switch
E1 - Light switch
E4 - Headlight Dimmer/Flasher Switch
E7 - Fog Light Switch
E20 - Instrument Panel Light Dimmer Switch
K17 - Fog Light Indicator Light
L9 - Headlight Switch Light
S223 - Fuse 23 in fuse holder
S236 - Fuse 36 in fuse holder
T3c - 3-Pin Connector
T5i - 5-Pin Connector, near left A-pillar, lower part, in harness
T12 - 12-Pin Connector
T17 - 17-Pin Connector

(81) - Ground connection -1-, in instrument panel wiring harness
(501) - Threaded connection -2- (30) on the relay plate
(A4) - Plus connection (58b), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A80) - Connector -1- (X) in instrument panel wiring harness
(A88) - Connector fog light, in instrument panel wiring harness
(B167) - Connection (56b), in passenger compartment wiring harness

-•-•- Golf only

Light switch, fog light switch



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

S3 - Fuse 3 in fuse holder
S4 - Fuse 4 in fuse holder
T2 - Double Connector, in luggage compartment, left (Golf only)
T5 - 5-Pin Connector, black, connector station C-pillar, left
X - License Plate Light

(50) - Ground connection, in luggage compartment, left
(86) - Ground connection -1-, in rear wiring harness
(218) - Ground connection -1-, in rear lid wiring harness
(A37) - Wire connection (58a), in instrument panel wiring harness
(W11) - Wire connection (58), in rear lid wiring harness
(W41) - Plus connection (58), in wiring harness
* - Jetta only
-•-•- Golf only

Edition 11/99
USA.5102.05.21

License plate light

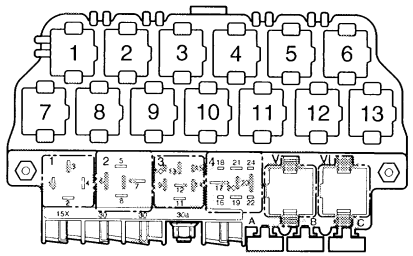
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Headlight washer,

from September 1998

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

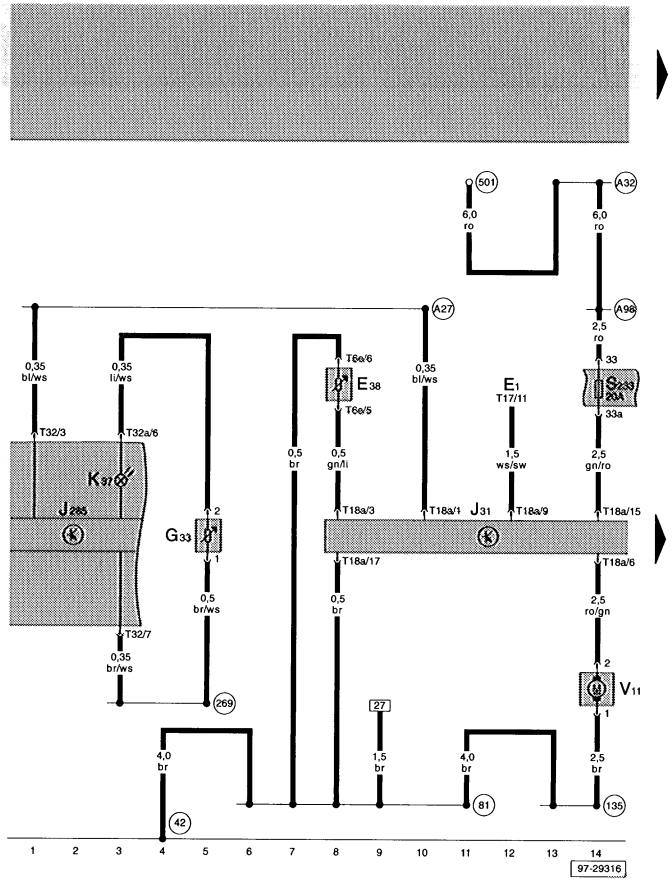
V Wiper/Washer Intermittent Relay (389)

VI

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

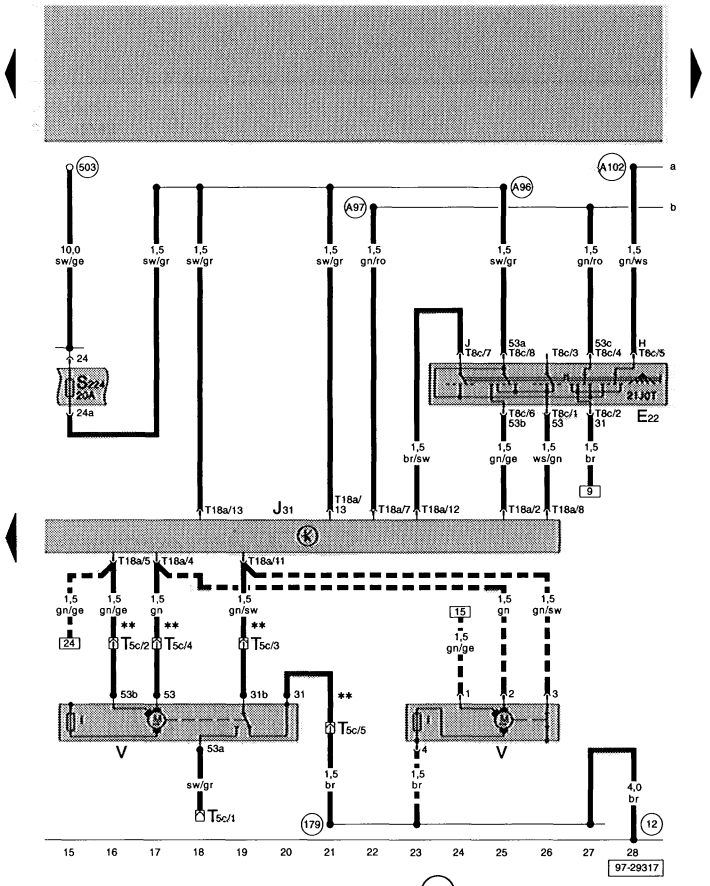


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E1 - Light switch
E38 - Windshield Wiper Intermittent Regulator
G33 - Windshield Washer Fluid Level Sensor
J31 - Wiper/Washer Intermittent Relay, on relais panel
J285 - Control module with indicator unit in instrument panel insert
K37 - Low Windshield Washer Fluid Level Indicator Light
S233 - Fuse 33 in fuse holder
T6e - 6-Pin Connector
T17 - 17-Pin Connector
T18a - 18-Pin Connector
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green
V11 - Headlight Washer Pump

(42) - Ground connection, beside steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(269) - Ground connector (sensor ground) -1-, in instrument panel wiring harness
(501) - Threaded connection -2- (30) on the relay plate
(A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness

Wiper/washer intermittent relay, windshield wiper intermittent regulator, windshield washer fluid level sensor, headlight washer pump, instrument cluster



E22 - Windshield Wiper/Washer Switch
J31 - Wiper/Washer Intermittent Relay, on relais panel
S224 - Fuse 24 in fuse holder
T5c - 5-Pin Connector, on windshield wiper motor
T8c - 8-Pin Connector
T18a - 18-Pin Connector
V - Windshield Wiper Motor

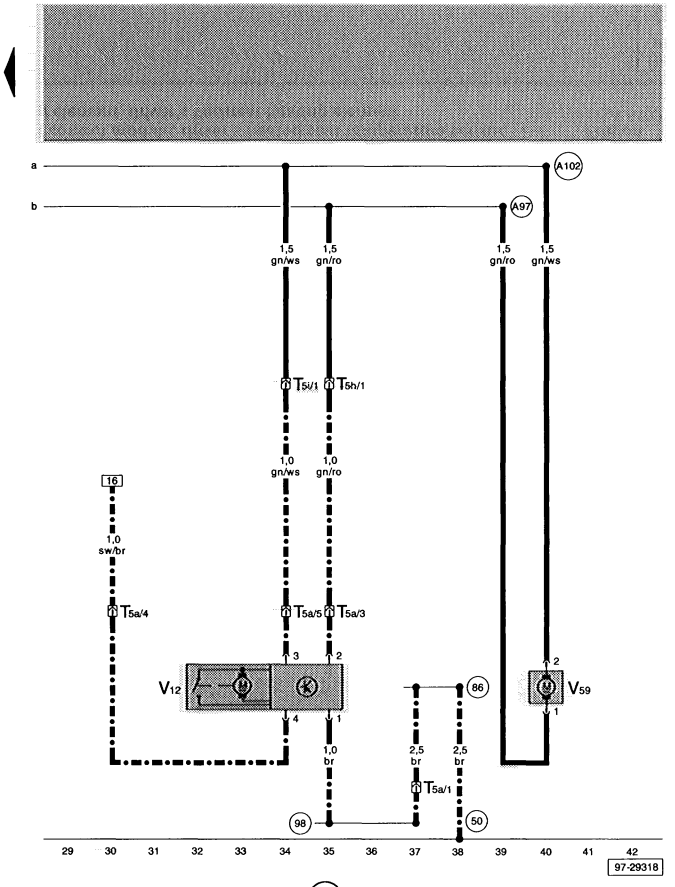
(12) - Ground connection, in engine compartment, left
(179) - Ground connection, in left headlight wiring harness
(503) - Threaded connection -2- (75x) on the relay plate

(A96) - Connector (53a), in instrument panel wiring harness
(A97) - Connector (53), in instrument panel wiring harness
(A102) - Connector (windshield wiper), in instrument panel wiring harness

** - Through August 2000
- - - Beginning September 2000

Edition 03/01
USA.5102.10.21

Wiper/washer intermittent relay, windshield wiper/washer switch, windshield wiper motor



T5a - 5-Pin Connector, pink, connector station C-pillar, left (Golf only)
T5h - 5-Pin Connector, near left A-pillar, lower part, in harness
T5i - 5-Pin Connector, near left A-pillar, lower part, in harness
V12 - Motor for rear windshield wiper
V59 - Windshield and Rear Window Washer Pump

(50) - Ground connection, in luggage compartment, left
(86) - Ground connection -1-, in rear wiring harness
(98) - Ground connection, in rear lid wiring harness

(A97) - Connector (53), in instrument panel wiring harness
(A102) - Connector (windshield wiper), in instrument panel wiring harness

-•-•- Golf only

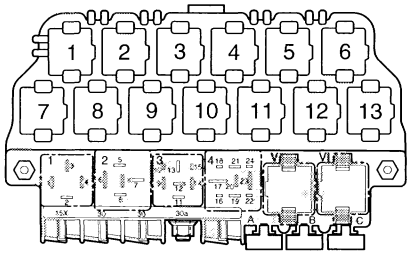
Motor for rear windshield wiper, windshield and rear window washer pump

Edition 03/01
USA.5102.10.21

Heated seats,

from September 1998

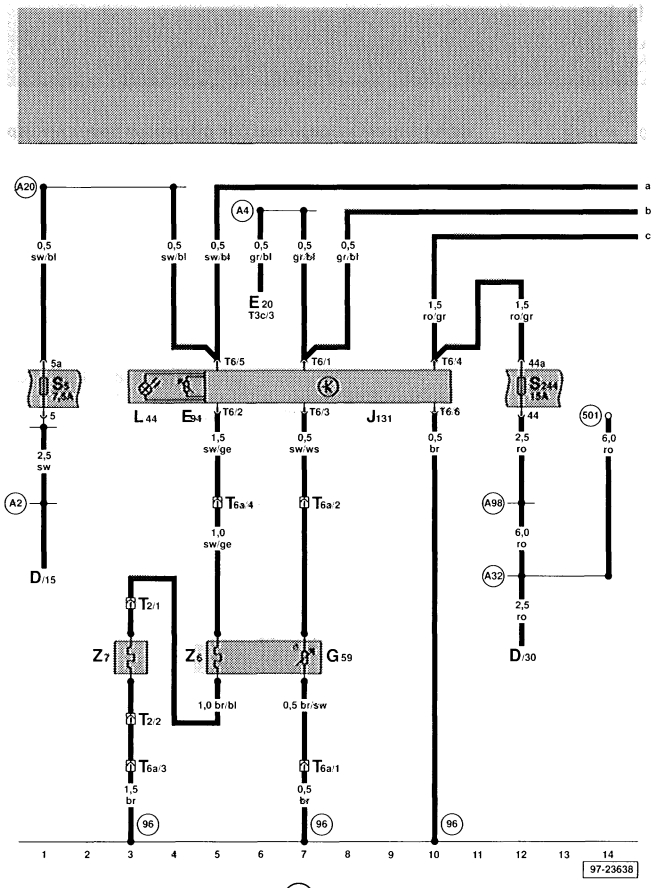
Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97-14163

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

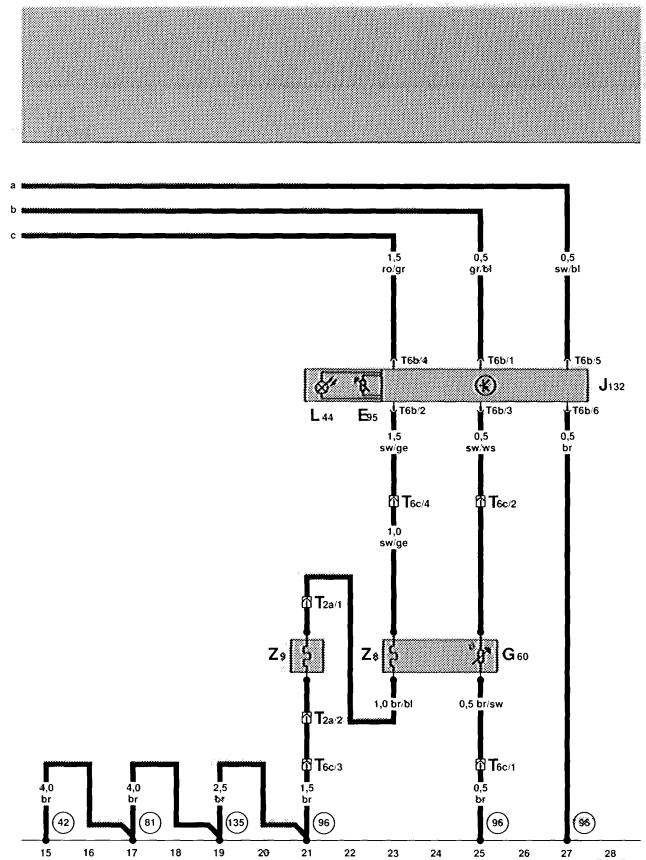


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

D - Ignition/Starter Switch
E20 - Instrument Panel Light Dimmer Switch
E94 - Adjuster for heated driver's seat
G59 - Driver's Heated Seat Temperature Sensor
J131 - Driver's Heated Seat Control Module
L44 - Heated Seat Switch Illumination Light
S5 - Fuse 5 in fuse holder
S244 - Fuse 44 in fuse holder
T2 - Double Connector, below driver's seat
T3c - 3-Pin Connector
T6 - 6-Pin Connector
T6a - 6-Pin Connector, green, below driver's seat
Z6 - Driver's Seat Heating Element
Z7 - Driver's Backrest Heating Element

(96) - Ground connection -1-, in heated seats wiring harness
(501) - Threaded connection -2- (30) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A4) - Plus connection (58b), in instrument panel wiring harness
(A20) - Wire connection (15a), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness

Driver's heated seat control module, driver's heated seat temperature sensor, driver's seat heating element, driver's backrest heating element



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E95 - Adjuster for heated passenger seat
G60 - Passenger's Heated Seat Temperature Sensor
J132 - Passenger's Heated Seat Control Module
L44 - Heated Seat Switch Illumination Light
T2a - Double Connector, below passenger's seat
T6b - 6-Pin Connector
T6c - 6-Pin Connector, green, below passenger's seat
Z8 - Passenger's Seat Heating Element
Z9 - Passenger's Backrest Heating Element

(42) - Ground connection, beside steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(96) - Ground connection -1-, in heated seats wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness

Edition 12/98
USA.5102.01.21

Passenger's heated seat control module, passenger's heated seat temperature sensor, passenger's seat heating element, passenger's backrest heating element

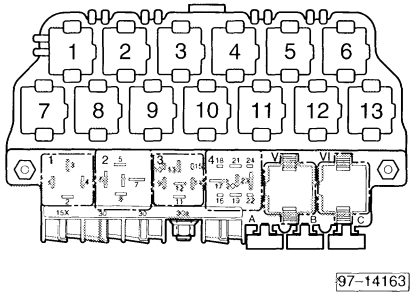
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Heated leather seats,

from September 1998

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".

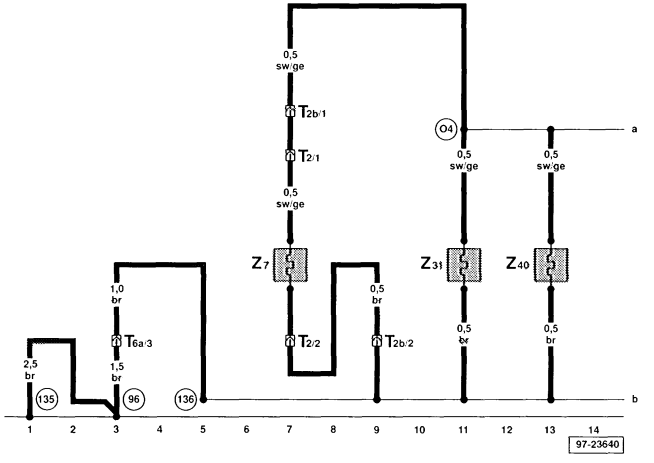


Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

Repair Manual page number
97-186

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

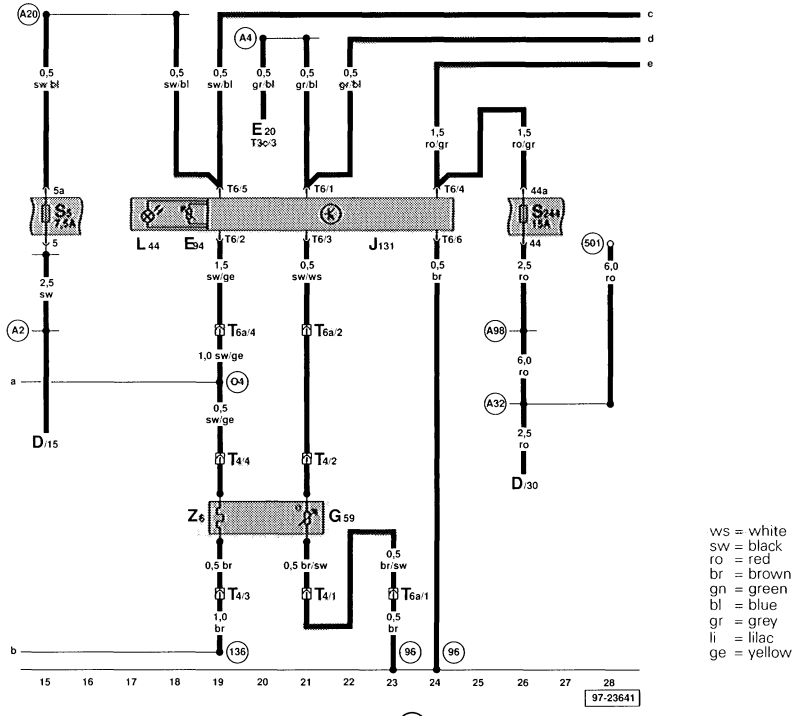


T2 - Double Connector, below driver's seat
T2b - Double Connector, below driver's seat
T6a - 6-Pin Connector, green, below driver's seat
Z7 - Driver's Seat Backrest Heater
Z31 - Driver's Seat Side Bolster Heater
Z40 - Driver's Seat Side Bolster Heater 2

(96) - Ground connection -1-, in heated seats wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(136) - Ground connection -2-, in heated seats wiring harness
(04) - Plus connection (30a), in heated seats wiring harness

Driver's seat backrest and side bolster heaters

Repair Manual page number
97-187



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

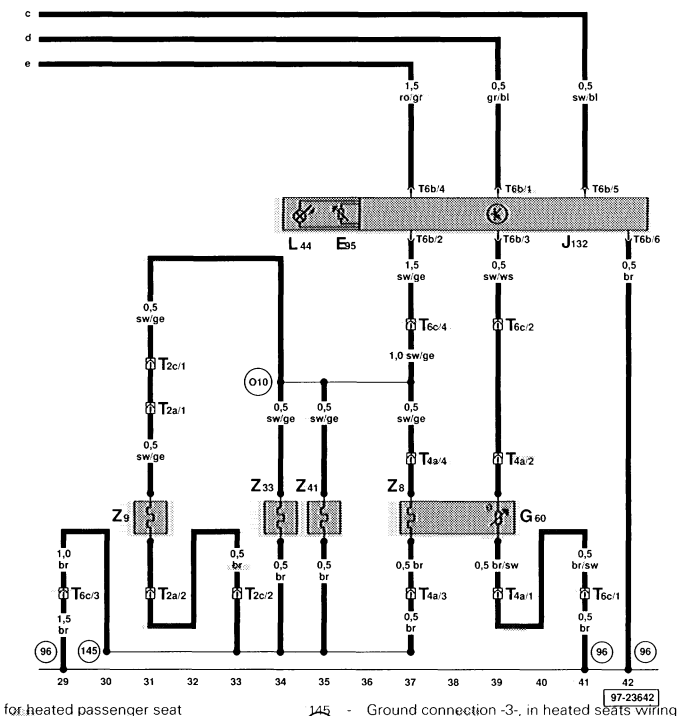
D - Ignition/Starter Switch
E20 - Instrument Panel Light Dimmer Switch
E94 - Adjuster for heated driver's seat
G59 - Driver's Heated Seat Temperature Sensor
J131 - Driver's Heated Seat Control Module
L44 - Heated Seat Switch Illumination Light
S5 - Fuse 5 in fuse holder
S244 - Fuse 44 in fuse holder
T3c - 3-Pin Connector
T4 - 4-Pin Connector, below driver's seat
T6 - 6-Pin Connector
T6a - 6-Pin Connector, green, below driver's seat
Z6 - Driver's Seat Heater

(96) - Ground connection -1-, in heated seats wiring harness
(136) - Ground connection -2-, in heated seats wiring harness
(501) - Threaded connection -2- (30) on the relay plate

(A2) - Plus connection (15), in instrument panel wiring harness
(A4) - Plus connection (58b), in instrument panel wiring harness
(A20) - Wire connection (15a), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness
(O4) - Plus connection (30a), in heated seats wiring harness

Edition 12/98
USA.5102.01.21

Driver's heated seat control module, driver's heated seat temperature sensor, driver's seat heater



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E95 - Adjuster for heated passenger seat
G60 - Passenger's Heated Seat Temperature Sensor
J132 - Passenger's Heated Seat Control Module
L44 - Heated Seat Switch Illumination Light
T2a - Double Connector, below passenger's seat
T2c - Double Connector, below passenger's seat
T4a - 4-Pin Connector, below passenger's seat
T6b - 6-Pin Connector
T6c - 6-Pin Connector, green, below passenger's seat
Z8 - Passenger's Seat Heater
Z9 - Passenger's Seat Backrest Heater
Z33 - Passenger's Seat Side Bolster Heater
Z41 - Passengers Seat Side Bolster Heater 2

(96) - Ground connection -1-, in heated seats wiring harness
(145) - Ground connection -3-, in heated seats wiring harness
(O10) - Plus connector -2- (30a), in wiring harness heated seat

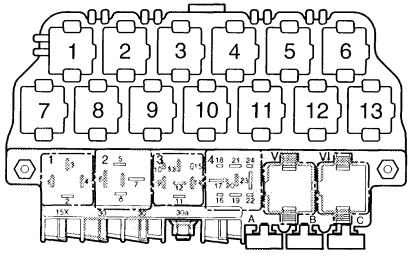
Passenger's heated seat control module, passenger's heated seat temperature sensor, passenger's seat heater, backrest and side bolster heaters

Edition 12/98
USA.5102.01.21

Washer nozzle heaters,

from September 1998

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

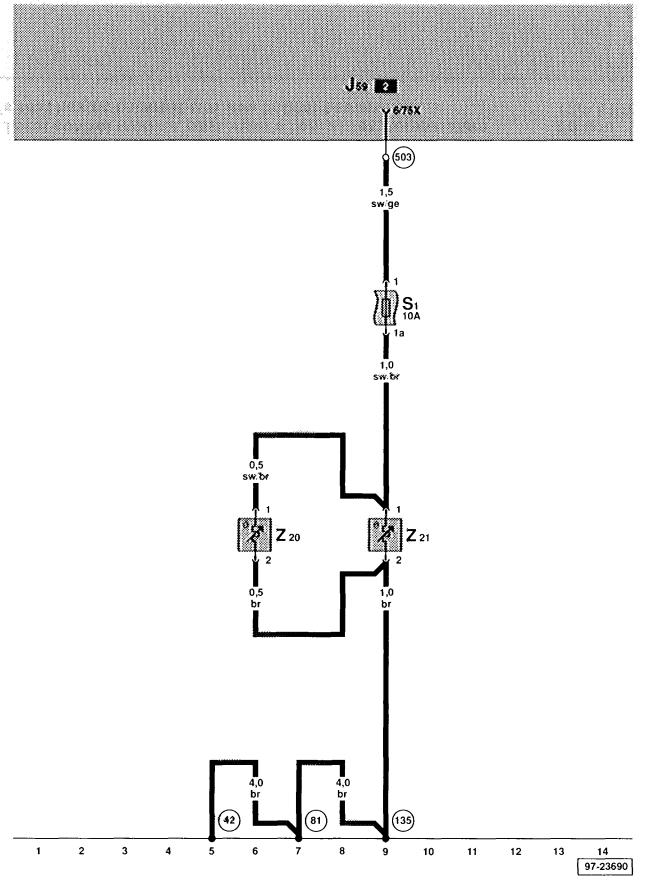
Relay panel:

2 Load Reduction Relay (18)

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

J59 - Load Reduction Relay
S1 - Fuse 1 in fuse holder
Z20 - Left Washer Nozzle Heater
Z21 - Right Washer Nozzle Heater

(42) - Ground connection, beside steering column

(81) - Ground connection -1-, in instrument panel wiring harness

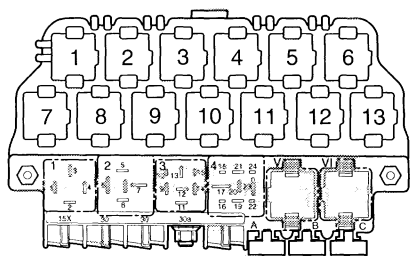
(135) - Ground connection -2-, in instrument panel wiring harness

(501) - Threaded connection -2- (30) on the relay plate

Power outlet (12V),

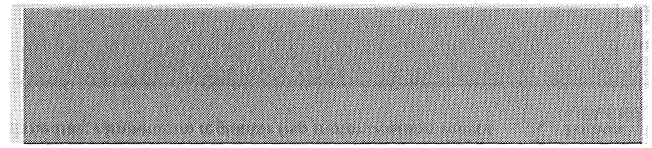
from September 1998

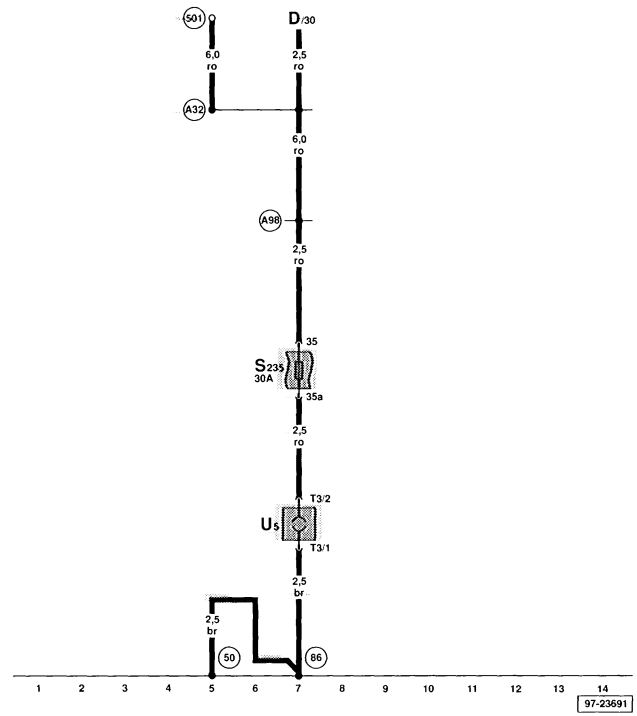
Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

D - Ignition/Starter Switch
S235 - Fuse 35 in fuse holder
T3 - 3-Pin Connector
U5 - 12 V-Socket, in luggage compartment, right

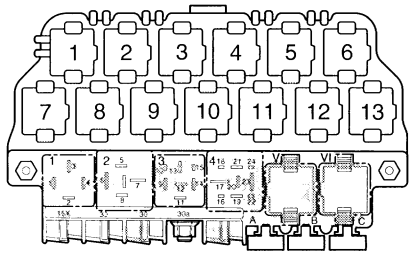
(50) - Ground connection, in luggage compartment, left
(86) - Ground connection -1-, in rear wiring harness
(501) - Threaded connection -2- (30) on the relay plate
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness

Climatronic (automatic climate control),

from December 1998

- **2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/130 kW, code AFP**

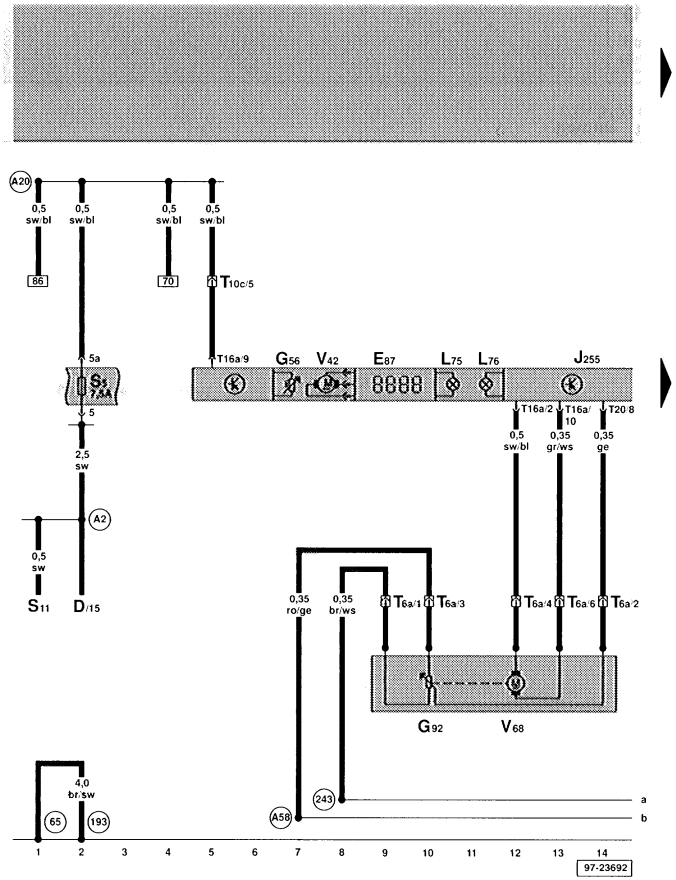
Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97–14163

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

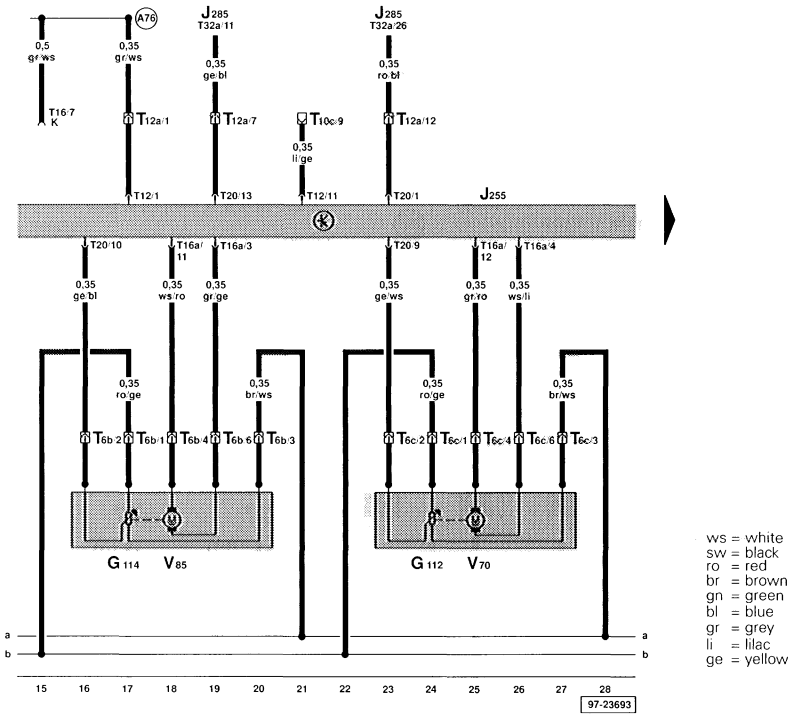


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

D - Ignition/Starter Switch
E87 - A/C Control Head
G56 - Instrument Panel Interior Temperature Sensor
G92 - Temperature Regulator Flap Motor Position Sensor
J255 - Climatronic Control Module
L75 - Digital Display Light
L76 - Push Button Light
S5 - Fuse 5 in fuse holder
S11 - Fuse 11 in fuse holder
T6a - 6-Pin Connector, behind instrument panel, center
T10c - 10-Pin Connector, behind instrument panel, center
T16a - 16-Pin Connector
T20 - 20-Pin Connector
V42 - Interior Temperature Sensor Fan
V68 - Temperature Regulator Flap Motor

(65) - Ground connection, on chassis side member, front left
(193) - Ground connection -1-, in coolant fan wiring harness
(243) - Ground connection -1- in wiring harness, Climatronic
(A2) - Plus connection (15), in instrument panel wiring harness
(A20) - Wire connection (15a), in instrument panel wiring harness
(A58) - Wire connection (5 V), in instrument cluster wiring harness

Climatronic control module, temperature regulator flap motor position sensor

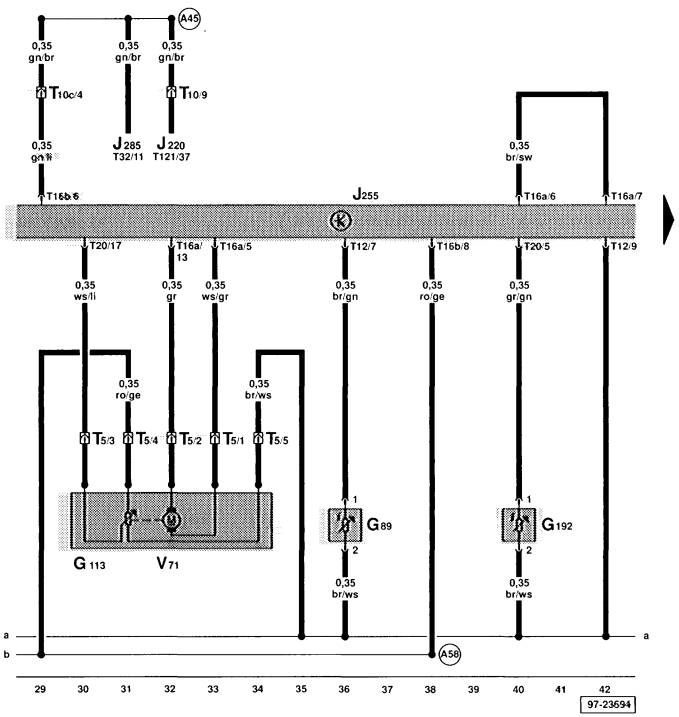


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

G112 - Central Flap Motor Position Sensor
G114 - Footwell/Defrost Flap Motor Position Sensor
J255 - Climatronic Control Module
J285 - Control module with indicator unit in instrument panel insert
T6b - 6-Pin Connector, behind instrument panel, center
T6c - 6-Pin Connector, behind instrument panel, center
T10c - 10-Pin Connector, behind instrument panel, center
T12 - 12-Pin Connector
T12a - 12-Pin Connector, behind instrument panel, center
T16 - Data Link Connector (DLC), below instrument panel, left
T16a - 16-Pin Connector
T20 - 20-Pin Connector
T32a - 32-Pin Connector, green
V70 - Central Air Flap Motor
V85 - Footwell/Defroster Flap Motor
(A76) - Connector (K-diagnosis wire) in instrument panel wiring harness

Edition 12/98
USA.5102.01.21

Climatronic control module, central flap motor position sensor, central air flap motor, footwell/defrost flap motor position sensor, footwell/defrost flap motor

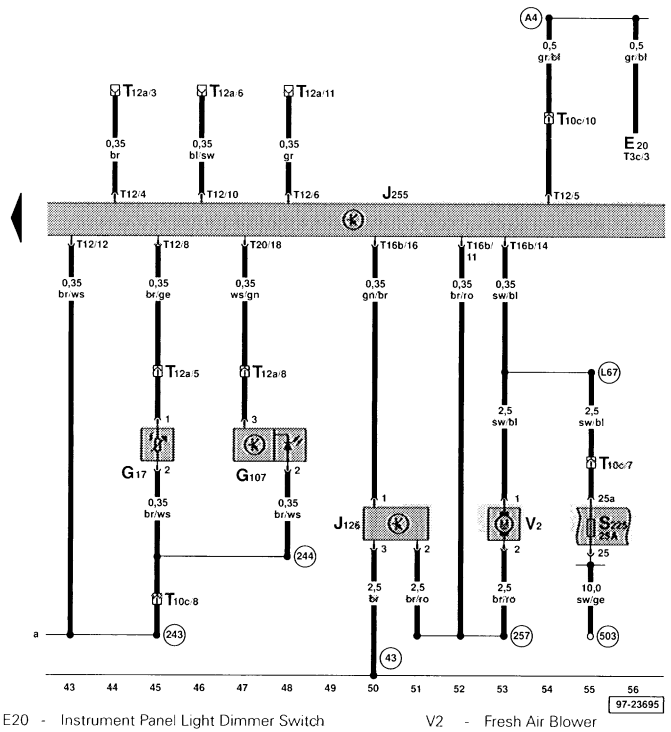


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

G89 - Fresh Air Intake Duct Temperature Sensor, below instrument panel, right
G113 - Back Pressure Flap Motor Position Sensor
G192 - Sender for outlet temperature, floor outlet
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J255 - Climatronic Control Module
J285 - Control module with indicator unit in instrument panel insert
T5 - 5-Pin Connector, behind instrument panel, center
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10c - 10-Pin Connector, behind instrument panel, center
T12 - 12-Pin Connector
T16a - 16-Pin Connector
T16b - 16-Pin Connector
T20 - 20-Pin Connector
T32 - 32-Pin Connector, blue
T121 - Connector, 121 point, on Motronic Engine Control Module (ECM)
V71 - Air Flow Flap Motor
(A45) - Wire connection (RPM-signal), in instrument panel wiring harness
(A58) - Wire connection (5 V), in instrument cluster wiring harness

Climatronic control module, fresh air intake duct temperature sensor, sender for outlet temperature, air flow flap motor, back pressure flap motor position sensor

Edition 12/98
USA.5102.01.21



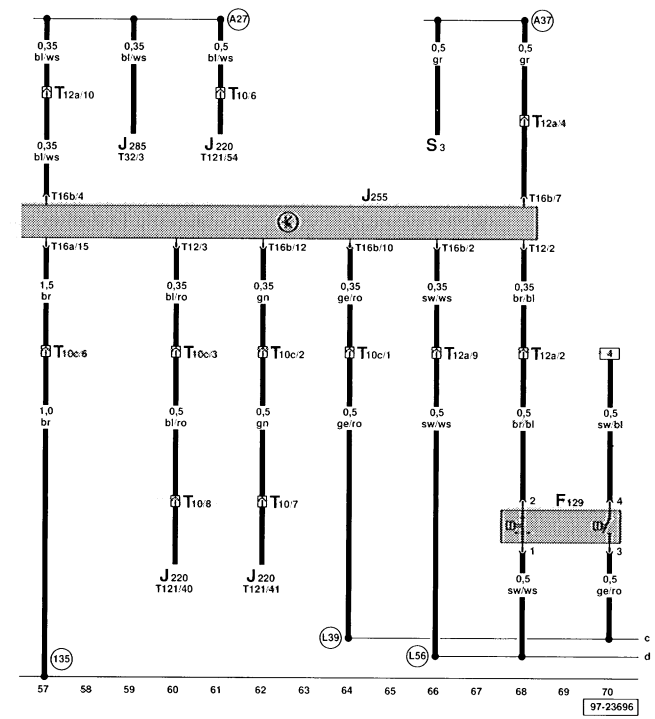
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E20 - Instrument Panel Light Dimmer Switch
G17 - Outside Air Temperature Sensor, on front bumper, left
G107 - Sunlight Photo Sensor, on instrument panel, center
J126 - Control module for fresh air blower, below instrument panel, right
J255 - Climatronic Control Module
S225 - Fuse 25 in fuse holder
T3c - 3-Pin Connector
T10c - 10-Pin Connector, behind instrument panel, center
T12 - 12-Pin Connector
T12a - 12-Pin Connector, behind instrument panel, center
T16b - 16-Pin Connector
T20 - 20-Pin Connector
V2 - Fresh Air Blower

(43) - Ground connection, on right A-pillar, lower part
(243) - Ground connection -1- in wiring harness, Climatronic
(244) - Ground connection (Sensor ground), in wiring harness Climatronic
(257) - Ground Connection -2-, in wirning harness Climatronic
(503) - Threaded connection -2- (75x) on the relay plate
(A4) - Plus connection (58b), in instrument panel wiring harness
(L67) - Positive connection (75x) in Climatronic wiring harness

Edition 12/98
USA.5102.01.21

Climatronic control module, outside air temperature sensor, sunlight photo sensor, control module for fresh air blower, fresh air blower



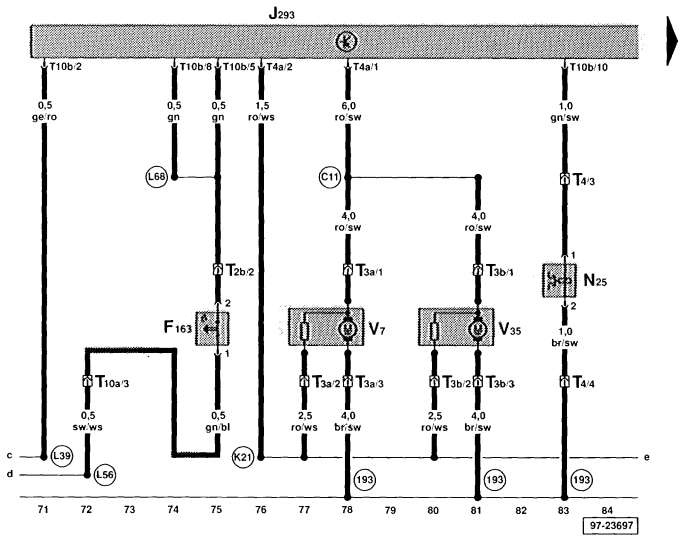
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

F129 - A/C Pressure Switch
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J255 - Climatronic Control Module
J285 - Control module with indicator unit in instrument panel insert
S3 - Fuse 3 in fuse holder
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10c - 10-Pin Connector, behind instrument panel, center
T12 - 12-Pin Connector
T12a - 12-Pin Connector, behind instrument panel, center
T16a - 16-Pin Connector
T16b - 16-Pin Connector
T32 - 32-Pin Connector, blue
T121 - 121-Pin Connector

(135) - Ground connection -2-, in instrument panel wiring harness
(A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness
(A37) - Wire connection (58a), in instrument panel wiring harness
(L39) - Wire connection (A/C Pressure Switch) -1-, in Climatronic wiring harness
(L56) - Connector (Sensor), in wiring harness Climatronic

Climatronic control module, A/C pressure switch

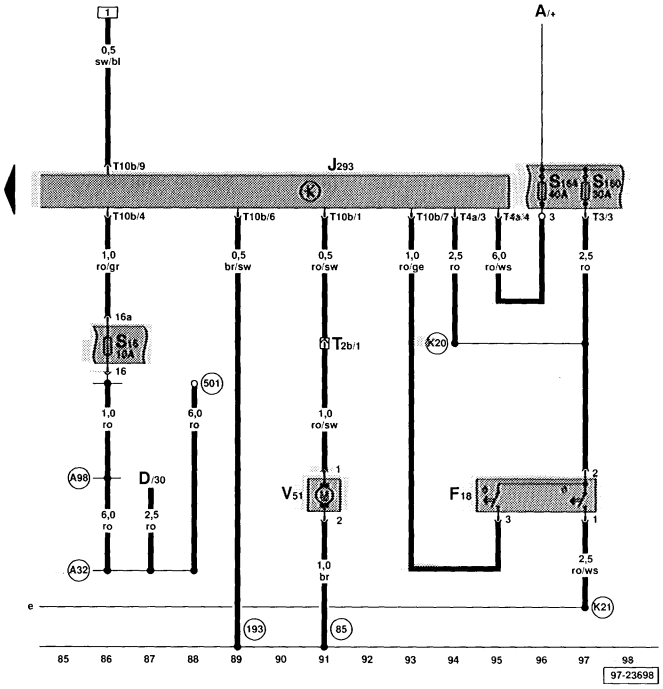
Edition 12/98
USA.5102.01.21



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

F163 - A/C Cut-Out Thermal Switch
J293 - Coolant Fan Control (FC) Control Module, in engine compartment, left
N25 - A/C Clutch
T2b - Double Connector, in engine compartment, in wiring duct, left
T3a - 3-Pin Connector, in engine compartment, left
T3b - 3-Pin Connector, in engine compartment, left
T4 - 4-Pin Connector, near starter
T4a - 4-Pin Connector
T10a - 10-Pin Connector, in engine compartment, in wiring duct, left
T10b - 10-Pin Connector
V7 - Left Coolant Fan
V35 - Right Coolant Fan

(193) - Ground connection -1-, in coolant fan wiring harness
(C11) - Wire connection, in coolant fan wiring harness
(K21) - Wire connection -1-, in coolant fan wiring harness
(L39) - Wire connection (A/C Pressure Switch) -1-, in Climatronic wiring harness
(L56) - Connector (Sensor), in wiring harness Climatronic
(L68) - Connection 2 (sensor) in Climatronic wiring harness



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

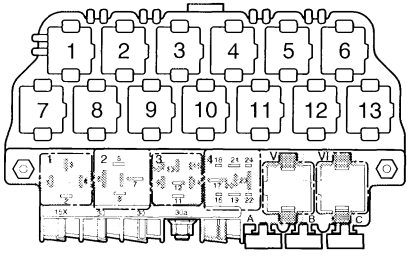
A - Battery
D - Ignition/Starter Switch
F18 - Coolant Fan Control (FC) Thermal Switch
J293 - Coolant Fan Control (FC) Control Module, in engine compartment, left
S16 - Fuse 16 in fuse holder
S164 - Fuse -3- (30) in fuse bracket/battery
S180 - Fuse -8- (30) in fuse bracket/battery
T2b - Double Connector, in engine compartment, in wiring duct, left
T3 - 3-Pin Connector
T4a - 4-Pin Connector
T10b - 10-Pin Connector
V51 - After-Run Coolant Pump

(85) - Ground connection -1-, in engine compartment wiring harness
(193) - Ground connection -1-, in coolant fan wiring harness
(501) - Threaded connection -2- (30) on the relay plate
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness
(K20) - Plus connection -1- (30), in coolant fan wiring harness
(K21) - Wire connection -1-, in coolant fan wiring harness

Interior rear view mirror (self-dimming), rain-sensor,

from September 1998

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97-14163

Relay location on the thirteenfold auxiliary relay panel, above relay panel:

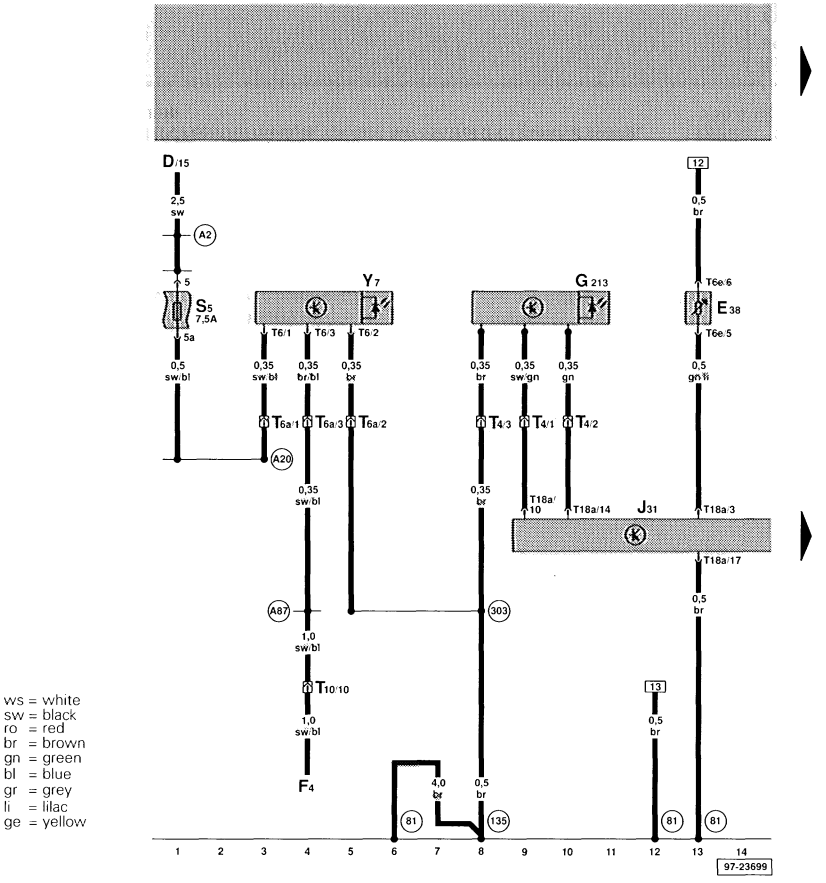
Relay panel:

V / **VI** Wiper/Washer Intermittent Relay (192)

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

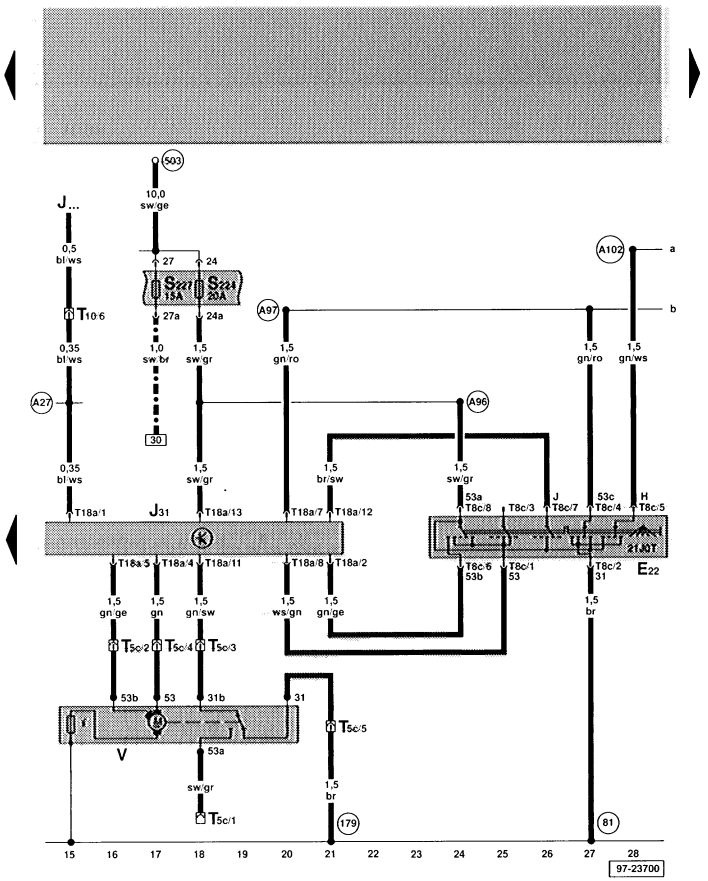
30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

D - Ignition/Starter Switch
E38 - Windshield Wiper Intermittent Regulator
F4 - Back-Up Light Switch
G213 - Rain-Sensor
J31 - Wiper/Washer Intermittent Relay, on relais panel
S5 - Fuse 5 in fuse holder
T4 - 4-Pin Connector, near front interior light
T6 - 6-Pin Connector, near front interior light
T6a - 6-Pin Connector, near front interior light
T6e - 6-Pin Connector
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T18a - 18-Pin Connector
Y7 - Automatic day/night interior mirror

(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(303) - Ground connection -rain-sensor/mirror-, in wiring harness interior
(A2) - Plus connection (15), in instrument panel wiring harness
(A20) - Wire connection (15a), in instrument panel wiring harness
(A87) - Connector (reverse lamp), in instrument panel wiring harness

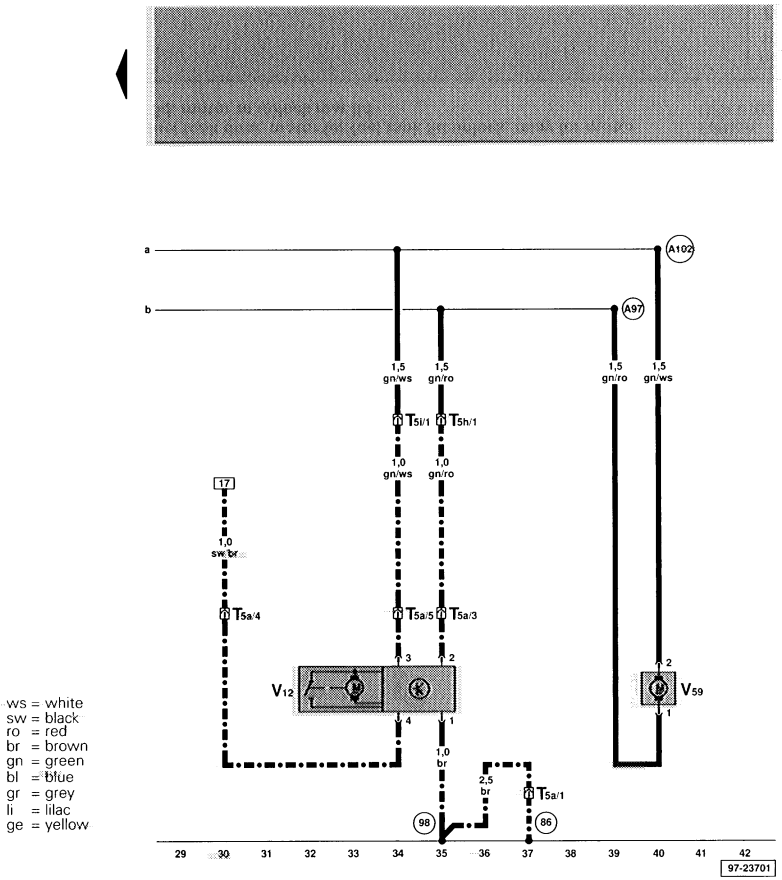


E22 - Windshield Wiper/Washer Switch
J31 - Wiper/Washer Intermittent Relay, on relais panel
J... - Engine Control Module (ECM)
S224 - Fuse 24 in fuse holder
S227 - Fuse 27 in fuse holder
T5c - 5-Pin Connector, on windshield wiper motor
T8c - 8-Pin Connector
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T18a - 18-Pin Connector
V - Windshield Wiper Motor

(81) - Ground connection -1-, in instrument panel wiring harness

(179) - Ground connection, in left headlight wiring harness
(503) - Threaded connection -2- (75x) on the relay plate
(A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness
(A96) - Connector (53a), in instrument panel wiring harness
(A97) - Connector (53), in instrument panel wiring harness
(A102) - Connector (windshield wiper), in instrument panel wiring harness

-•-•- Golf only



T5a - 5-Pin Connector, pink, connector station C-pillar, left (Golf only)
T5h - 5-Pin Connector, near left A-pillar, lower part, in harness
T5i - 5-Pin Connector, near left A-pillar, lower part, in harness
V12 - Motor for rear windshield wiper
V59 - Windshield and Rear Window Washer Pump

(86) - Ground connection -1-, in rear wiring harness
(98) - Ground connection, in rear lid wiring harness
(A97) - Connector (53), in instrument panel wiring harness
(A102) - Connector (windshield wiper), in instrument panel wiring harness

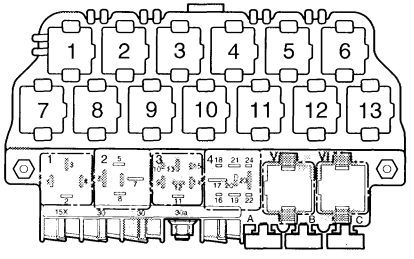
-•-•- Golf only

Comfort system (vehicles without power windows),

from September 1998

- **Anti-theft warning system**
- **Central locking system with remote control**
- **Fuel tank lid unlock system**
- **Heated outside mirrors**
- **Interior lights**
- **Luggage compartment light**
- **Power sunroof**
- **Rear lid unlock system**

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97-14163

Relay location on the thirteenfold auxiliary relay panel, above relay panel:

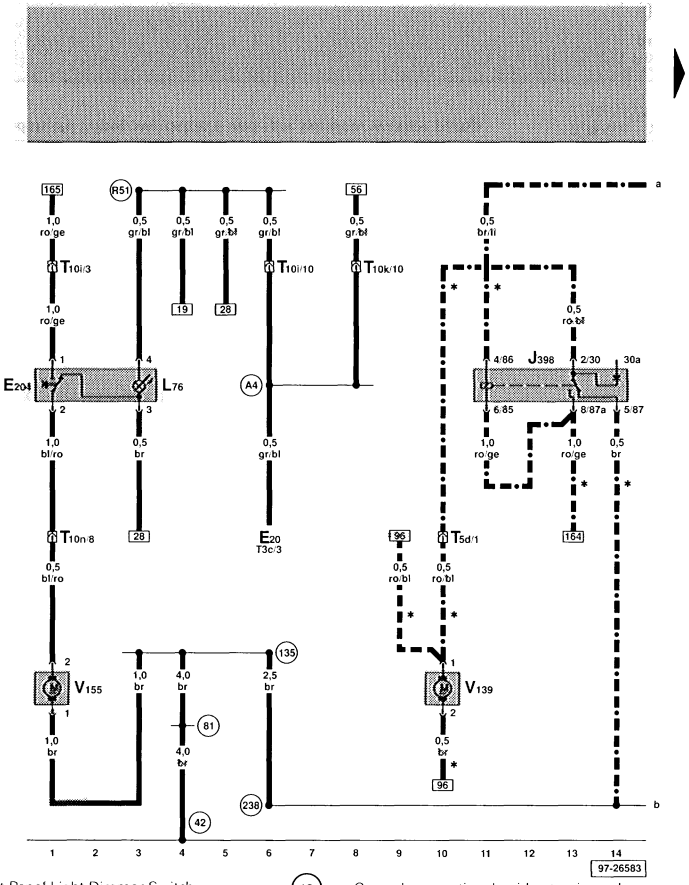
2 Relay for motor remote unlock rear lid (79)

Relay panel:

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

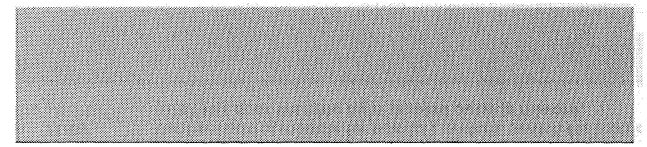


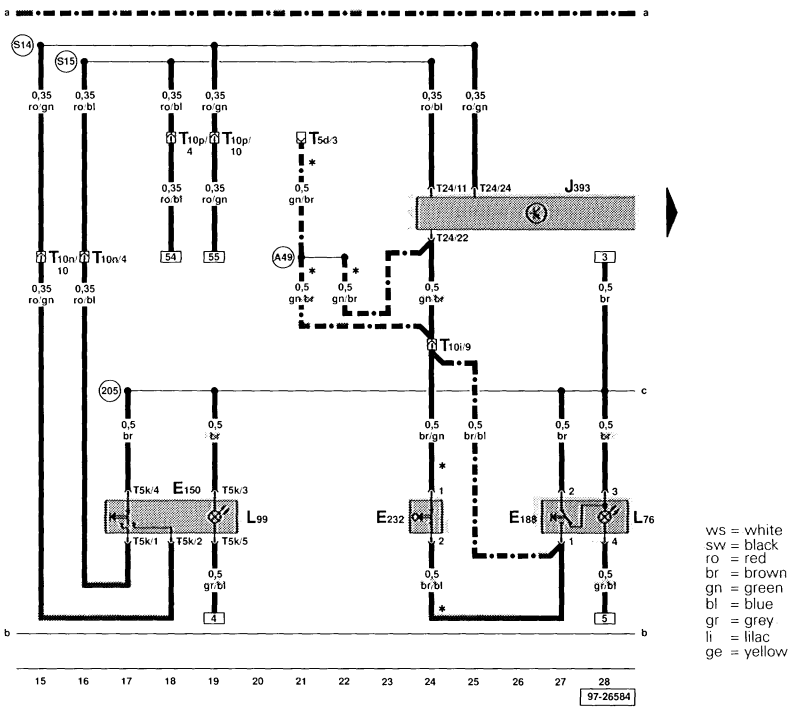
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E20 - Instrument Panel Light Dimmer Switch
E204 - Switch for remote/fuel tank door
J398 - Relay for motor remote unlock rear lid, on the thirteenfold auxiliary relay panel, above relay panel (through January 1999)*
L76 - Push Button Light
T3c - 3-Pin Connector
T5d - 5-Pin Connector, brown, connector station C-pillar, left
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10k - 10-Pin Connector, black, connector station A-pillar, right
T10n - 10-Pin Connector, brown, connector station A-pillar, left
V139 - Motor to unlock rear lid*
V155 - Motor for fuel tank lid unlock

(42) - Ground connection, beside steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(238) - Ground connection -1-, in wiring harness interior
(A4) - Plus connection (58b), in instrument panel wiring harness
(R51) - Connection (58b) in door wiring harness, driver side
-•--- - Through January 1999
* - Jetta only
- - - Beginning February 1999

Switch for remote/fuel tank door, motor for fuel tank lid unlock, relay for motor remote unlock rear lid, motor to unlock rear lid

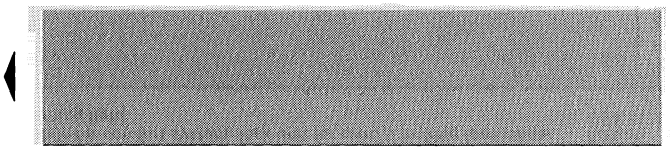


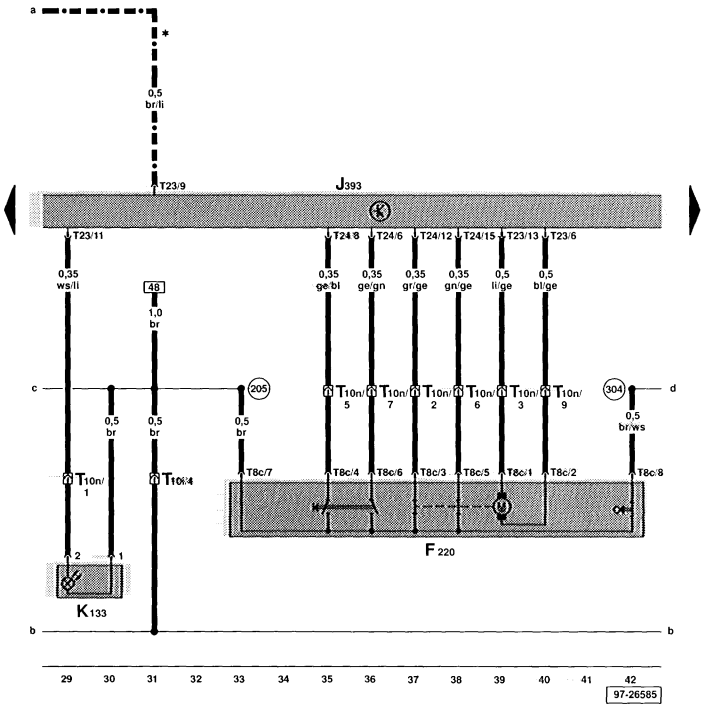


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E150 - Switch for interior lock, driver side
E188 - Switch for remote unlock, rear lid, driver side
E232 - Key switch for switching off remote unlock rear lid
J393 - Central control module for comfort system, behind instrument panel, left
L76 - Push Button Light
L99 - Lighting for switch interior lock
T5d - 5-Pin Connector, brown, connector station C-pillar, left
T5k - 5-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10n - 10-Pin Connector, brown, connector station A-pillar, left
T10p - 10-Pin Connector, brown, connector station A-pillar, right
T24 - 24-Pin Connector
(205) - Ground connection, in driver's door wiring harness
(A49) - Wire connection -1-, in instrument panel wiring harness
(S14) - Wire connection (open), in central locking system wiring harness
(S15) - Wire connection (closed), in central locking system wiring harness
-•--- - Through January 1999
* - Jetta only
-•-•- Golf only

Central control module for comfort system, switch for interior lock (driver side), switch for remote unlock rear lid

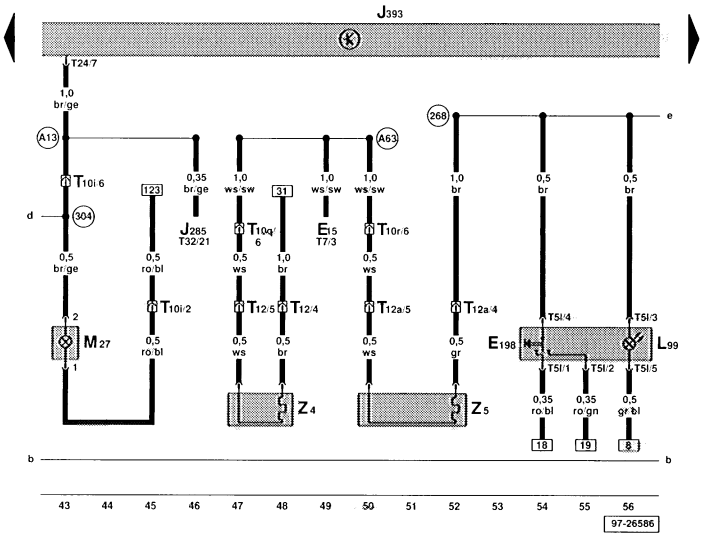




ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

F220 - Lock unit for central locking, driver side
J393 - Central control module for comfort system, behind instrument panel, left
K133 - Warning light for central locking -SAFE-
T8c - 8-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10n - 10-Pin Connector, brown, connector station A-pillar, left
T23 - 23-Pin Connector
T24 - 24-Pin Connector
(205) - Ground connection, in driver's door wiring harness
(304) - Ground connector -3-, in wiring harness door cable - driver side
* - Jetta only
-•--- - Through January 1999

Central control module for comfort system, lock unit for central locking, warning light for central locking -SAFE-



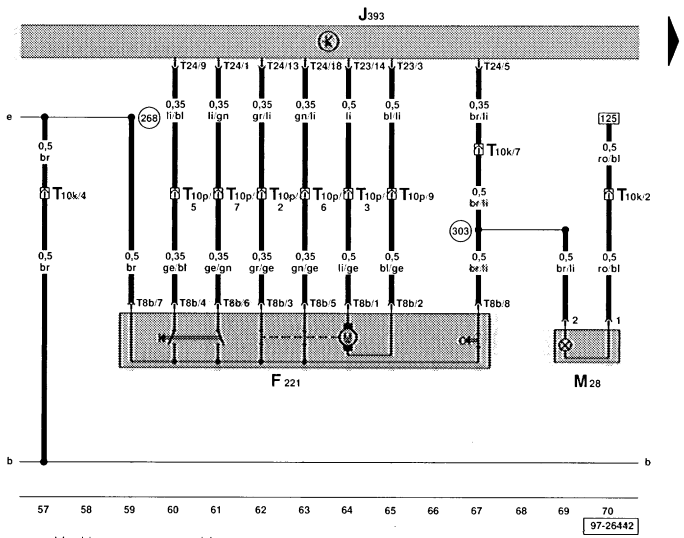
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E15 - Rear window defogger switch
E198 - Switch for interior lock, passenger side
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
L99 - Lighting for switch interior lock
M27 - Left Door Warning Light
T5l - 5-Pin Connector
T7 - 7-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10q - 10-Pin Connector, blue, connector station A-pillar, left
T10r - 10-Pin Connector, blue, connector station A-pillar, right
T12 - 12-Pin Connector
T12a - 12-Pin Connector
T24 - 24-Pin Connector
T32 - 32-Pin Connector, blue
Z4 - Heated outside mirror, driver side
Z5 - Heated outside mirror, passenger side

(268) - Ground connector -2-, in wiring harness door cable - passenger side
(304) - Ground connector -3-, in wiring harness door cable - driver side
(A13) - Wire connection (door contact switch) in instrument panel wiring harness
(A63) - Connector (mirror adjustment/-heated) in instrument panel wiring harness

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USA.5102.05.21

Central control module for comfort system, switch for interior lock (passenger side), left door warning light, heated outside mirrors



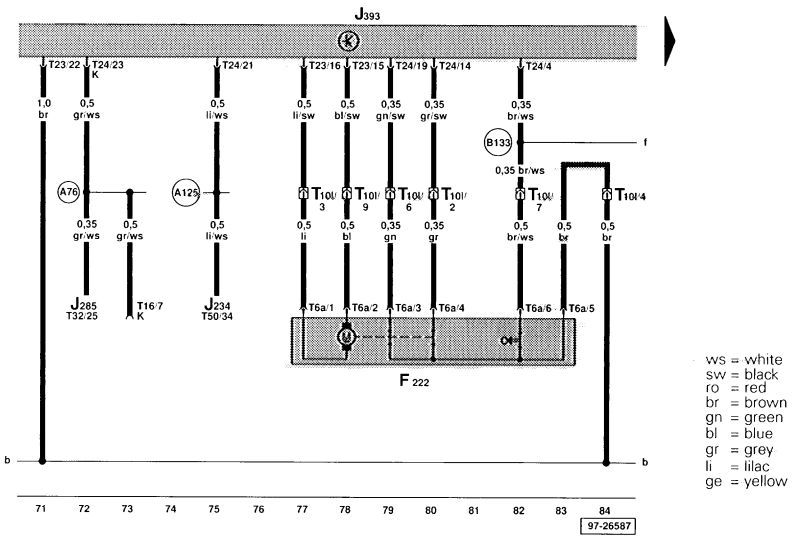
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

F221 - Lock unit for central locking, passenger side
J393 - Central control module for comfort system, behind instrument panel, left
M28 - Right Door Warning Light
T8b - 8-Pin Connector
T10k - 10-Pin Connector, black, connector station A-pillar, right
T10p - 10-Pin Connector, brown, connector station A-pillar, right
T23 - 23-Pin Connector
T24 - 24-Pin Connector

(268) - Ground connector -2-, in wiring harness door cable - passenger side
(303) - Ground connector -3-, in wiring harness door cable - passenger side

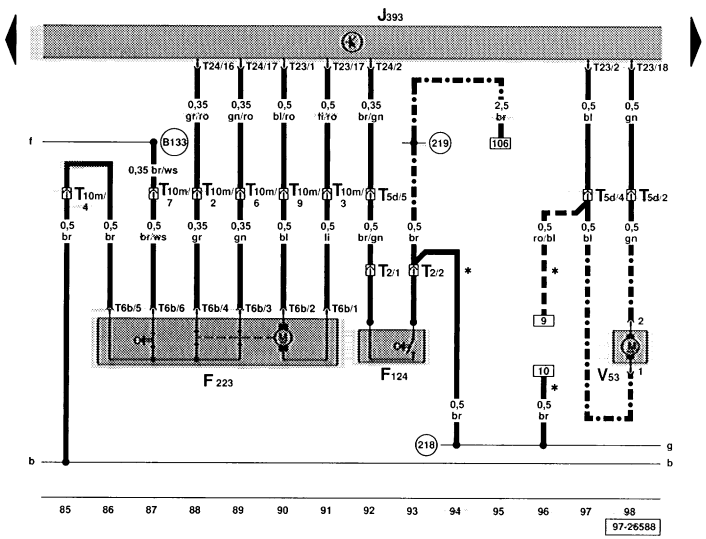
Central control module for comfort system, lock unit for central locking (passenger side), right door warning light

Edition 11/99
USA.5102.05.21



F222 - Lock unit for central locking, rear, left
J234 - Airbag Control Module, behind console, lower part
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
T6a - 6-Pin Connector
T10l - 10-Pin Connector, black, connector station B-pillar, left
T16 - Data Link Connector (DLC), below instrument panel, left
T23 - 23-Pin Connector
T24 - 24-Pin Connector
T32 - 32-Pin Connector, blue
T50 - 50-Pin Connector

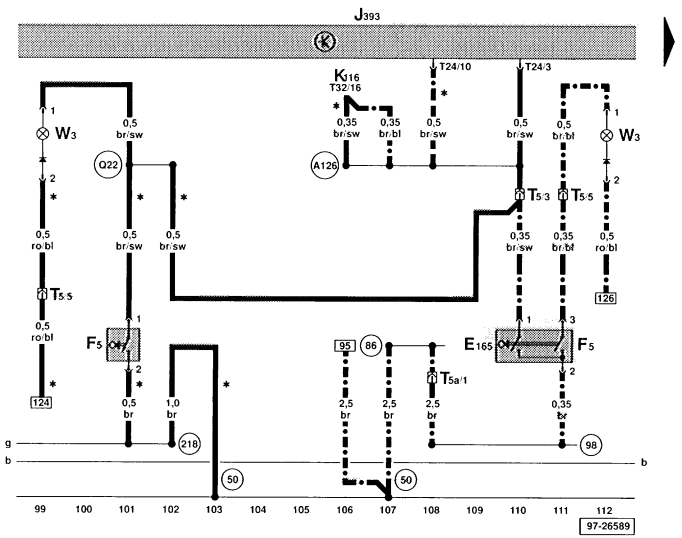
(A76) - Connector (K-diagnosis wire) in instrument panel wiring harness
(A126) - Connection (crash signal) in instrument panel wiring harness
(B133) - Connector (central locking open), in wiring harness interior



F124 - Trunk Lock Alarm/Central Locking Switch
F223 - Lock unit for central locking, rear, right
J393 - Central control module for comfort system, behind instrument panel, left
T2 - Double Connector, in rear lid
T5d - 5-Pin Connector, brown, connector station C-pillar, left
T6b - 6-Pin Connector
T10m - 10-Pin Connector, black, connector station B-pillar, right
T23 - 23-Pin Connector
T24 - 24-Pin Connector
V53 - Decklid Central Locking System Motor (Golf only)

(218) - Ground connection -1-, in rear lid wiring harness
(219) - Ground connection -2-, in rear lid wiring harness
(B133) - Connector (central locking open), in wiring harness interior

* - Jetta only
--- - Beginning February 1999
-•-•- Golf only



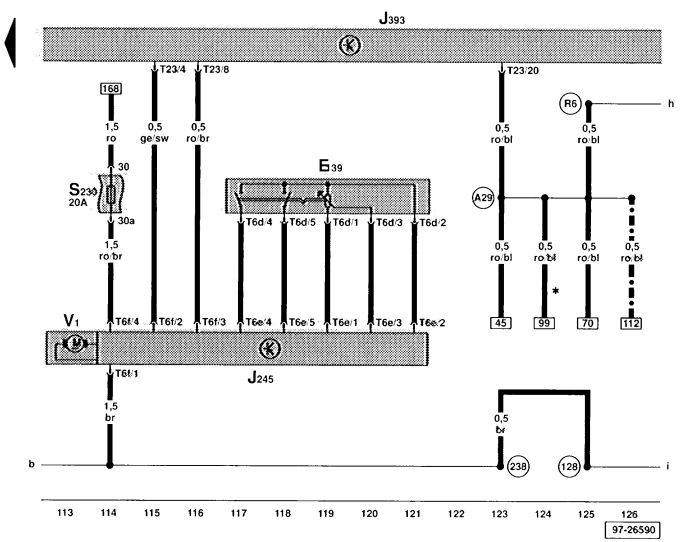
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E165 - Trunk Lid Release Switch
F5 - Luggage Compartment Light Switch
J393 - Central control module for comfort system, behind instrument panel, left
K116 - Warning light for rear lid unlocked, in instrument cluster
T5 - 5-Pin Connector, black, connector station C-pillar, left
T5a - 5-Pin Connector, pink, connector station C-pillar, left (Golf only)
T24 - 24-Pin Connector
T32 - 32-Pin Connector, blue, on Instrument cluster
W3 - Luggage compartment Light

(50) - Ground connection, in luggage compartment, left
(86) - Ground connection -1-, in rear wiring harness
(98) - Ground connection, in rear lid wiring harness
(218) - Ground connection -1-, in rear lid wiring harness
(A126) - Connection (contact switch in rear lid) in instrument panel wiring harness
(Q22) - Wire connection -1-, in rear lid wiring harness

-•-•- - Through January 1999
* - Jetta only
-•-•- Golf only

Central control module for comfort system, trunk lid release switch, luggage compartment light switch



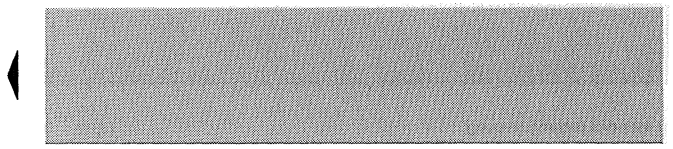
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

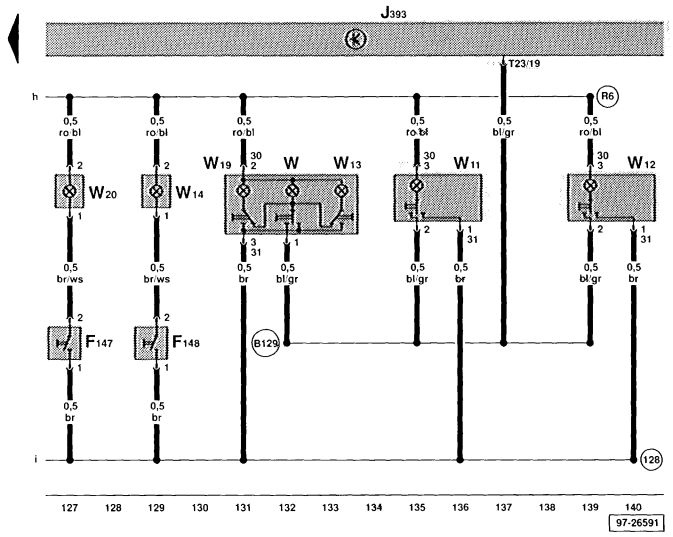
E139 - Sunroof Regulator
J245 - Power Sunroof Control Module
J393 - Central control module for comfort system, behind instrument panel, left
S230 - Fuse 30 in fuse holder
T6d - 6-Pin Connector
T6e - 6-Pin Connector
T6f - 6-Pin Connector
T23 - 23-Pin Connector
V1 - Sunroof Motor

(128) - Ground connection -1-, in interior light wiring harness
(238) - Ground connection -1-, in wiring harness interior
(A29) - Wire connection (interior light), in instrument panel wiring harness
(R6) - Plus connection -1-, in interior light wiring harness

* - Jetta only
-•-•- Golf only

Central control module for comfort system, power sunroof control module, sunroof regulator, sunroof motor



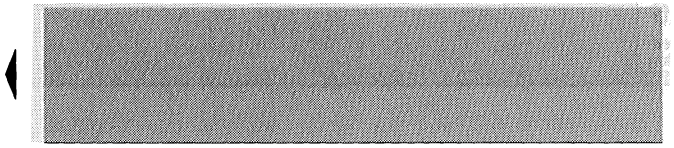


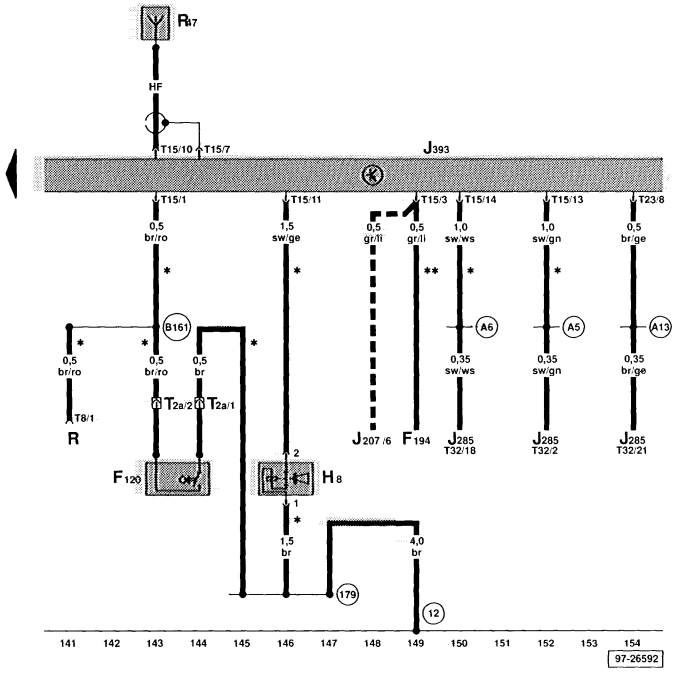
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

F147 - Left Make-Up Mirror Light Switch
F148 - Right Make-Up Mirror Light Switch
J393 - Central control module for comfort system, behind instrument panel, left
W - Front Interior Light
W11 - Left Rear Reading Light
W12 - Right Rear Reading Light
W13 - Right Front Map/Reading Light
W14 - Right Make-up Mirror Light
W19 - Left Front Reading Light
W20 - Left Make-up Mirror Light
T23 - 23-Pin Connector

(128) - Ground connection -1-, in interior light wiring harness
(B129) - Connector (interior light 3/L) in wiring harness interior
(R6) - Plus connection -1-, in interior light wiring harness

Edition 11/99 **Central control module for comfort system, Interior lights, make-up mirror lights**
USA.5102.05.21



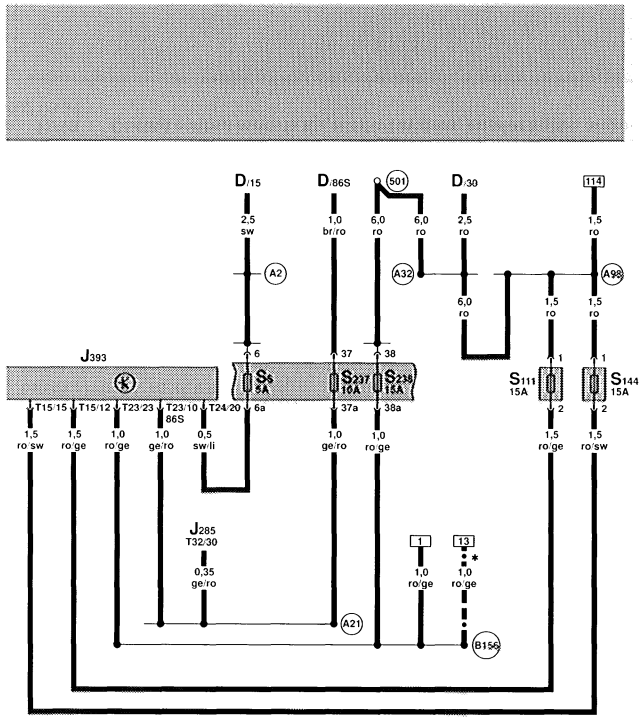


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

F120 - Hood Alarm Switch*
F194 - Clutch Pedal Position (CPP) Switch**
H8 - Alarm Horn*
J207 - Starting Interlock Relay
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
R - Radio
R47 - Antenna wire for central locking and antitheft warning system
T2a - Double Connector, near headlight, right
T8 - 8-Pin Connector, on radio
T15 - 15-Pin Connector
T23 - 23-Pin Connector
T32 - 32-Pin Connector, blue, on Instrument cluster

(12) - Ground connection, in engine compartment, left
(179) - Ground connection, in left headlight wiring harness
(A5) - Plus connection (right turn signal), in instrument panel wiring harness
(A6) - Plus connection (left turn signal), in instrument panel wiring harness
(A13) - Wire connection (door contact switch) in instrument panel wiring harness
(B161) - Connector (anti-theft warning system), in wiring harness interior
* - Vehicles with anti-theft warning system only
** - Manual transmission only
--- - Automatic transmission only

Central control module for comfort system, antitheft warning system, antenna wire for central locking and antitheft warning system
Edition 11/99
USA.5102.05.21



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

D - Ignition/Starter Switch
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
S6 - Fuse 6 in fuse holder
S111 - Alarm System and Anti-Theft Fuse, above the thirteenfold auxiliary relay panel
S144 - Fuse for central locking/anti-theft warning system, above the thirteenfold auxiliary relay panel
S237 - Fuse 37 in fuse holder
S238 - Fuse 38 in fuse holder
T15 - 15-Pin Connector
T23 - 23-Pin Connector
T24 - 24-Pin Connector
T32 - 32-Pin Connector, blue
(501) - Threaded connection -2- (30) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A21) - Wire connection (86s), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness
(B156) - Plus connector (30a), in wiring harness interior
* - Jetta only
-•-- - Through January 1999

Edition 11/99
USA.5102.05.21

Central control module for comfort system

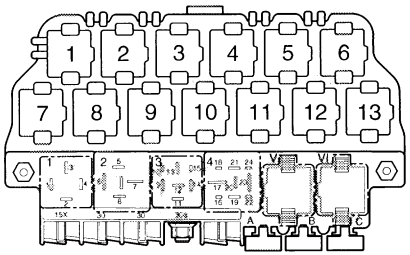
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Power seats and mirror adjustment with memory,

from September 1998

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

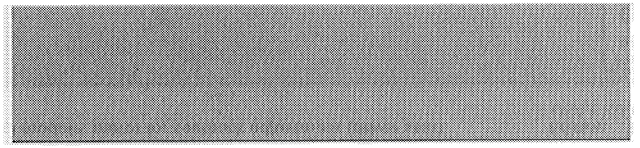
2 Load Reduction Relay (18)/ (100)

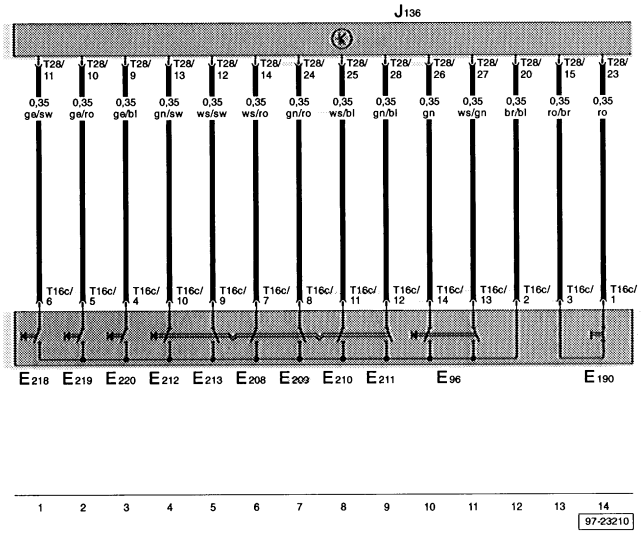
Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

Repair Manual page number **97-220**



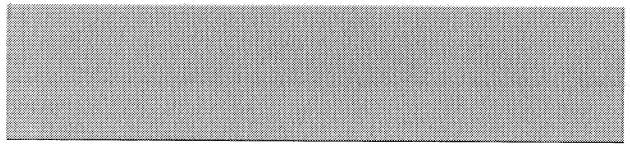


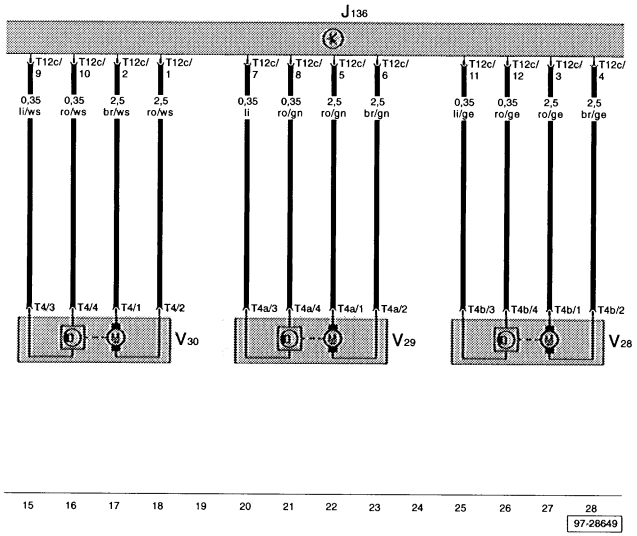
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E96 - Driver's Backrest Adjustment Switch
E190 - Emergency Shut-Off Switch for Memory
E208 - Button for front height adjustment, upwards, driver seat
E209 - Button for front height adjustment, downwards, driver seat
E210 - Button for rear height adjustment, upwards, driver seat
E211 - Button for rear height adjustment, downwards, driver seat
E212 - Button for length adjustment, forward, driver seat
E213 - Button for length adjustment, backward, driver seat
E218 - Button for driver 1, memory seat
E219 - Button for driver 2, memory seat
E220 - Button for driver 3, memory seat
J136 - Memory Seat Control Module, below driver's seat
T16c - 16-Pin Connector
T28 - 28-Pin Connector

Memory seat control module, button for front -and rear height adjustment, button for length adjustment, driver's backrest adjustment switch, emergency shut-off switch for memory

Repair Manual page number **97-221**

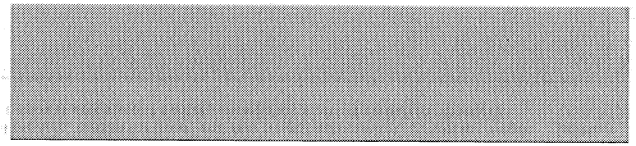


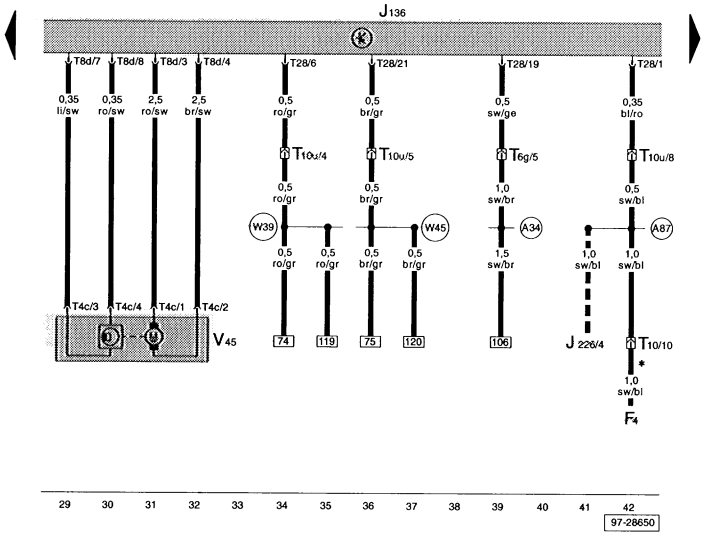


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

J136 - Memory Seat Control Module, below driver's seat
T4 - 4-Pin Connector
T4a - 4-Pin Connector
T4b - 4-Pin Connector
T12c - 12-Pin Connector
V28 - Driver's seat fore/aft adjusting motor
V29 - Motor for front height adjustment, driver seat
V30 - Motor for rear height adjustment, driver seat

Edition 12/00 **Memory seat control module, driver's seat fore/aft adjusting motor, motor for front height adjustment (driver seat), motor for rear height adjustment (driver seat)**
USA.5102.09.21





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

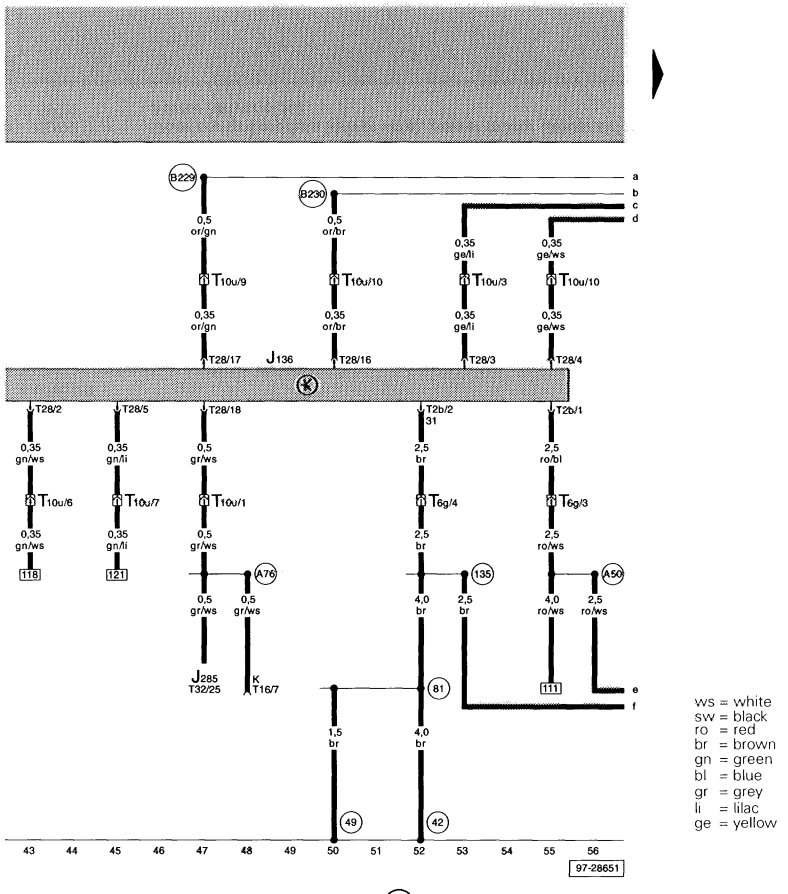
F4 - Back-Up Light Switch
J136 - Memory Seat Control Module
J226 - Park/Neutral Position (PNP) Relay
T4c - 4-Pin Connector
T6g - 6-Pin Connector, red, below driver's seat
T8d - 8-Pin Connector
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10u - 10-Pin Connector, brown, below driver's seat
T28 - 28-Pin Connector
V45 - Motor for seatback adjustment, driver seat

(A34) - Wire connection (75x), in instrument panel wiring harness
(A87) - Connector (RF), in instrument panel wiring harness
(W39) - Connection -1- (mirror memory), in floor wiring harness
(W45) - Connection -2- (mirror memory), in floor wiring harness

* - Manual transmission only
--- Automatic transmission only

Memory seat control module, motor for seatback adjustment (driver seat)

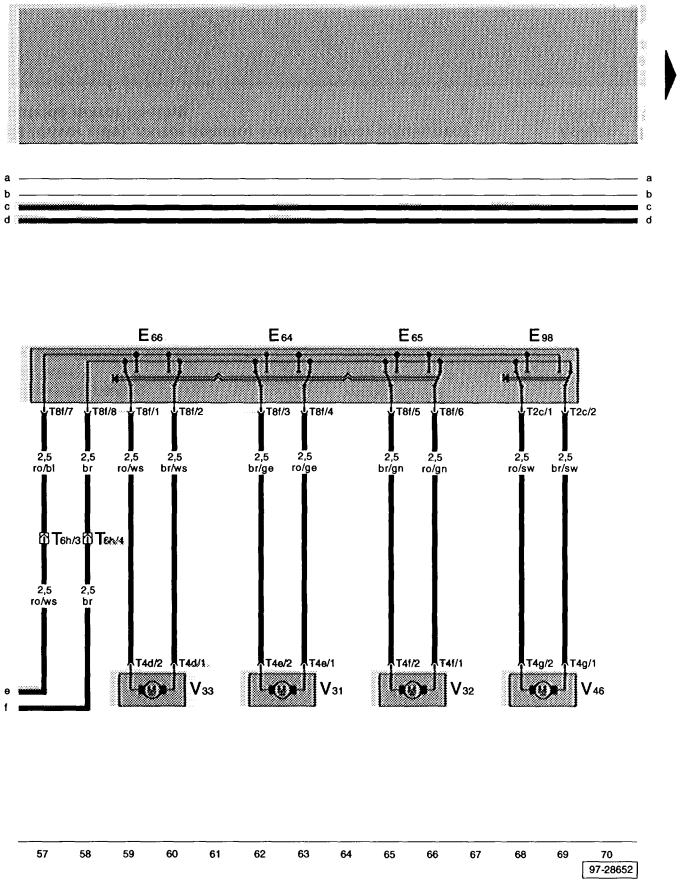
Edition 12/00
USA.5102.09.21



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

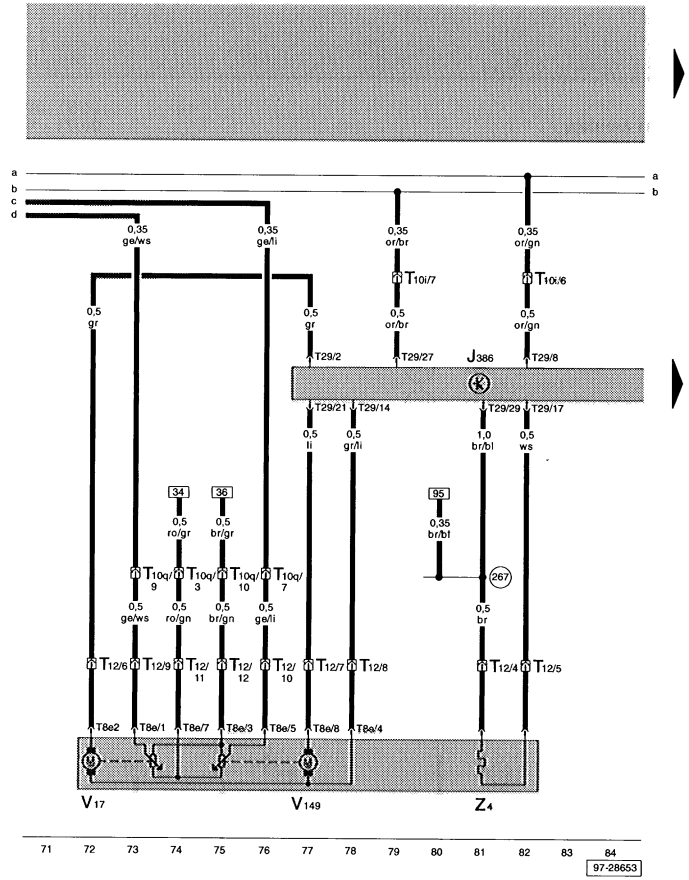
J136 - Memory Seat Control Module, below driver's seat
J285 - Control module with indicator unit in instrument panel insert
T2b - Double Connector
T6g - 6-Pin Connector, red, below driver's seat
T10u - 10-Pin Connector, brown, below driver's seat
T16 - 16-Pin Connector, On Board Diagnostic (OBD), below instrument panel, left
T28 - 28-Pin Connector
T32 - 32-Pin Connector, blue

(42) - Ground connection, beside steering column
(49) - Ground connection on steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(A50) - Plus connection (30a), in instrument panel wiring harness
(A76) - Connector (K-diagnosis wire) in instrument panel wiring harness
(B229) - Connection (high bus), in instrument panel wiring harness
(B230) - Connection (low bus), in instrument panel wiring harness



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E64 - Passenger's Seat Fore/Aft Adjusting Switch
E65 - Passenger's Seat Front Height Adjusting Switch
E66 - Passenger's Seat Rear Height Adjusting Switch
E98 - Passenger Backrest Adjustment Switch
T2c - Double Connector
T4d - 4-Pin Connector
T4e - 4-Pin Connector
T4f - 4-Pin Connector
T4g - 4-Pin Connector
T6h - 6-Pin Connector, red, below passenger's seat
T8f - 8-Pin Connector
V31 - Passenger's Seat Fore/Aft Adjusting Motor
V32 - Passenger's Seat Front Height Adjusting Motor
V33 - Passenger's Seat Rear Height Adjusting Motor
V46 - Passenger's Backrest Adjusting Motor



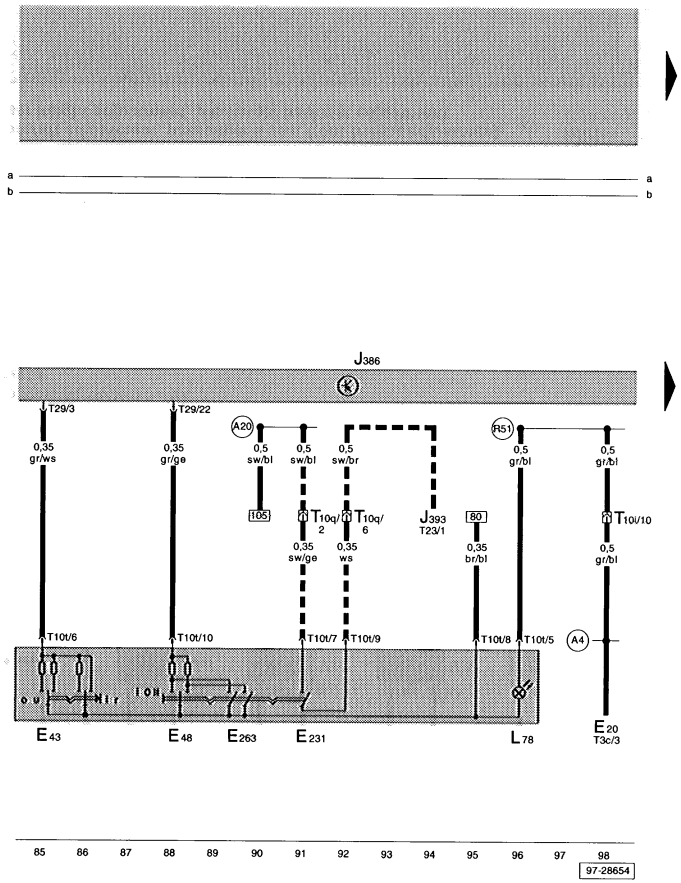
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

J386 - Door control module, driver side
T8e - 8-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10q - 10-Pin Connector, blue, connector station A-pillar, left
T12 - 12-Pin Connector
T29 - 29-Pin Connector
V17 - Driver's Side Mirror Adjustment Motor
V149 - Motor for mirror adjustment, driver side
Z4 - Heated outside mirror, driver side

(267) - Ground connector -2-, in wiring harness door cable - driver side

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Door control module (driver side), power mirror (driver side), heated outside mirror (driver side)



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

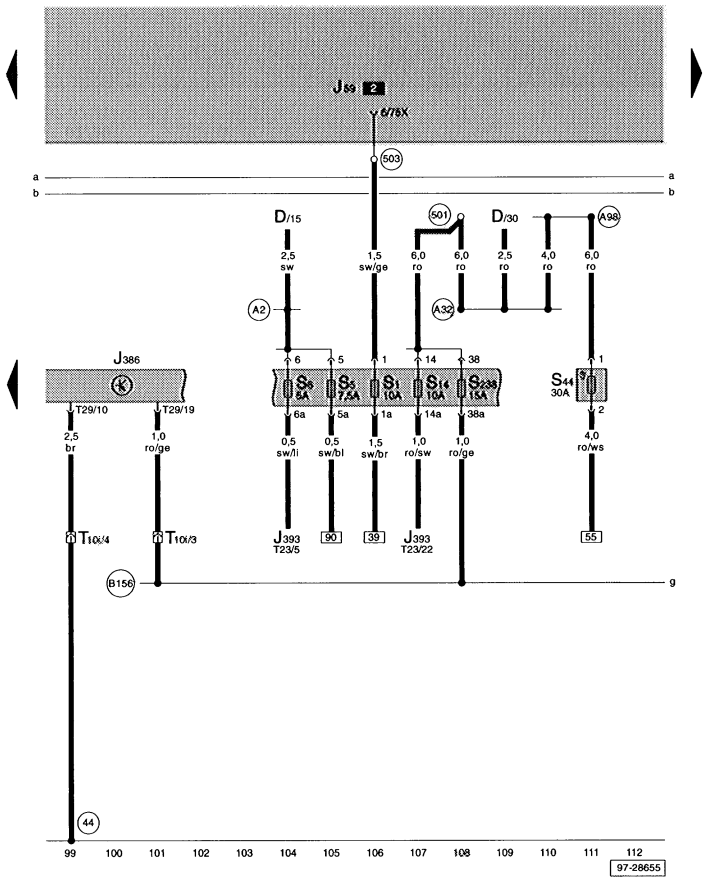
E20 - Instrument Panel Light Dimmer Switch
E43 - Mirror Adjustment Switch
E48 - Mirror Selector Switch
E231 - Switch for outside mirror heating
E263 - Mirror fold-away Switch*
J386 - Door control module, driver side
J393 - Central control module for comfort system, behind instrument panel, left
L78 - Mirror Adjusting Switch Light
T3c - 3-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10q - 10-Pin Connector, blue, connector station A-pillar, left
T10t - 10-Pin Connector
T23 - 23-Pin Connector
T29 - 29-Pin Connector

(A4) - Plus connection (58b), in instrument panel wiring harness
(A20) - Wire connection (15a), in instrument panel wiring harness
(R51) - Connection (58b), in driver's door wiring harness

* - Only on vehicles with mirror fold-away function
--- Only on vehicles with separate switch for outside mirror heating

Door control module (driver side), mirror selector switch, mirror adjustment switch, switch for outside mirror heating

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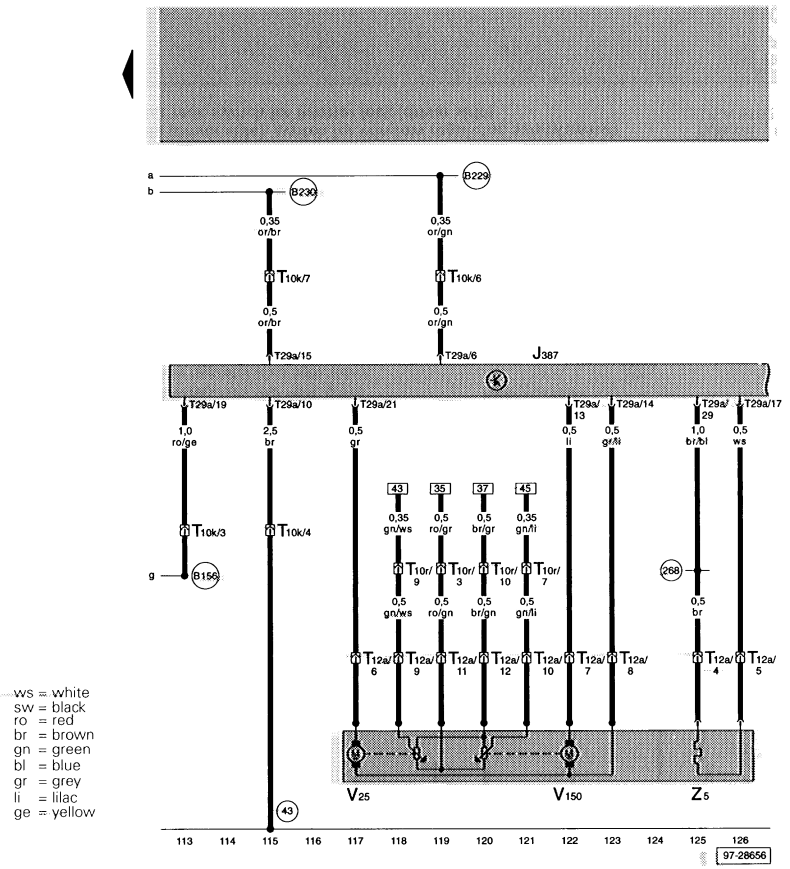


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

D - Ignition/Starter Switch
J59 - Load Reduction Relay
J386 - Door control module, driver side
J393 - Central control module for comfort system, behind instrument panel, left
S1 - Fuse 1 in fuse holder
S5 - Fuse 5 in fuse holder
S6 - Fuse 6 in fuse holder
S14 - Fuse 14 in fuse holder
S44 - Power (Memory) Seat Circuit Breaker, on relay panel
S238 - Fuse 38 in fuse holder
T10i - 10-Pin Connector, black, connector station A-pillar, left
T23 - 23-Pin Connector
T29 - 29-Pin Connector

(44) - Ground connection, on left A-pillar, lower part
(501) - Threaded connection -2- (30) on the relay plate
(503) - Threaded connection -2- (75x) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness
(B156) - Plus connector (30a), in wiring harness interior

Door control module (driver side)



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

J387 - Door Control Module, passenger side
T10k - 10-Pin Connector, black, connector station A-pillar, right
T10r - 10-Pin Connector, blue, connector station A-pillar, right
T12a - 12-Pin Connector
T29a - 29-Pin Connector
V25 - Passenger's Side Mirror Adjustment Motor
V150 - Motor for mirror adjustment, passenger side
Z5 - Heated outside mirror, passenger side

(43) - Ground connection, on right A-pillar, lower part
(268) - Ground connector -2-, in wiring harness door cable - passenger side
(B156) - Plus connector (30a), in wiring harness interior
(B229) - Connection (high bus), in instrument panel wiring harness
(B230) - Connection (low bus), in instrument panel wiring harness

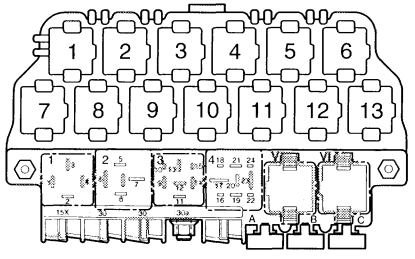
Door control module (passenger side), power mirror (passenger side), heated outside mirror (passenger side)

Comfort System (vehicles with power windows),

from September 1998

- Anti-theft warning system
- Central locking system with remote control
- Fuel tank lid unlock system
- Heated power mirrors
- Interior lights
- Luggage compartment light
- Power sunroof
- Power windows
- Rear lid unlock system

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97-14163

Relay location on the thirteenfold auxiliary relay panel, above relay panel:

2 Relay for motor remote unlock rear lid (79)

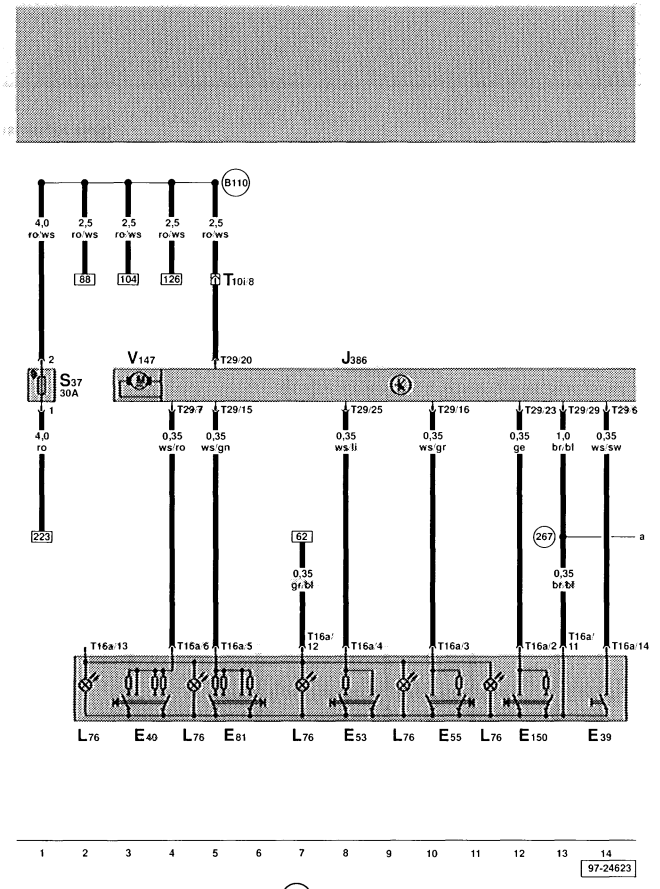
Relay panel:

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

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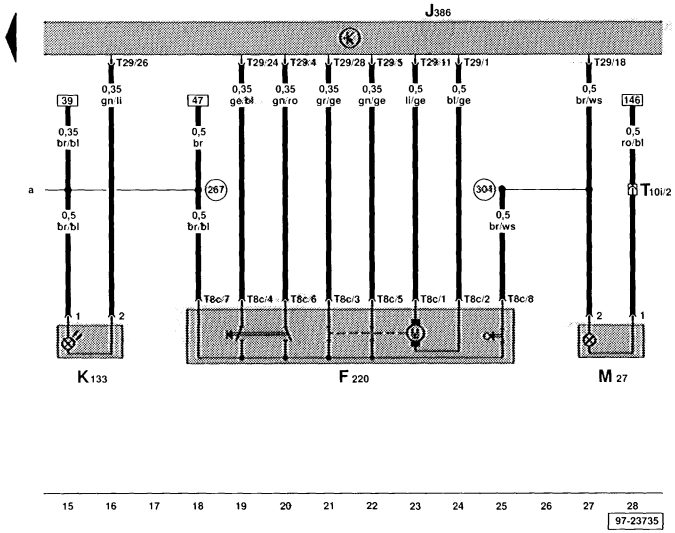
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E39 - Safety switch for window regulator rear
E40 - Switch for window regulator front left
E53 - Switch for window regulator rear left, driver
E55 - Switch for window regulator rear right, driver
E81 - Switch for window regulator front right, driver
E150 - Switch for interior lock, driver side
J386 - Door control module, driver side
L76 - Push Button Light
S37 - Fuse for window regulator (circuit breaker), on thirteen position auxiliary relay panel
T10i - 10-Pin Connector, black, connector station A-pillar, left
T16a - 16-Pin Connector
T29 - 29-Pin Connector
V147 - Motor for window regulator, driver side

(267) - Ground connector -2-, in wiring harness door cable - driver side
(B110) - Connection (30), window regulator) in wiring harness interior

Door control module (driver side), switch for window regulator, safety switch for window regulator rear, switch for interior lock (driver side)

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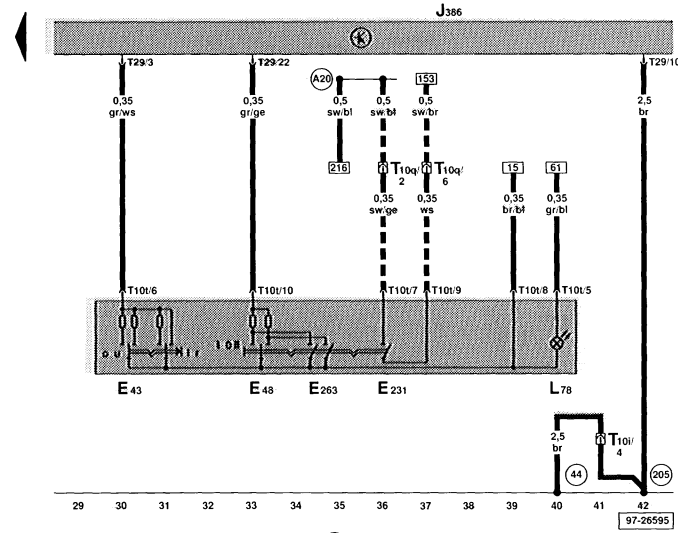


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

F220 - Lock unit for central locking, driver side
J386 - Door control module, driver side
K133 - Warning light for central locking -SAFE-
M27 - Left Door Warning Light
T8c - 8-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T29 - 29-Pin Connector

(267) - Ground connector -2-, in wiring harness door cable - driver side
(304) - Ground connector -3-, in wiring harness door cable - driver side

Door control module (driver side), lock unit for central locking (driver side), warning light for central locking -SAFE-, left door warning light



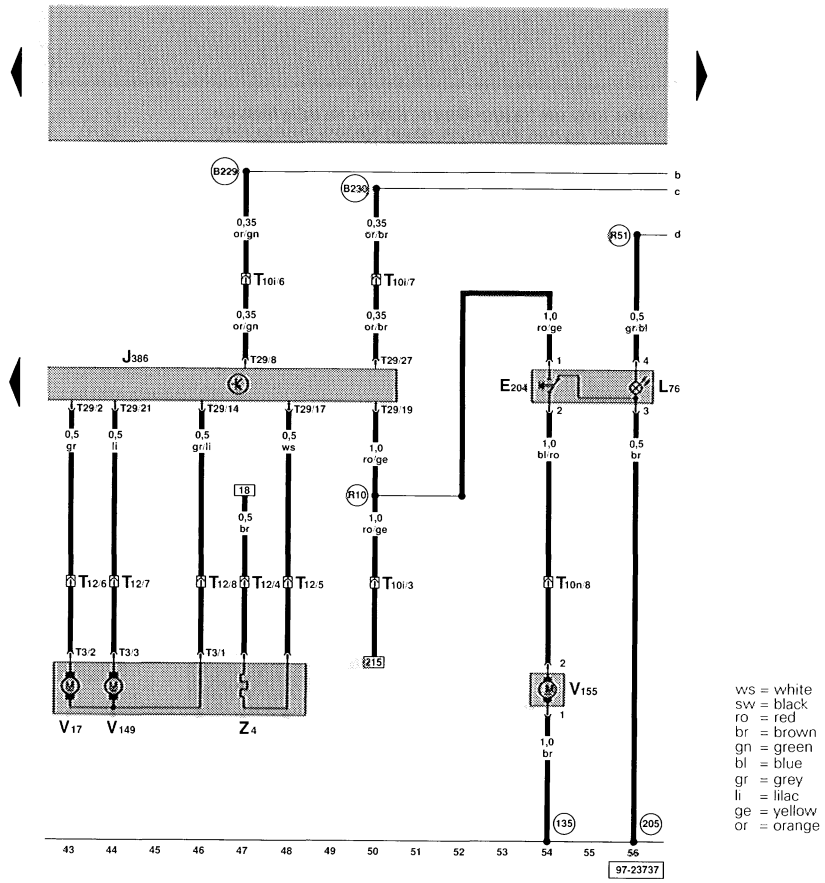
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E43 - Mirror Adjustment Switch
E48 - Mirror Selector Switch
E231 - Switch for outside mirror heating
E263 - Mirror fold-away Switch*
J386 - Door control module, driver side
L78 - Mirror Adjusting Switch Light
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10q - 10-Pin Connector, blue, connector station A-pillar, left
T10t - 10-Pin Connector
T29 - 29-Pin Connector

(44) - Ground connection, on left A-pillar, lower part
(205) - Ground connection, in driver's door wiring harness
(A20) - Wire connection (15a), in instrument panel wiring harness

* - If equipped
--- - Vehicles with seperate heated outside mirrors only

Door control module (driver side), mirror adjustment switch, mirror selector switch, switch for outside mirror heating



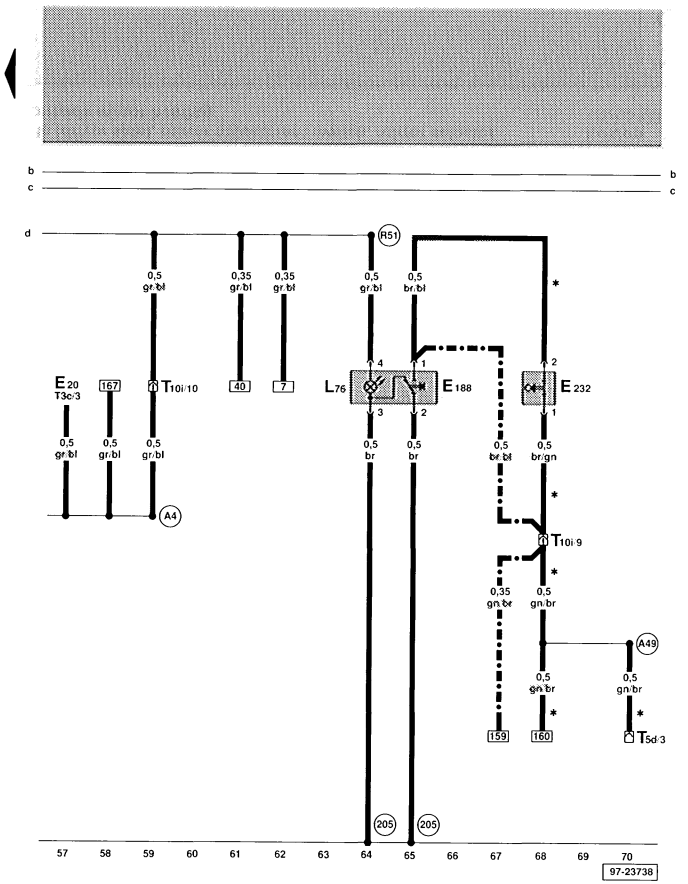
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E204 - Switch for remote/fuel tank door
J386 - Door control module, driver side
L76 - Push Button Light
T3 - 3-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10n - 10-Pin Connector, brown, connector station A-pillar, left
T12 - 12-Pin Connector
T29 - 29-Pin Connector
V17 - Driver's Side Mirror Adjustment Motor
V149 - Motor for mirror adjustment, driver side
V155 - Motor for fuel tank lid unlock
Z4 - Heated outside mirror, driver side

(135) - Ground connection -2-, in instrument panel wiring harness
(205) - Ground connection, in driver's door wiring harness
(B229) - Connection (high bus), in instrument panel wiring harness
(B230) - Connection (low bus), in instrument panel wiring harness
(R10) - Plus connection -1- (30a), in driver's door wiring harness
(R51) - Connection (58b), in driver's door wiring harness

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Door control module (driver side), switch for remote/fuel tank door, motor for fuel tank lid unlock, power mirror (driver side), heated outside mirror (driver side)



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

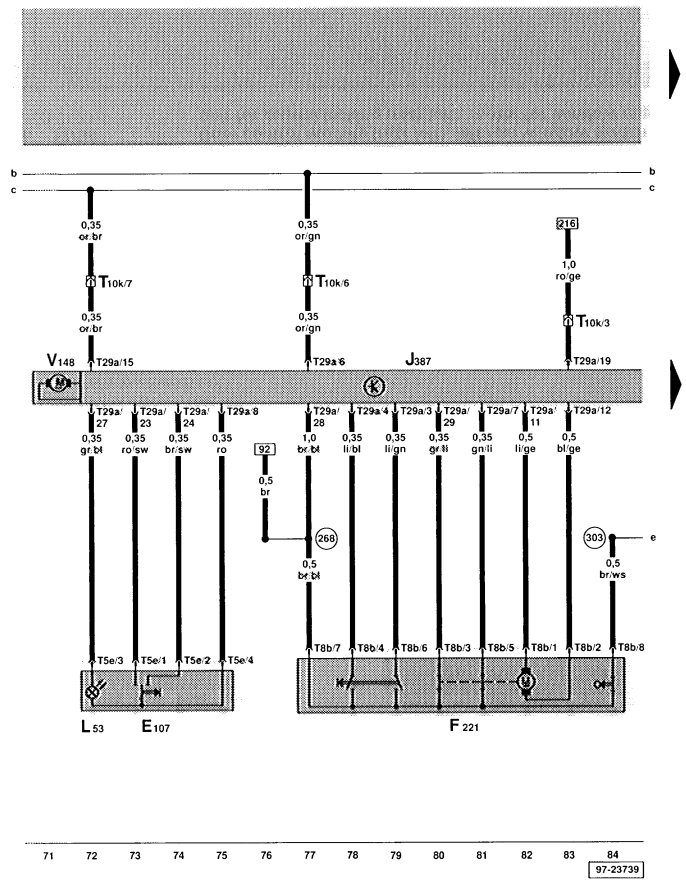
E20 - Instrument Panel Light Dimmer Switch
E188 - Switch for remote unlock, rear lid, driver side
E232 - Key switch for switching off remote unlock rear lid
L76 - Push Button Light
T3c - 3-Pin Connector
T5d - 5-Pin Connector, brown, connector station C-pillar, left
T10i - 10-Pin Connector, black, connector station A-pillar, left

(205) - Ground connection, in driver's door wiring harness
(A4) - Plus connection (58b), in instrument panel wiring harness
(A49) - Wire connection -1-, in instrument panel wiring harness
(R51) - Connection (58b), in driver's door wiring harness

* - Jetta only
-•-•- Golf only

Switch for remote unlock rear lid (driver side), key switch for switching off remote unlock rear lid

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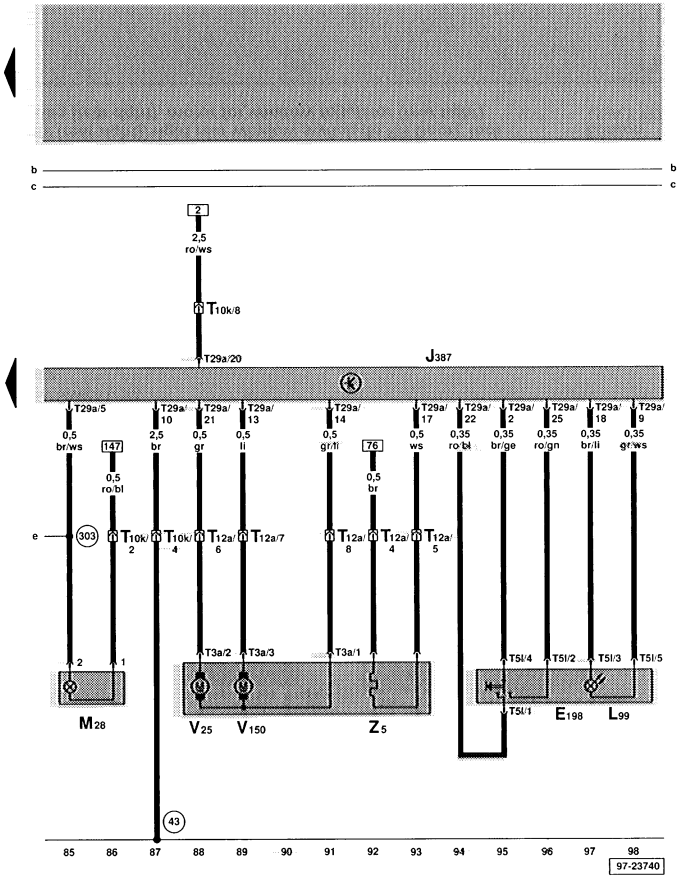
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E107 - Switch for window regulator, in passenger door
F221 - Lock unit for central locking, passenger side
J387 - Door control module, passenger side
L53 - Power Window Switch Light
T5e - 5-Pin Connector
T8b - 8-Pin Connector
T10k - 10-Pin Connector, black, connector station A-pillar, right
T29a - 29-Pin Connector
V148 - Motor for window regulator, passenger side

(268) - Ground connector -2-, in wiring harness door cable - passenger side
(303) - Ground connector -3-, in wiring harness door cable - passenger side

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Door control module (passenger side), switch for window regulator (passenger door), lock unit for central locking (passenger side)



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

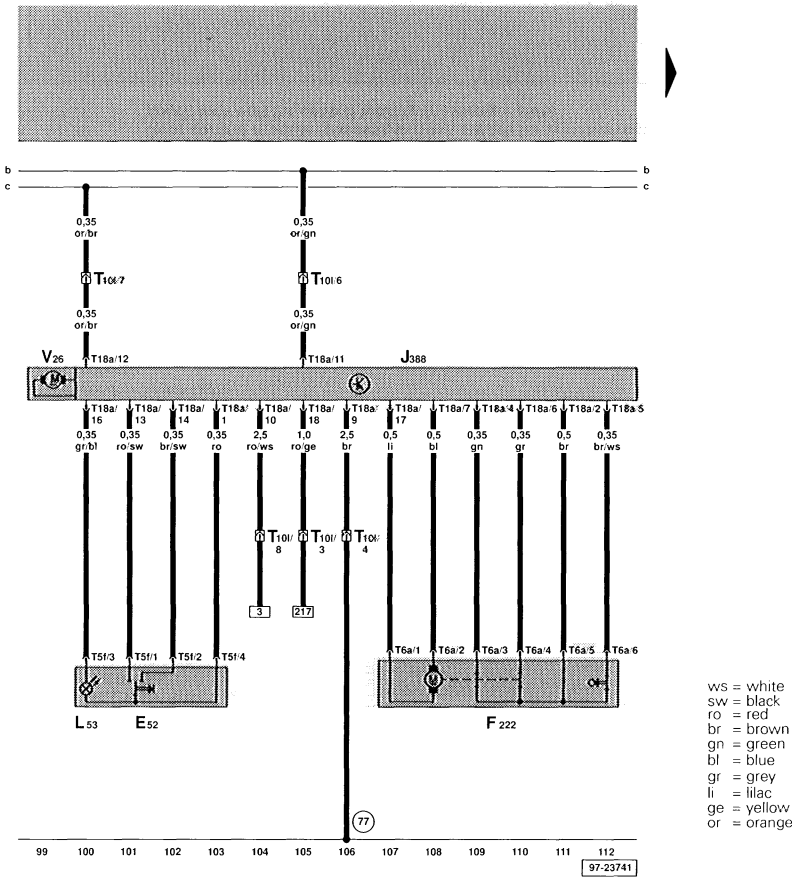
E198 - Switch for interior lock, passenger side
J387 - Door control module, passenger side
L99 - Lighting for switch interior lock
M28 - Right Door Warning Light
T3a - 3-Pin Connector
T5l - 5-Pin Connector
T10k - 10-Pin Connector, black, connector station A-pillar, right
T12a - 12-Pin Connector
T29a - 29-Pin Connector
V25 - Passenger's Side Mirror Adjustment Motor
V150 - Motor for mirror adjustment, passenger side
Z5 - Heated outside mirror, passenger side

(43) - Ground connection, on right A-pillar, lower part

(303) - Ground connector -3-, in wiring harness door cable - passenger side

Door control module (passenger side), switch for interior lock (passenger side), right door warning light, power mirror (passenger side), heated outside mirror

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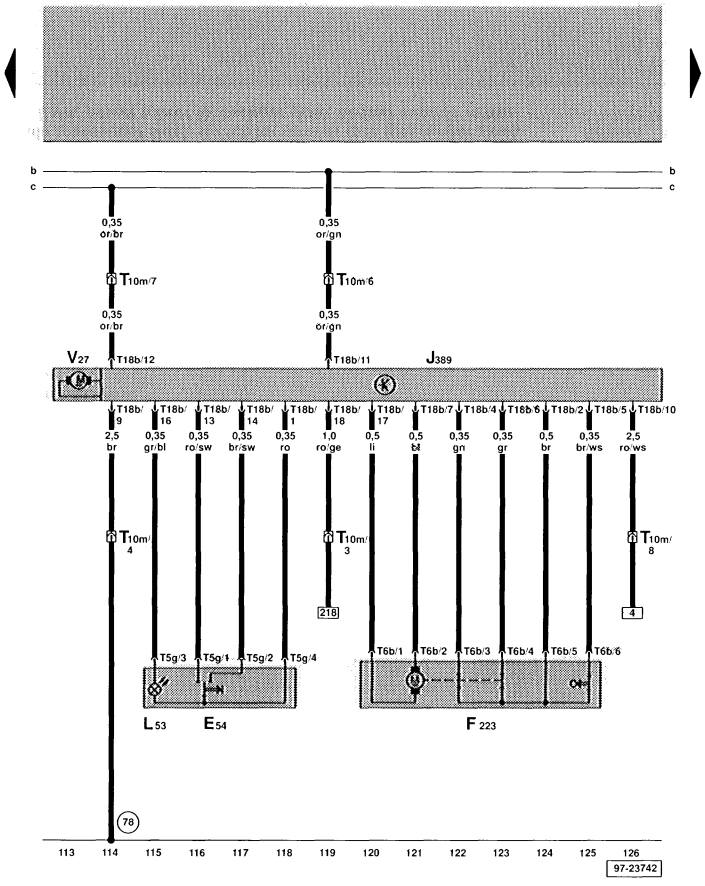
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E52 - Left Rear Window Switch, (In LR Door)
F222 - Lock unit for central locking, rear, left
J388 - Door control module, rear, left
L53 - Power Window Switch Light
T5f - 5-Pin Connector
T6a - 6-Pin Connector
T10l - 10-Pin Connector, black, connector station B-pillar, left
T18a - 18-Pin Connector
V26 - Motor for window regulator, rear, left

(77) - Ground connection, on left B-pillar, lower part

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Door control module (rear left), left rear window switch (In LR Door), lock unit for central locking (rear left), motor for window regulator (rear left)



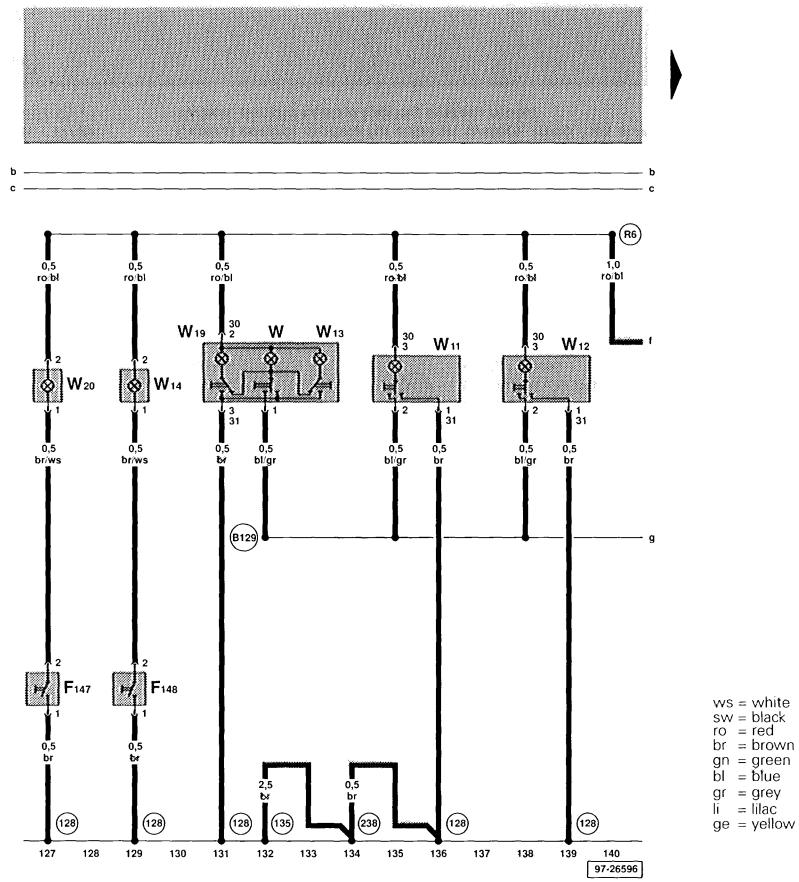
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E54 - Right Rear Window Switch, (In RR Door)
F223 - Lock unit for central locking, rear, right
J389 - Door control module, rear, right
L53 - Power Window Switch Light
T5g - 5-Pin Connector
T6b - 6-Pin Connector
T10m - 10-Pin Connector, black, connector station B-pillar, right
T18b - 18-Pin Connector
V27 - Motor for window regulator, rear, right

(78) - Ground connection, on right B-pillar, lower part

Door control module (rear right), right rear window switch (In RR Door), lock unit for central locking (rear right), motor for window regulator (rear right)

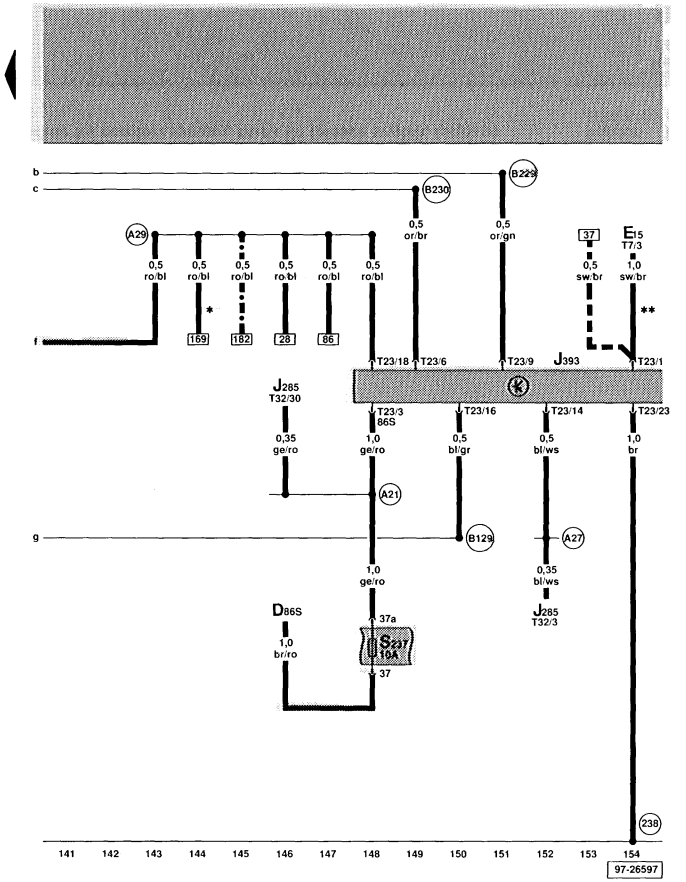
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ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

F147 - Left Make-Up Mirror Light Switch
F148 - Right Make-Up Mirror Light Switch
W - Front Interior Light
W11 - Left Rear Reading Light
W12 - Right Rear Reading Light
W13 - Right Front Map/Reading Light
W14 - Right Make-up Mirror Light
W19 - Left Front Reading Light
W20 - Left Make-up Mirror Light

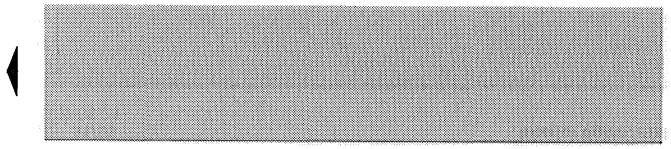
(128) - Ground connection -1-, in interior light wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(238) - Ground connection -1-, in wiring harness interior
(B129) - Connector (interior light 3/L) in wiring harness interior
(R6) - Plus connection -1-, in interior light wiring harness

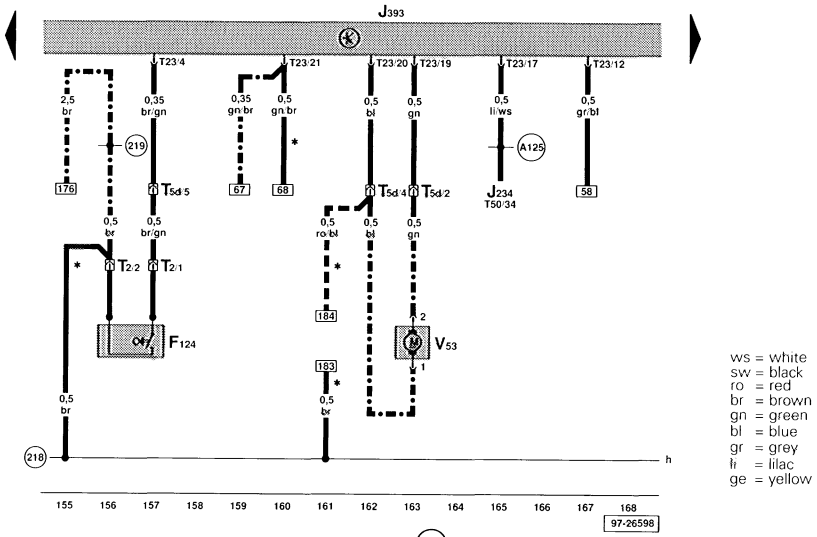


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = violet
li = lilac
or = orange

D - Ignition/Starter Switch
E15 - Rear window defogger switch
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
S237 - Fuse 37 in fuse holder
T7 - 7-Pin Connector
T23 - 23-Pin Connector
T32 - 32-Pin Connector, blue

(238) - Ground connection -1-, in wiring harness interior
(A21) - Wire connection (86s), in instrument panel wiring harness
(A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness
(A29) - Wire connection (interior light), in instrument panel wiring harness
(B129) - Connector (interior light 3/L) in wiring harness interior
(B229) - Connection (high bus), in instrument panel wiring harness
(B230) - Connection (low bus), in instrument panel wiring harness
- - - - Vehicles with seperate heated outside mirrors only
* - Jetta only
-•-•- Golf only
** - Vehicles without seperate heated outside mirrors only





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

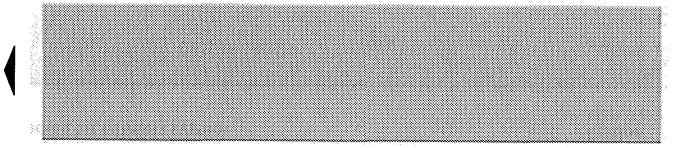
F124 - Trunk Lock Alarm/Central Locking Switch
J234 - Airbag Control Module, behind console, lower part
J393 - Central control module for comfort system, behind instrument panel, left
T2 - Double Connector, in rear lid
T5d - 5-Pin Connector, brown, connector station C-pillar, left
T23 - 23-Pin Connector
T50 - 50-Pin Connector
V53 - Decklid Central Locking System Motor

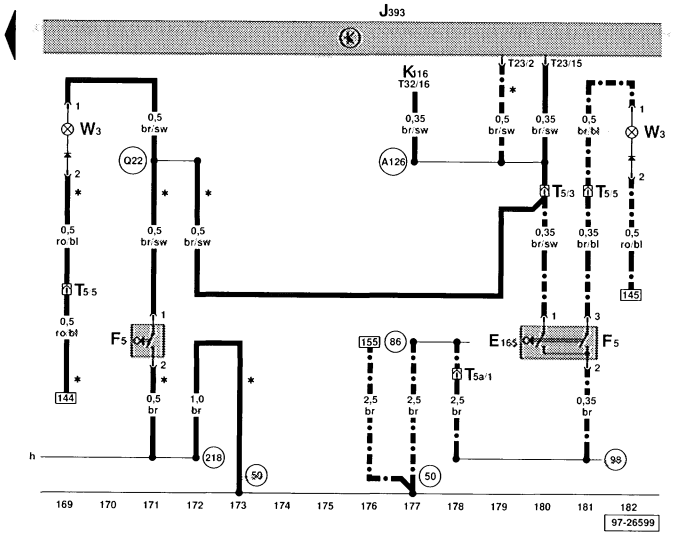
(218) - Ground connection -1-, in rear lid wiring harness
(219) - Ground connection -2-, in rear lid wiring harness
(A125) - Connection (crash signal) in instrument panel wiring harness
--- - Beginning February 1999
* - Jetta only
-•-•- Golf only

Edition 11/99
USA.5102.05.21

Central control module for comfort system, trunk lock alarm/central locking switch, decklid central locking system motor

Repair Manual page number **97-242**





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

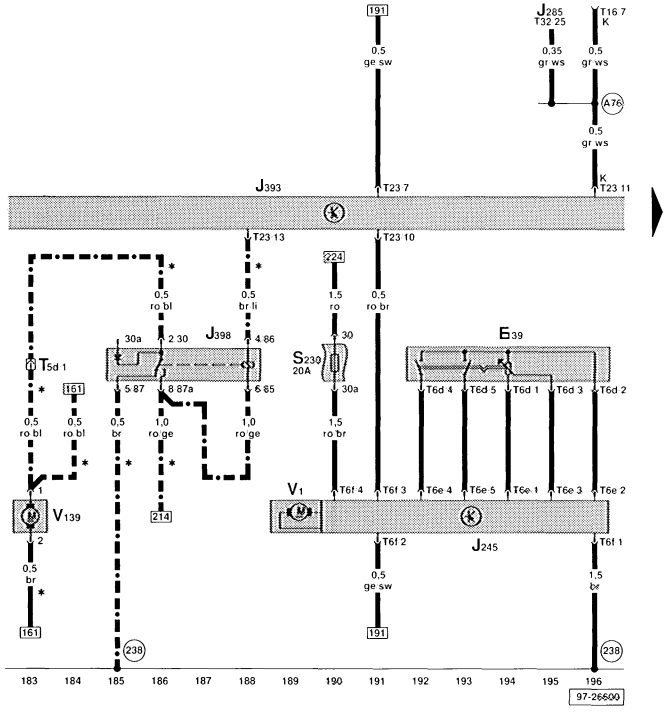
E165 - Trunk Lid Release Switch
F5 - Luggage Compartment Light Switch
J393 - Central control module for comfort system, behind instrument panel, left
K116 - Warning light for rear lid unlocked, in Instrument cluster
T5 - 5-Pin Connector, black, connector station C-pillar, left
T5a - 5-Pin Connector, pink, connector station C-pillar, left (Golf only)
T23 - 23-Pin Connector
T32 - 32-Pin Connector, blue, on Instrument cluster
W3 - Luggage compartment Light

(50) - Ground connection, in luggage compartment, left
(86) - Ground connection -1-, in rear wiring harness
(98) - Ground connection, in rear lid wiring harness
(218) - Ground connection -1-, in rear lid wiring harness
(A126) - Connection (contact switch in rear lid) in instrument panel wiring harness
(Q22) - Wire connection -1-, in rear lid wiring harness
-•--- - Through January 1999
* - Jetta only
-•-•- Golf only

Central control module for comfort system, trunk lid release switch, luggage compartment light

Edition 11/99
USA.5102.05.21

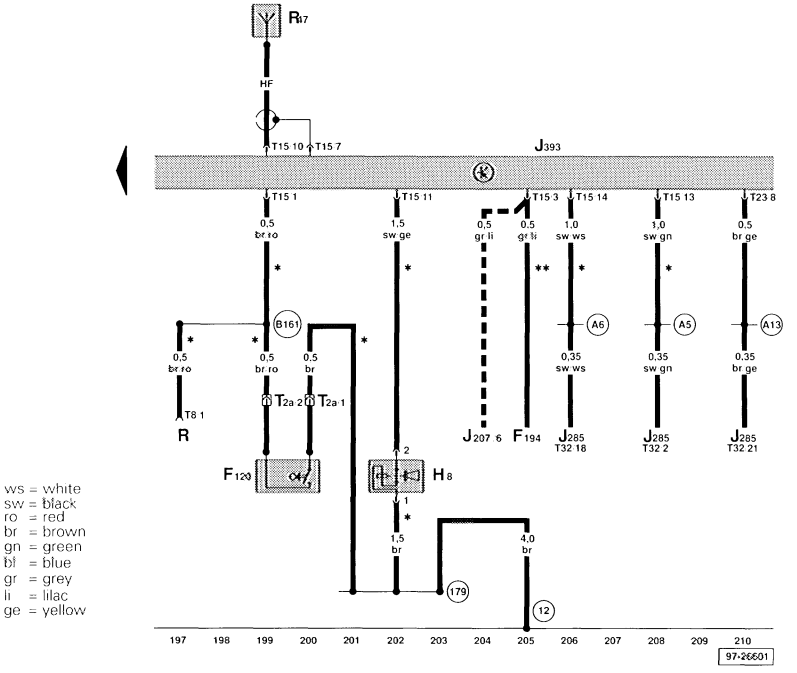
Repair Manual page number **97-243**



E139 - Sunroof Regulator
J245 - Power Sunroof Control Module
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
J398 - Relay for motor remote unlock rear lid, on the thirteenfold auxiliary relay panel, above relay panel*
S230 - Fuse 30 in fuse holder
T5d - 5-Pin Connector, brown, connector station C-pillar, left
T6d - 6-Pin Connector
T6e - 6-Pin Connector
T6f - 6-Pin Connector
T16 - Data Link Connector (DLC), below instrument panel, left
T23 - 23-Pin Connector
T32 - 32-Pin Connector, blue, on Instrument cluster
V1 - Sunroof Motor
V139 - Motor to unlock rear lid*
(238) - Ground connection -1-, in wiring harness interior
(A76) - Connector (K-diagnosis wire) in instrument panel wiring harness
-•--- - Through January 1999
* - Jetta only
- - - Beginning February 1999

Edition 11/99
USA.5102.05.21

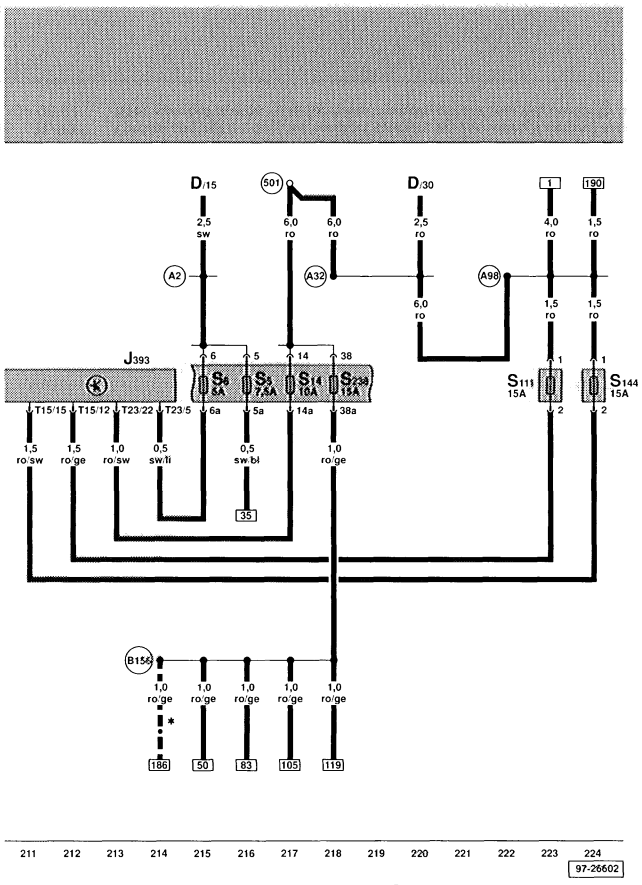
Central control module for comfort system, power sunroof control module, sunroof regulator, sunroof motor, relay for motor remote unlock rear lid, motor to unlock rear lid



F120 - Hood Alarm Switch*
F194 - Clutch Pedal Position (CPP) Switch**
H8 - Alarm Horn*
J207 - Starting Interlock Relay
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
R - Radio
R47 - Antenna wire for central locking and antitheft warning system
T2a - Double Connector, near headlight, right
T8 - 8-Pin Connector, on radio
T15 - 15-Pin Connector
T23 - 23-Pin Connector
T32 - 32-Pin Connector, blue, on Instrument cluster
(12) - Ground connection, in engine compartment, left
(179) - Ground connection, in left headlight wiring harness
(A5) - Plus connection (right turn signal), in instrument panel wiring harness
(A6) - Plus connection (left turn signal), in instrument panel wiring harness
(A13) - Wire connection (door contact switch) in instrument panel wiring harness
(B161) - Connector (anti-theft warning system), in wiring harness interior
* - Vehicles with anti-theft warning system only
** - Manual transmission only
--- - Automatic transmission only

Central control module for comfort system, antitheft warning system, antenna wire for central locking and antitheft warning system

Edition 11/99
USA.5102.05.21



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

D - Ignition/Starter Switch
J393 - Central control module for comfort system, behind instrument panel, left
S5 - Fuse 5 in fuse holder
S6 - Fuse 6 in fuse holder
S14 - Fuse 14 in fuse holder
S111 - Alarm System and Anti-Theft Fuse, above the thirteenfold auxiliary relay panel
S144 - Fuse for central locking/anti-theft warning system, above the thirteenfold auxiliary relay panel
S238 - Fuse 38 in fuse holder
T15 - 15-Pin Connector
T23 - 23-Pin Connector

(501) - Threaded connection -2- (30) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness
(B156) - Plus connector (30a), in wiring harness interior
* - Jetta only
-•-- - Through January 1999

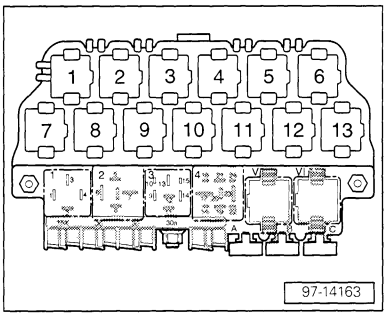
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Radio system (with CD changer wiring preparation),

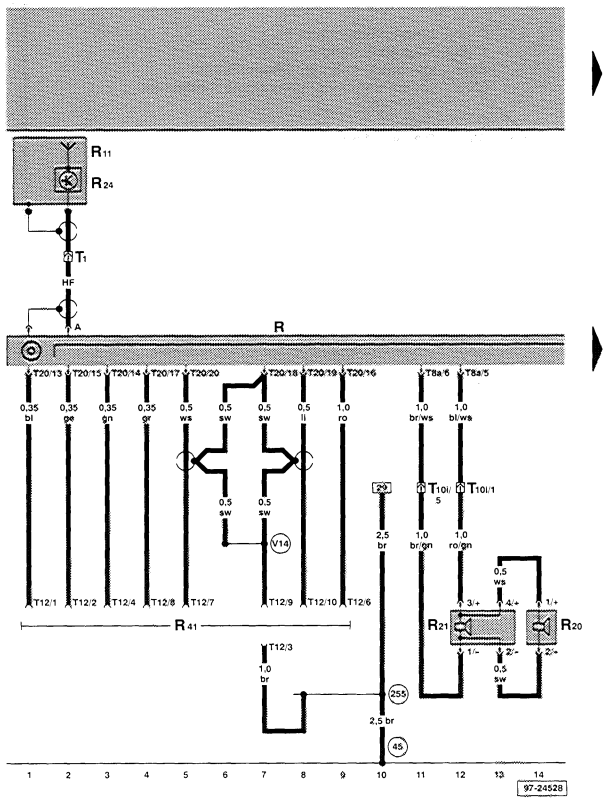
from September 1998

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations"



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

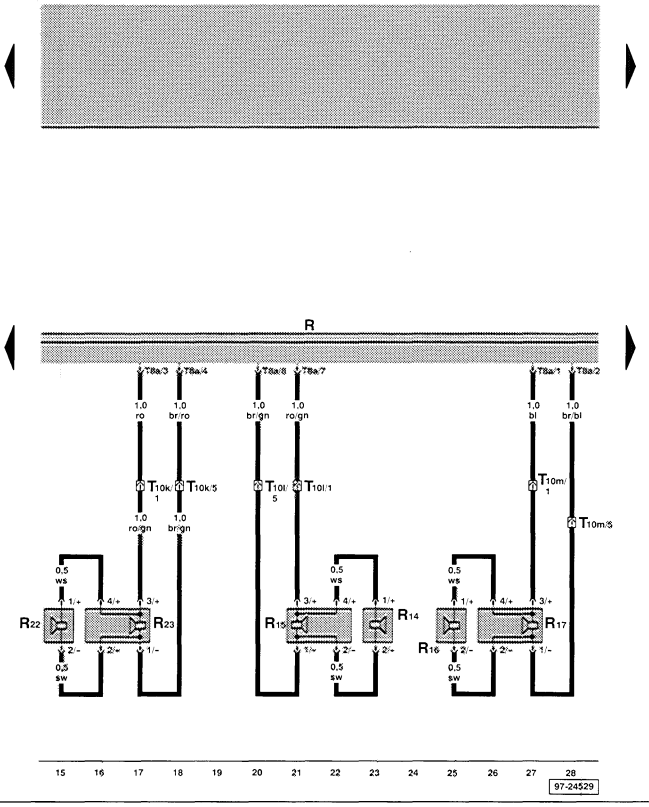


Radio, wiring harness from radio to CD changer unit, loud speaker (left front), antenna

- R - Radio
- R11 - Antenna
- R20 - Treble speaker, left front
- R21 - Bass speaker, left front
- R24 - Antenna Amplifier
- R41 - CD Changer Unit
- T1 - Single Connector
- T8a - 8-Pin Connector
- T10i - 10-Pin Connector, black, connector station A-pillar, left
- T12 - 12-Pin Connector
- T20 - 20-Pin Connector, on Radio
- (45) - Ground connection, behind instrument panel, center
- (255) - Ground connection, -1-, in wiring harness radio
- (V14) - Wire connection (shielding), in CD-changer wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

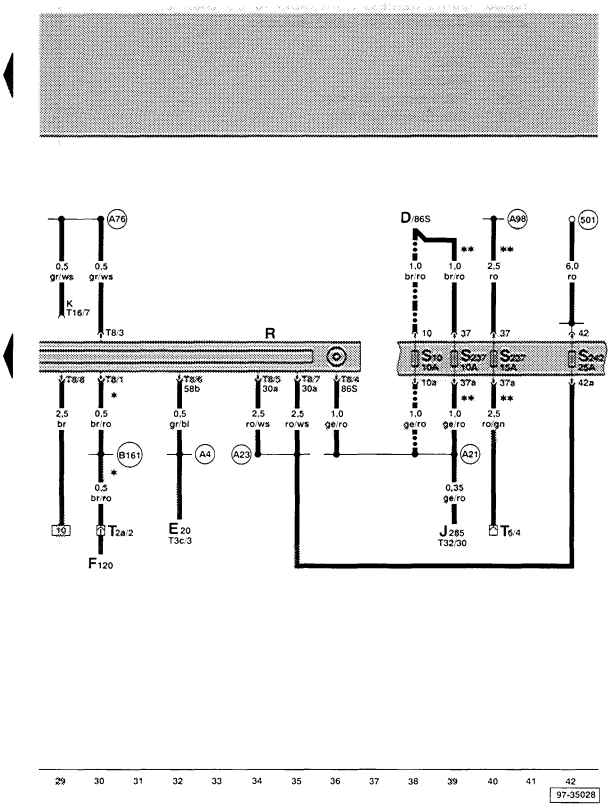
Radio, loud speaker (right front), loud speaker rear



- R - Radio
- R14 - Treble speaker, left rear
- R15 - Bass speaker, left rear
- R16 - Treble speaker, right rear
- R17 - Bass speaker, right rear
- R22 - Treble speaker, right front
- R23 - Bass speaker, right front
- T8a - 8-Pin Connector
- T10k - 10-Pin Connector, black, connector station A-pillar, right
- T10l - 10-Pin Connector, black, connector station B-pillar, left
- T10m - 10-Pin Connector, black, connector station B-pillar, right

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Radio



- D - Ignition/Starter Switch
- F120 - Hood Alarm Switch*
- E20 - Instrument Panel Light Dimmer Switch
- J285 - Control module with indicator unit in instrument panel insert
- R - Radio
- S10 - Fuse 10 in fuse holder
- S237 - Fuse 37 in fuse holder
- S242 - Fuse 42 in fuse holder
- T2a - Double Connector, near headlight, right
- T3c - 3-Pin Connector
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T8 - 8-Pin Connector
- T16 - Data Link Connector (DLC), below instrument panel, left
- T32 - 32-Pin Connector, blue
- (501) - Threaded connection -2- (30) on the relay plate
- (A4) - Plus connection (58b), in instrument panel wiring harness
- (A21) - Wire connection (86s), in instrument panel wiring harness
- (A23) - Wire connection (30a), in instrument panel wiring harness
- (A76) - Connection (K-diagnosis wire) in instrument panel wiring harness
- (A98) - Plus connection -4- (30), in instrument panel wiring harness
- (B161) - Connection (anti-theft warning system), in wiring harness interior*

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

- * - Vehicles with anti-theft warning system only (see wiring diagram comfort system)
- ** - Beginning November 2001
- -•••- Through October 2001

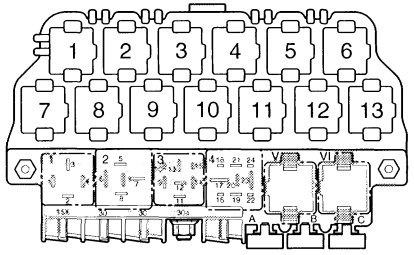
Repair Manual page number 97-251

Repair Manual page number 97-250

Golf /Jetta - Standard Equipment,

from May 1999

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

3 Starting Interlock Relay (53)

Relay panel:

1 Dual Horn Relay (53)

2 Load Reduction Relay (18)/(100)

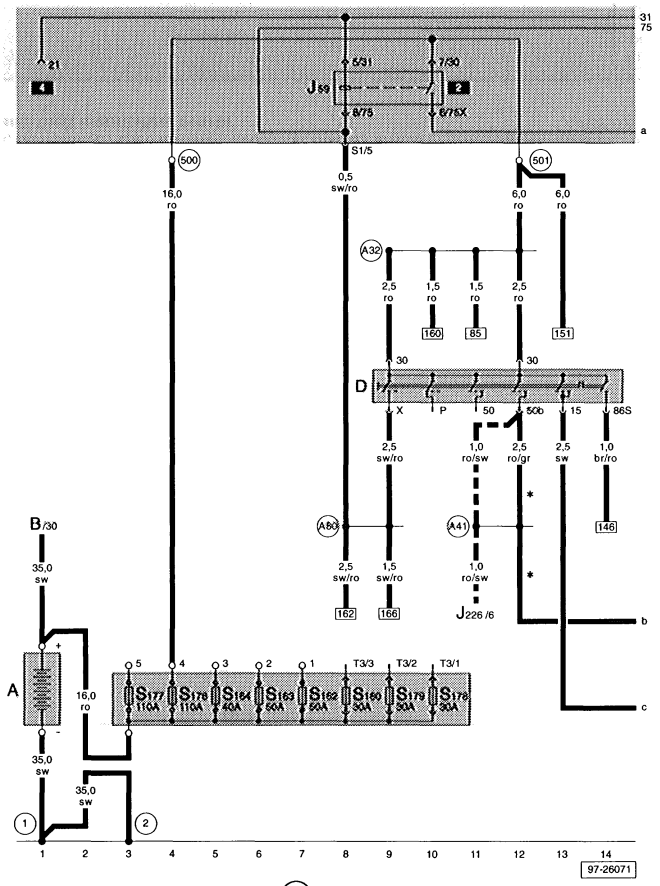
V

VI Wiper/Washer Intermittent Relay (377)

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



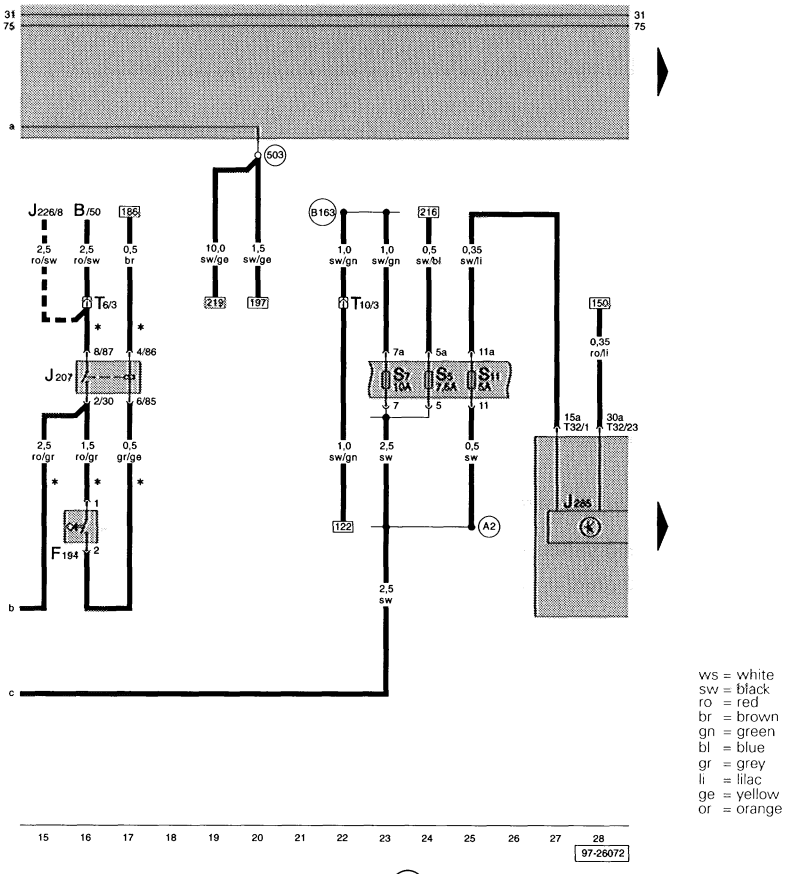
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

A - Battery
B - Starter
D - Ignition/Starter Switch
J59 - Load Reduction Relay
J226 - Park/Neutral Position (PNP) Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S164 - Fuse -3- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
S178 - Fuse -6- (30) in fuse bracket/battery
S179 - Fuse -7- (30) in fuse bracket/battery
S180 - Fuse -8- (30) in fuse bracket/battery
T3 - 3-Pin Connector

(1) - Ground strap, battery to body
(2) - Ground strap, transmission to body
(500) - Threaded connection -1- (30) on the relay plate
(501) - Threaded connection -2- (30) on the relay plate
(A32) - Plus connection (30), in instrument panel wiring harness
(A41) - Plus connection (50), in instrument panel wiring harness (gasoline engine only)
(A80) - Connector -1- (X) in instrument panel wiring harness

* - Manual transmission only
--- Automatic transmission only

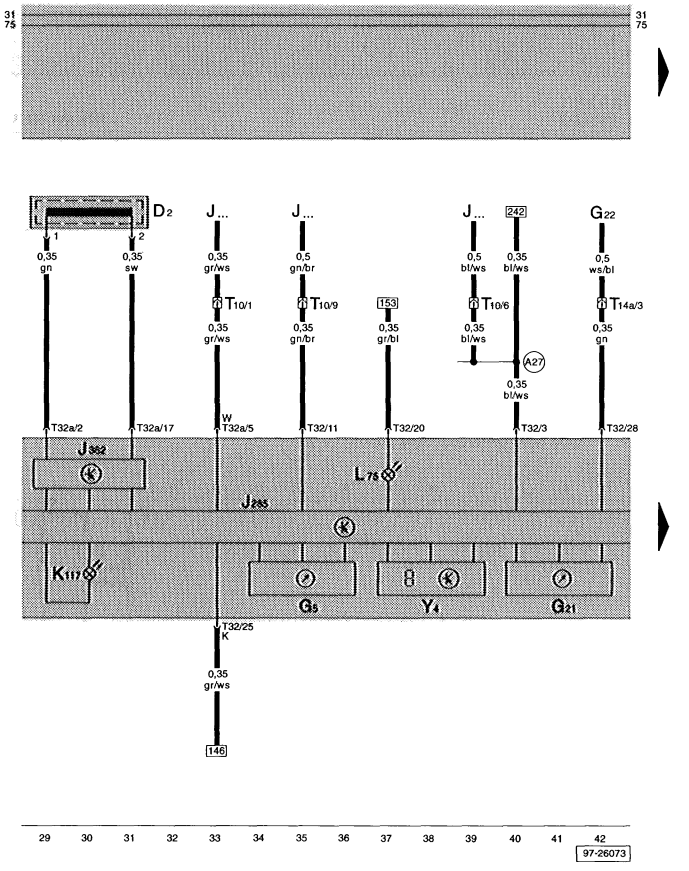
Battery, ignition/starter switch



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

B - Starter
F194 - Clutch Pedal Position (CPP) Switch*
J207 - Starting Interlock Relay*, on the thirteenfold auxiliary relay panel, above relay panel
J226 - Park/Neutral Position (PNP) Relay
J285 - Control module with indicator unit in instrument panel insert
S5 - Fuse 5 in fuse holder
S7 - Fuse 7 in fuse holder
S11 - Fuse 11 in fuse holder
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T32 - 32-Pin Connector, blue

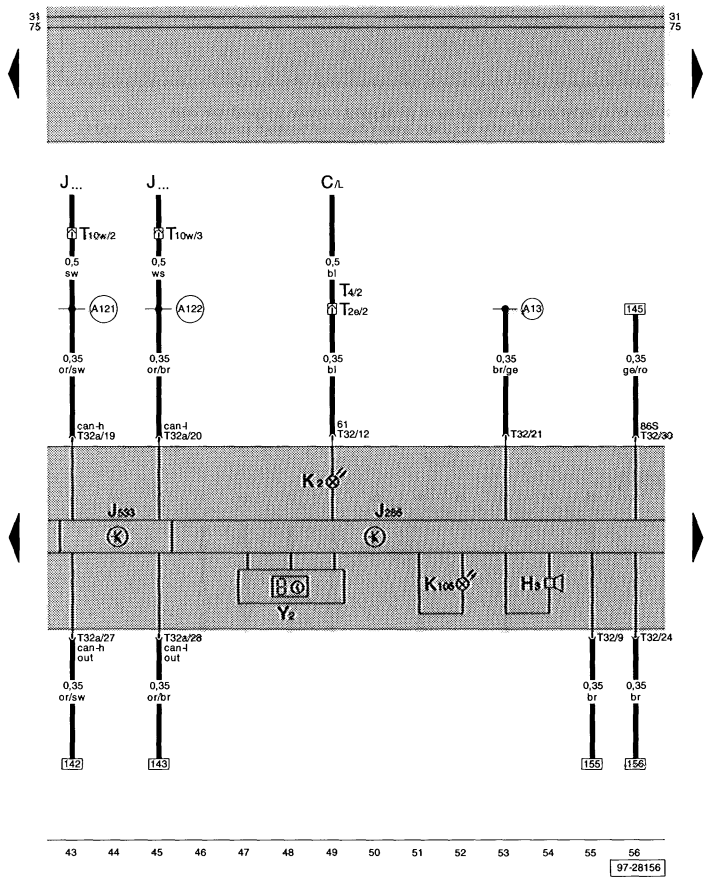
(A2) - Plus connection (15), in instrument panel wiring harness
(B163) - Plus connector -1- (15) in wiring harness interior
(503) - Threaded connection -2- (75x) on the relay plate
* - Manual transmission only
--- Automatic transmission only



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

D2 - Induction coil of antitheft immobilizer
G5 - Tachometer
G21 - Speedometer
G22 - Speedometer Vehicle Speed Sensor
J285 - Control module with indicator unit in instrument panel insert
J362 - Control module for anti-theft immobilizer
J... - Engine Control Module (ECM)
K117 - Warning light for anti-theft immobilizer sensor
L75 - Digital Display Light
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, near battery
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green
Y4 - Odometer Display

(A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness



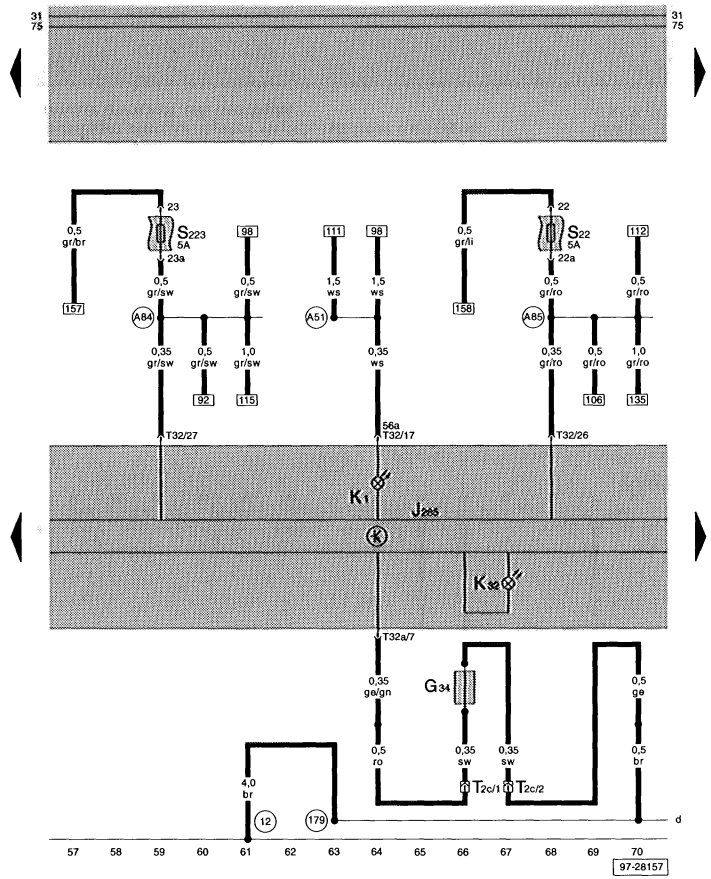
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

C - Generator (GEN)
H3 - Warning buzzer
J285 - Control module with indicator unit in instrument panel insert
J533 - Data Bus On Board Diagnostic Interface
J... - Engine Control Module (ECM)
K2 - Generator (GEN) Warning Light
K105 - Low Fuel Level Warning Light
T2e - Double Connector, near starter (in vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (in vehicles with air conditioning)
T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green
Y2 - Digital Clock

(A13) - Wire connection (door contact switch) in instrument panel wiring harness
(A121) - Connection (high bus), in instrument panel wiring harness
(A122) - Connection (low bus), in instrument panel wiring harness

Edition 09/00 USA.5102.08.21

Instrument cluster, generator (GEN) warning light, digital clock, low fuel level warning light



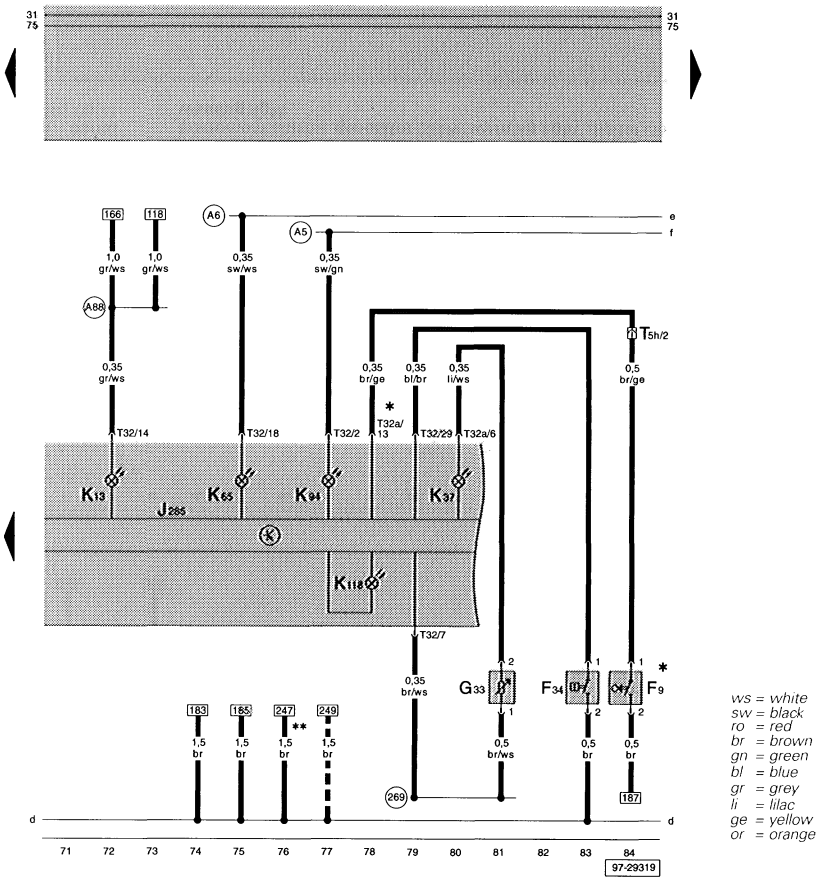
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

G34 - Left Front Brake Pad Wear Sensor
J285 - Control module with indicator unit in instrument panel insert
K1 - Headlight High Beam Indicator Light
K32 - Brake Pad Wear Indicator Light
S22 - Fuse 22 in fuse holder
S223 - Fuse 23 in fuse holder
T2c - Double Connector, near left front brake pad wear sensor
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(12) - Ground connection, in engine compartment, left
(179) - Ground connection, in left headlight wiring harness
(A51) - Wire connection (56), in instrument panel wiring harness
(A84) - Connector (58L) in instrument panel wiring harness
(A85) - Connector (58R) in instrument panel wiring harness

Instrument cluster, left front brake pad wear sensor, brake pad wear indicator light, headlight high beam indicator light

Edition 09/00 USA.5102.08.21



F9 - *Parking Brake Warning Light Switch**
F34 - *Brake Fluid Level Warning Switch*
G33 - *Windshield Washer Fluid Level Sensor*
J285 - *Control module with indicator unit in instrument panel insert*
K13 - *Rear Fog Light Indicator Light*
K37 - *Low Windshield Washer Fluid Level Indicator Light*
K65 - *Left Turn Signal Indicator Light*
K94 - *Right Turn Signal Indicator Light*
K118 - *Warning light for brake system*
T5h - *5-Pin Connector, near left A-pillar, lower part, in harness*
T32 - *32-Pin Connector, blue*
T32a - *32-Pin Connector, green*

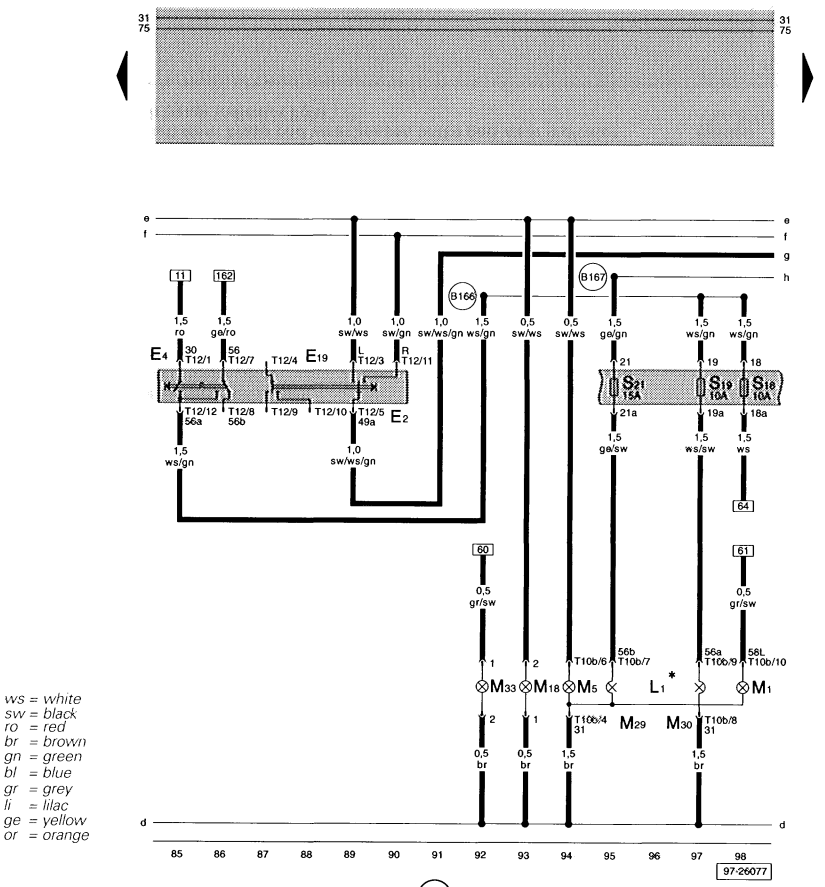
(269) - *Ground connector (sensor ground) -1-, in instrument panel wiring harness*
(A5) - *Plus connection (right turn signal), in instrument panel wiring harness*
(A6) - *Plus connection (left turn signal), in instrument panel wiring harness*
(A88) - *Connector fog light, in instrument panel wiring harness*

** - *Through August 2000*
- - - *Beginning September 2000*

* - *Vehicles with daytime running lights ⇒ wiring diagram No. 16*

Edition 12/01
USA.5102.12+.21

Instrument cluster, parking brake warning light switch, brake fluid level warning switch, low windshield washer fluid level indication, left and right turn signal indicator lights



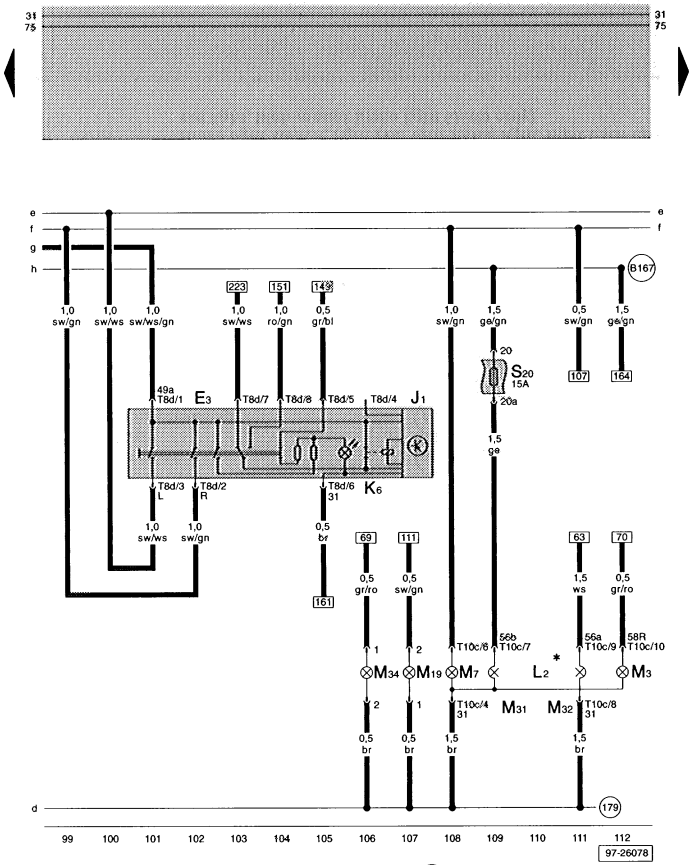
E2 - *Turn signal switch*
E4 - *Headlight Dimmer/Flasher Switch*
E19 - *Park Light Switch*
L1 - *Left Headlight**
M1 - *Left Parking Light*
M5 - *Left Front Turn Signal Light*
M18 - *Left, Side Turn Signal Light*
M29 - *Left Low Beam Headlight (Golf only)*
M30 - *Left High Beam Headlight (Golf only)*
M33 - *Light for side marker front left*
S18 - *Fuse 18 in fuse holder*
S19 - *Fuse 19 in fuse holder*
S21 - *Fuse 21 in fuse holder*
T10b - *10-Pin Connector*
T12 - *12-Pin Connector*

(B166) - *Connection (56a) in passenger compartment wiring harness*
(B167) - *Connection (56b) in passenger compartment wiring harness*

* - *Jetta only*
- *Vehicles with daytime running lights ⇒ wiring diagram No. 16*

Turn signal switch, headlight dimmer/flasher switch, left front turn signal light, light for side marker front left, left headlight

Edition 12/01
USA.5102.12.21



E3 - *Emergency Flasher Switch*
J1 - *Turn Signal Relay*
K6 - *Indicator light for emergency flasher system*
L2 - *Right Headlight**
M3 - *Right Parking Light*
M7 - *Right Front Turn Signal Light*
M19 - *Right, Side Turn Signal Light*
M31 - *Right Low Beam Headlight (Golf only)*
M32 - *Right High Beam Headlight (Golf only)*
M34 - *Light for side marker front right*
S20 - *Fuse 20 in fuse holder*
T8d - *8-Pin Connector*
T10c - *10-Pin Connector*

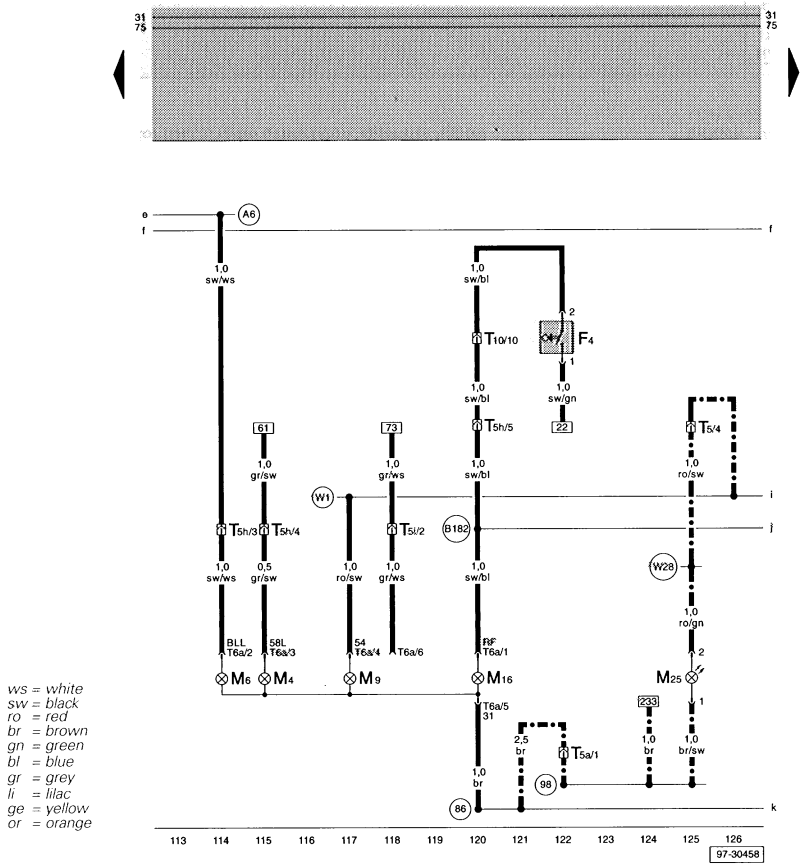
(179) - *Ground connection, in left headlight wiring harness*

(B167) - *Connection (56b), in passenger compartment wiring harness*

* - *Jetta only*
- *Vehicles with daytime running lights*
⇒ *wiring diagram No. 16*

Edition 12/01 *USA.5102.12.21*

Emergency flasher switch, turn signal relay, right front turn signal light, light for side marker front right, right headlight



F4 - *Back-Up Light Switch*
M4 - *Left Tail Light*
M6 - *Left Rear Turn Signal Light*
M9 - *Left Brake Light*
M16 - *Left Back-Up Light*
M25 - *High-mount Brake Light (32 light emitting diodes)*
T5 - *5-Pin Connector, black, connector station C-pillar, left*
T5a - *5-Pin Connector, pink, connector station C-pillar, left (Golf only)*
T5h - *5-Pin Connector, near left A-pillar, lower part, in harness*
T5i - *5-Pin Connector, near left A-pillar, lower part, in harness*
T6a - *6-Pin Connector*
T10 - *10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left*

(86) - *Ground connection -1-, in rear wiring harness*

(98) - *Ground connection, in rear lid wiring harness*

(A6) - *Plus connection (left turn signal), in instrument panel wiring harness*

(B182) - *Connection (RF), in passenger compartment wiring harness*

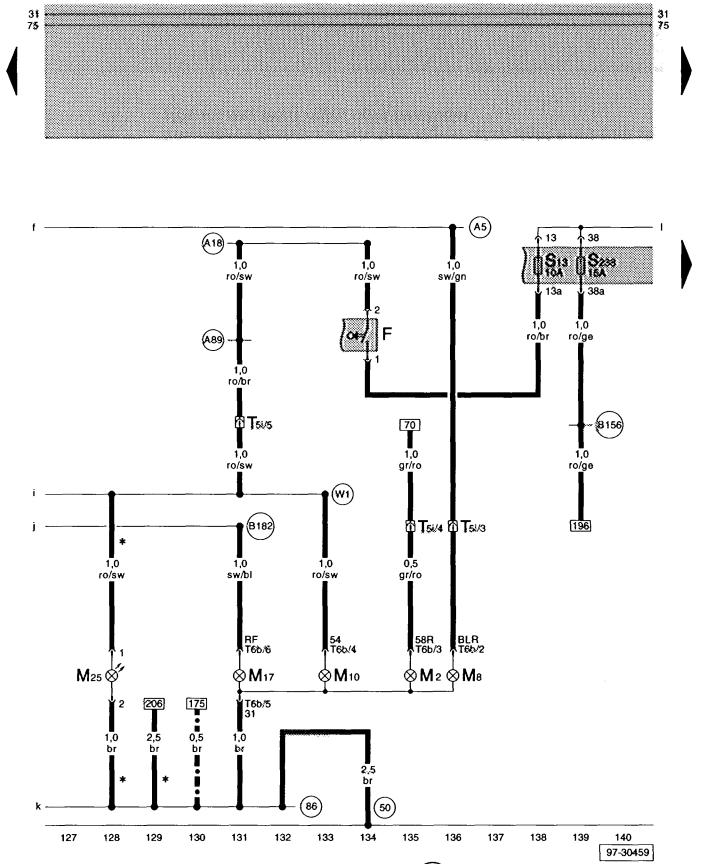
(W1) - *Plus connection (54), in rear wiring harness*

(W28) - *Plus connector -2- (54), in wiring harness taillight assembly*

-•-•- *Golf only*

Back-up light switch, left rear turn signal light, left back-up light, left brake/ tail light, high-mount brake light (Golf only)

Edition 12/01 *USA.5102.12.21*



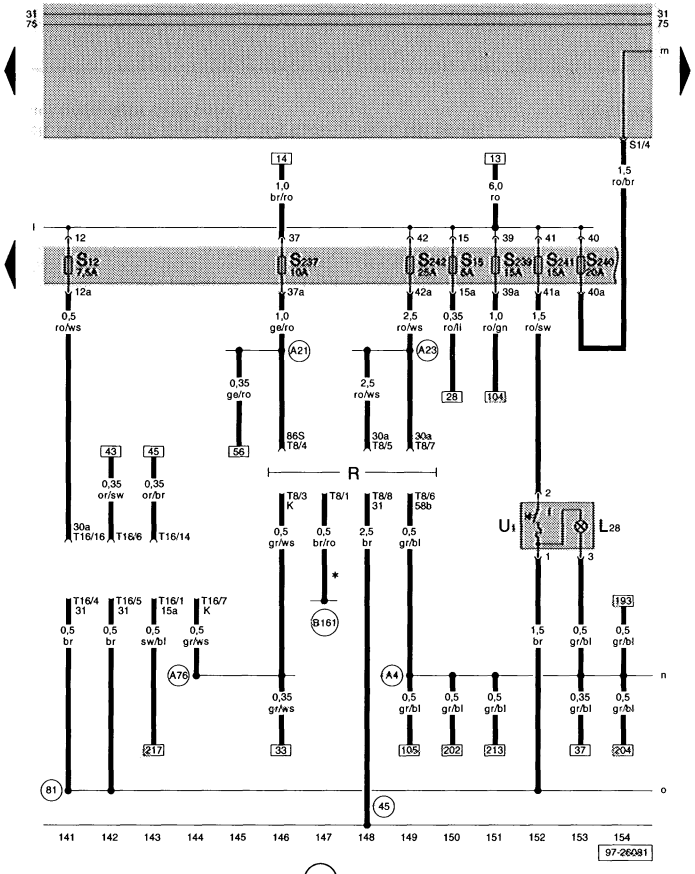
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F - Brake Light Switch
M2 - Right Tail Light
M8 - Right Rear Turn Signal Light
M10 - Right Brake Light
M17 - Right Back-Up Light
M25 - High-mount Brake Light (18 light emitting diodes)*
S13 - Fuse 13 in fuse holder
S238 - Fuse 38 in fuse holder
T5i - 5-Pin Connector, near left A-pillar, lower part, in harness
T6b - 6-Pin Connector

(50) - Ground connection, in luggage compartment, left
(86) - Ground connection -1-, in rear wiring harness
(A5) - Plus connection (right turn signal), in instrument panel wiring harness
(A18) - Wire connection (54), in instrument panel wiring harness
(A89) - Connector (54), in instrument panel wiring harness
(B156) - Plus connector (30a), in wiring harness interior
(B182) - Connection (RF), in passenger compartment wiring harness
(W1) - Plus connection (54), in rear wiring harness

* - Jetta only
-•-•- Golf only

Brake light switch, right rear turn signal light, right back-up light, right brake/ tail light, high-mount brake light (Jetta only)



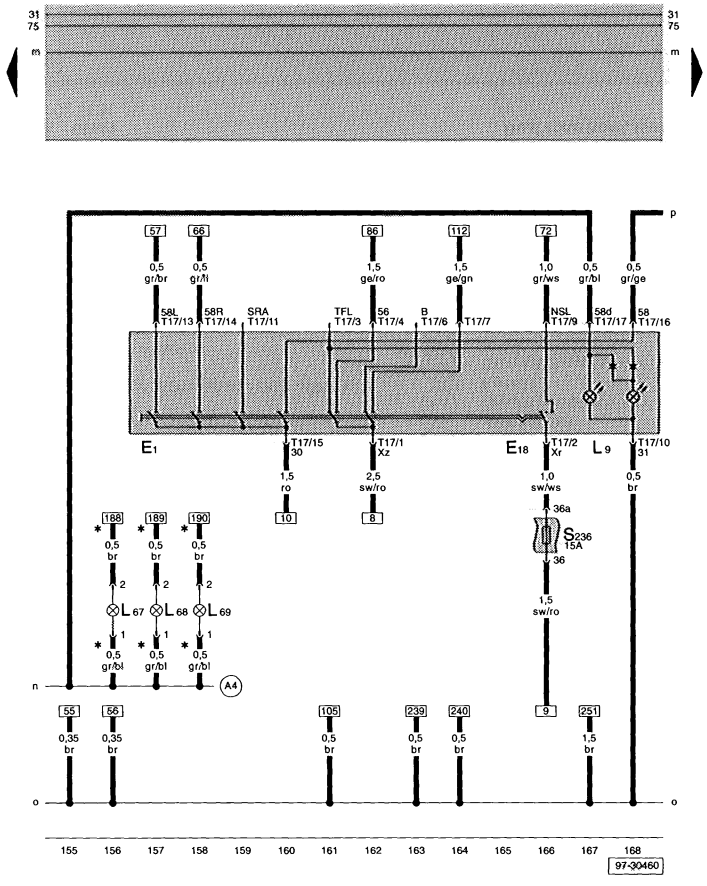
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

L28 - Cigarette Lighter Light
R - Radio
S12 - Fuse 12 in fuse holder
S15 - Fuse 15 in fuse holder
S237 - Fuse 37 in fuse holder
S239 - Fuse 39 in fuse holder
S240 - Fuse 40 in fuse holder
S241 - Fuse 41 in fuse holder
S242 - Fuse 42 in fuse holder
T8 - 8-Pin Connector
T16 - Data Link Connector (DLC), below instrument panel, left
U1 - Cigarette Lighter

(45) - Ground connection, behind instrument panel, center
(81) - Ground connection -1-, in instrument panel wiring harness
(A4) - Plus connection (58b), in instrument panel wiring harness
(A21) - Wire connection (86s), in instrument panel wiring harness
(A23) - Wire connection (30a), in instrument panel wiring harness
(A76) - Connector (K-diagnosis wire) in instrument panel wiring harness
(B161) - Connector (anti-theft warning system), in wiring harness interior*

* - Vehicles with anti-theft warning system only (see wiring diagram comfort system/ central locking)

Data Link Connector (DLC), radio connection, cigarette lighter

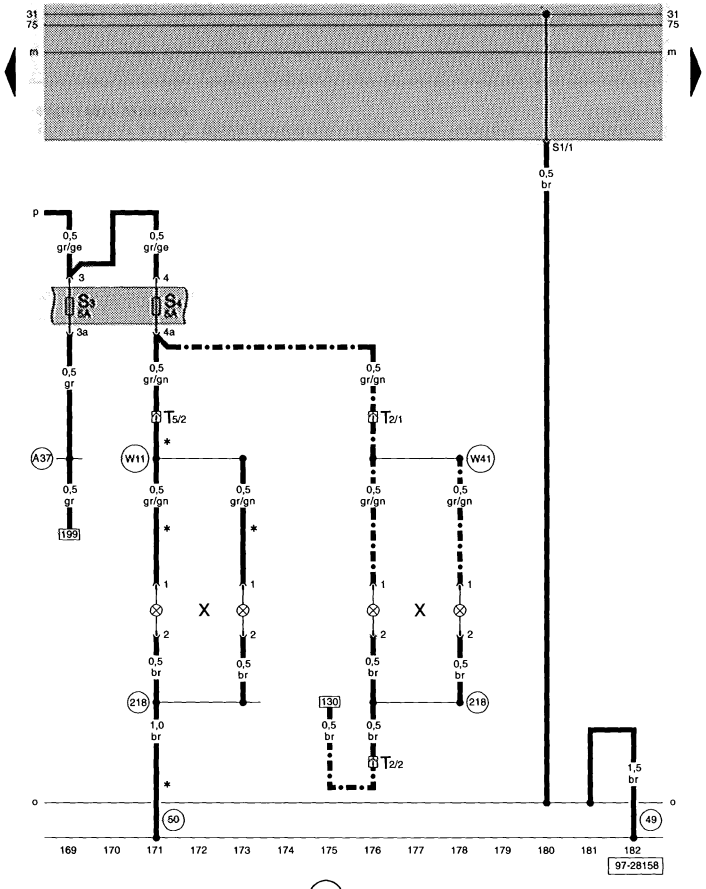


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E1 - Light switch
E18 - Rear Fog Light Switch
L9 - Headlight Switch Light
L67 - Left Instrument Panel Vent Illumination*
L68 - Center Instrument Panel Vent Illumination*
L69 - Right Instrument Panel Vent Illumination*
S236 - Fuse 36 in fuse holder
T17 - 17-Pin Connector

(A4) - Plus connection (58b), in instrument panel wiring harness

* - Jetta only



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

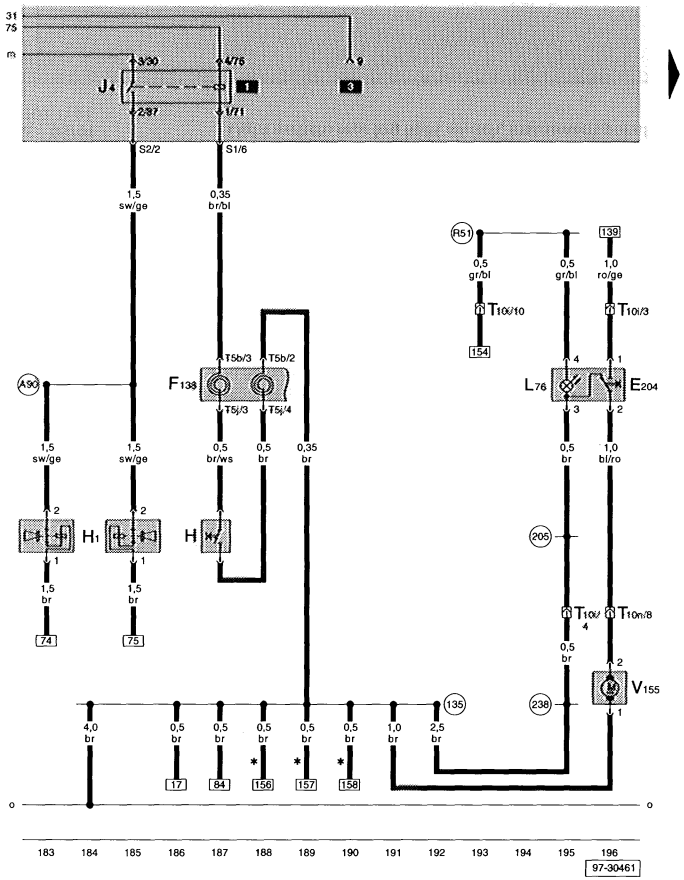
S3 - Fuse 3 in fuse holder
S4 - Fuse 4 in fuse holder
T2 - Double Connector, in luggage compartment, left (Golf only)
T5 - 5-Pin Connector, black, connector station C-pillar, left
X - License Plate Light

(49) - Ground connection, on steering column
(50) - Ground connection, in luggage compartment, left
(218) - Ground connection -1-, in rear lid wiring harness
(A37) - Wire connection (58a), in instrument panel wiring harness
(W11) - Wire connection (58), in rear lid wiring harness
(W41) - Plus connection (58), in wiring harness

* - Jetta only
-•-•- Golf only

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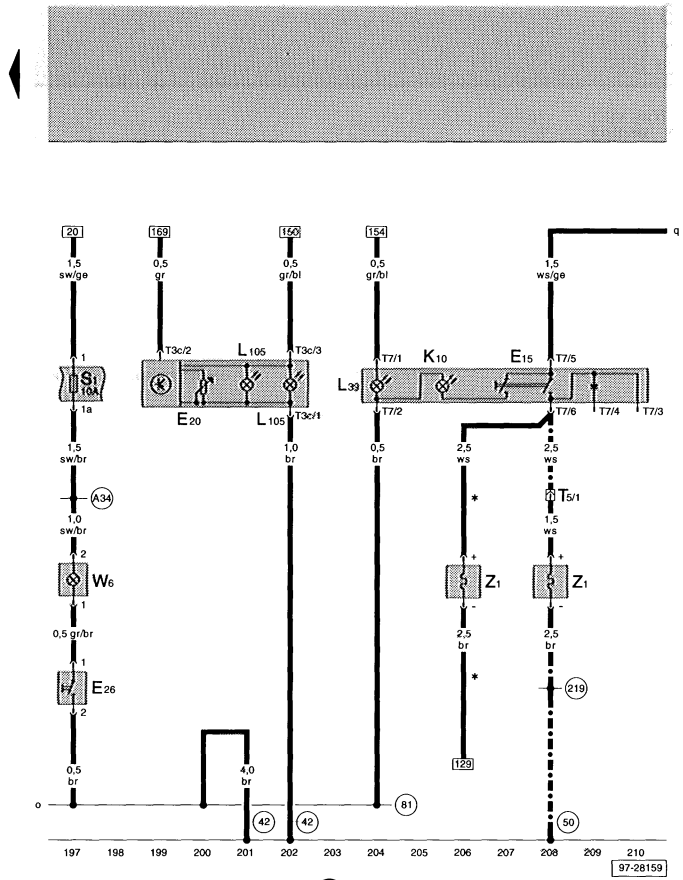
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E204 - Switch for remote/fuel tank door (also see Comfort System with power windows wiring diagram)
F138 - Airbag Spiral Spring/Return Spring with Slip Ring
H - Signal horn activation
H1 - Dual tone horn
J4 - Dual Horn Relay
L76 - Push Button Light
T5b - 5-Pin Connector
T5j - 5-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10n - 10-Pin Connector, brown, connector station A-pillar, left
V155 - Motor for fuel tank lid unlock

(135) - Ground connection -2-, in instrument panel wiring harness
(205) - Ground connection, in driver's door wiring harness
(238) - Ground connection -1-, in wiring harness interior
(A90) - Connector (dual tone horn), in instrument panel wiring harness
(R51) - Connection (58b) in door wiring harness, driver side

* - Jetta only

Dual tone horn, fuel tank door remote



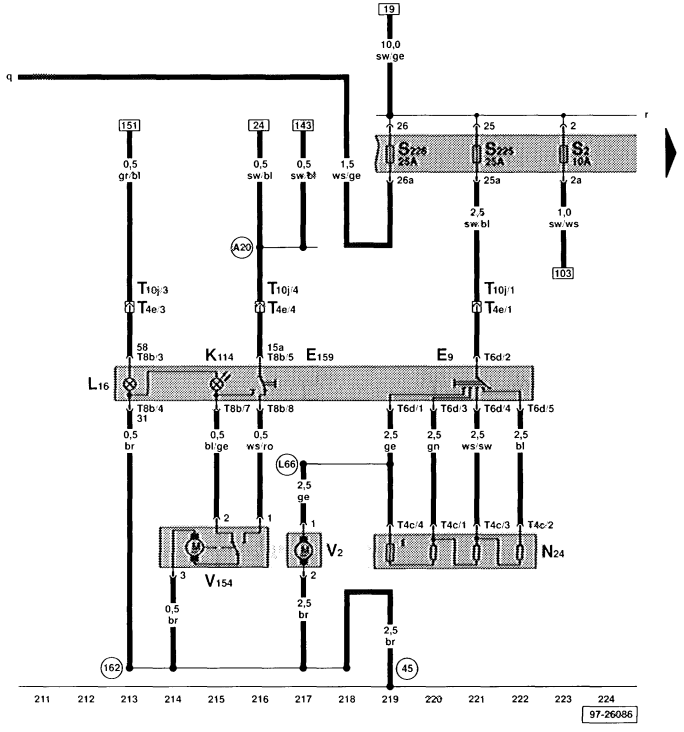
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E15 - Rear window defogger switch
E20 - Instrument Panel Light Dimmer Switch
E26 - Glove compartment light switch
K10 - Indicator light for heated rear windshield
L39 - Rear Window Defogger Switch Light
L105 - Illumination for lighting controller
S1 - Fuse 1 in fuse holder
T3c - 3-Pin Connector
T5 - 5-Pin Connector, black, connector station C-pillar, left (Golf only)
T7 - 7-Pin Connector
W6 - Glove Compartment Light
Z1 - Heated rear window

(42) - Ground connection, beside steering column
(50) - Ground connection, in luggage compartment, left
(81) - Ground connection -1-, in instrument panel wiring harness
(219) - Ground connection -2-, in rear lid wiring harness
(A34) - Wire connection (75x), in instrument panel wiring harness

* - Jetta only
-•-•- Golf only

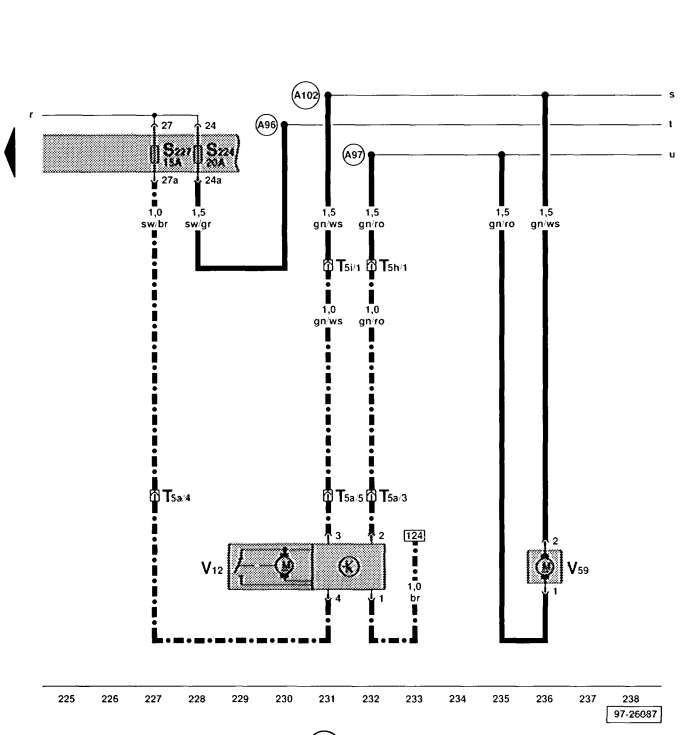
Instrument panel light dimmer switch, glove compartment light, rear window defogger switch, heated rear window



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E9 - Fresh Air Blower Switch
E159 - Fresh Air/Recirculating Flap Switch
K114 - Fresh Air and Recirculating Air Mode Indicator Light
L16 - Fresh Air Control Lever Light
N24 - Fresh Air Blower Series Resistance With Fuse
S2 - Fuse 2 in fuse holder
S225 - Fuse 25 in fuse holder
S226 - Fuse 26 in fuse holder
T4c - 4-Pin Connector
T4e - 4-Pin Connector (in vehicles without air conditioning)
T6d - 6-Pin Connector
T8b - 8-Pin Connector
T10j - 10-Pin Connector, behind instrument panel, center (in vehicles with air conditioning)
V2 - Fresh Air Blower
V154 - Servo motor for fresh-/recirculating air door

(45) - Ground connection, behind instrument panel, center
(162) - Ground connection, in blower motor wiring harness
(A20) - Wire connection (15a), in instrument panel wiring harness
(L66) - Connector, in wiring harness heater blower

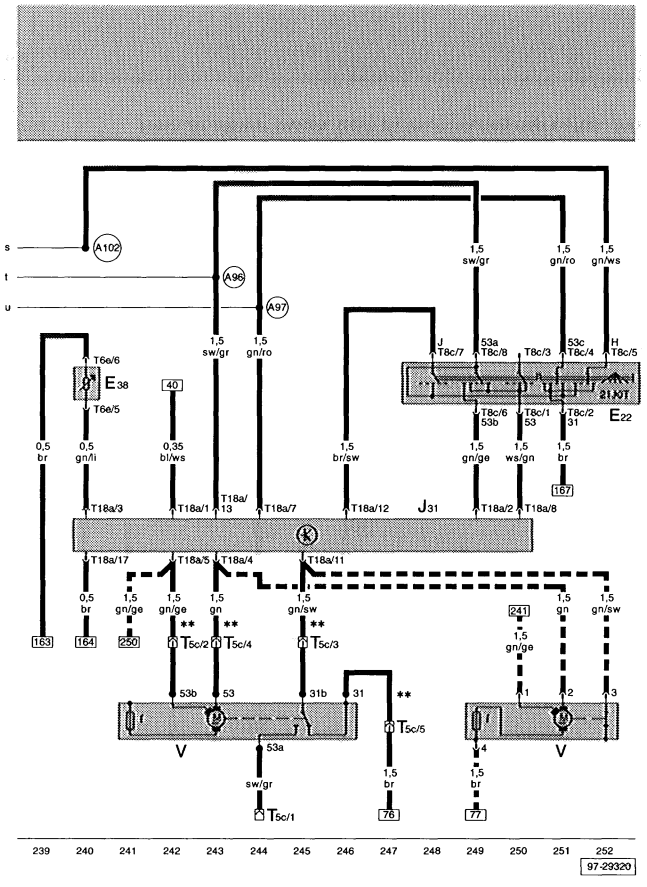


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

S224 - Fuse 24 in fuse holder
S227 - Fuse 27 in fuse holder
T5a - 5-Pin Connector, pink, connector station C-pillar, left (Golf only)
T5h - 5-Pin Connector, near left A-pillar, lower part, in harness
T5i - 5-Pin Connector, near left A-pillar, lower part, in harness
V12 - Motor for rear windshield wiper
V59 - Windshield and Rear Window Washer Pump

(A96) - Connector (53a), in instrument panel wiring harness
(A97) - Connector (53), in instrument panel wiring harness
(A102) - Connector (windshield wiper), in instrument panel wiring harness

-•-•- Golf only



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E22 - Windshield Wiper/Washer Switch
E38 - Windshield Wiper Intermittent Regulator
J31 - Wiper/Washer Intermittent Relay, on relais panel
T5c - 5-Pin Connector, on windshield wiper motor
T6e - 6-Pin Connector
T8c - 8-Pin Connector
T18a - 18-Pin Connector
V - Windshield Wiper Motor

A96 - Connector (53a), in instrument panel wiring harness
A97 - Connector (53), in instrument panel wiring harness
A102 - Connector (windshield wiper), in instrument panel wiring harness

** - Through August 2000
- - - Beginning September 2000

Edition 03/01
USA.5102.10.21

Windshield wiper/washer switch, windshield wiper intermittent regulator, windshield wiper motor, wiper/washer intermittent relay

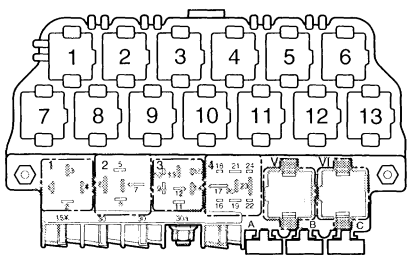
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2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, (without cruise control), code AEG,

from May 1999

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97-14163

Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

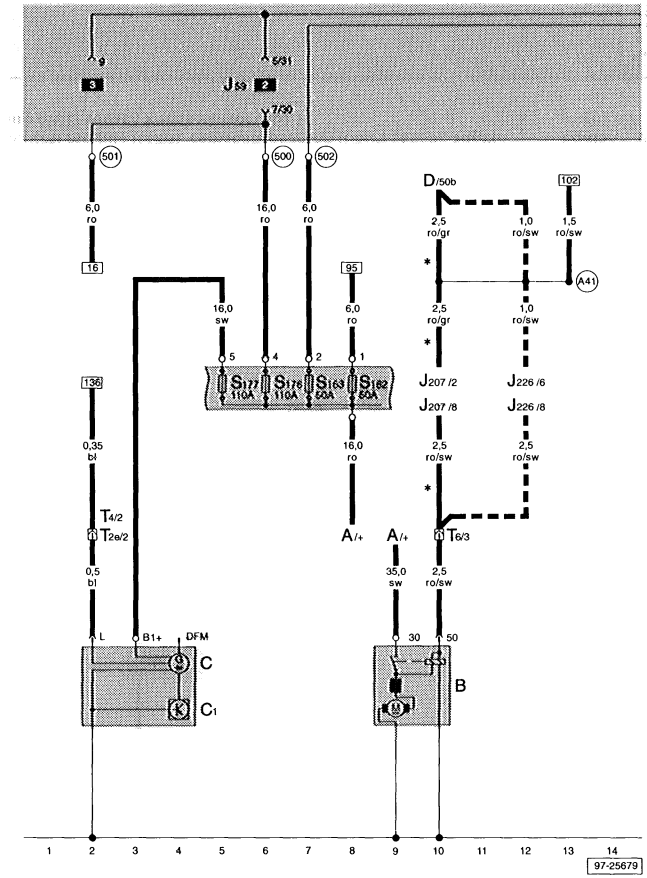
2 *Load Reduction Relay (100)*

4 *Fuel Pump (FP) Relay (409)*

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

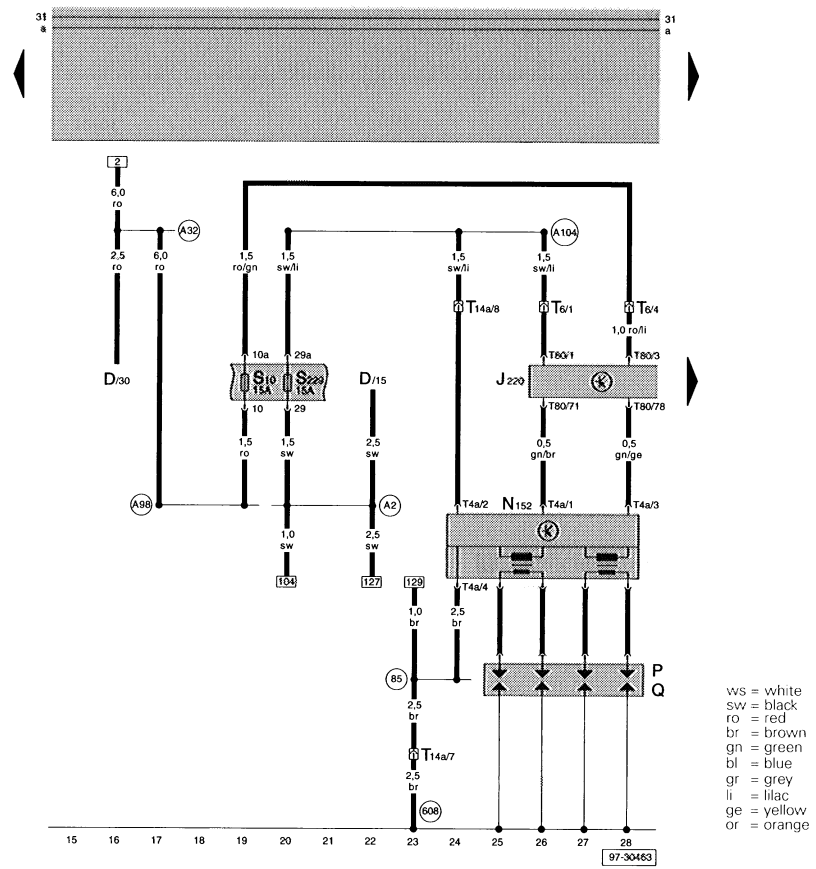
30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

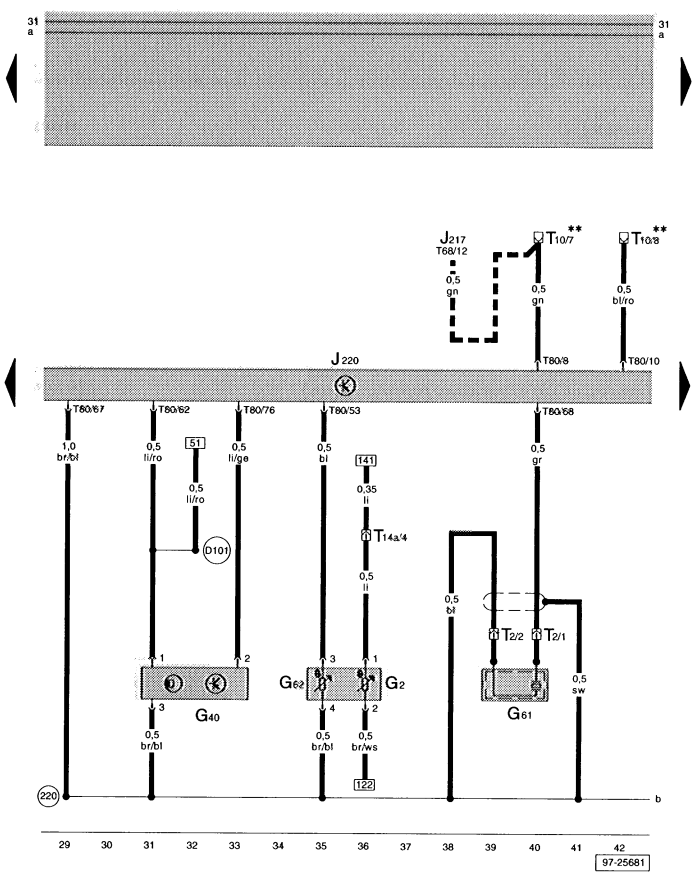
A - Battery
B - Starter
C - Generator (GEN)
C1 - Voltage Regulator (VR)
D - Ignition/Starter Switch
J59 - Load Reduction Relay
J207 - Starting Interlock Relay
J226 - Park/Neutral Position (PNP) Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
T2e - Double Connector, near starter (vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
(500) - Threaded connection -1- (30) on the relay plate
(501) - Threaded connection -2- (30) on the relay plate
(502) - Threaded connection -1- (30a) on the relay plate
(A41) - Plus connection (50), in instrument panel wiring harness
* - *Manual transmission only*
--- *Automatic transmission only*

Generator (GEN), starter



D - Ignition/Starter Switch
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N152 - Ignition Coil
P - Spark Plug Connectors
Q - Spark Plugs
S10 - Fuse 10 in fuse holder
S229 - Fuse 29 in fuse holder
T4a - 4-Pin Connector
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, near battery
T80 - Connector, 80 point

(85) - Ground connection -1-, in engine compartment wiring harness
(608) - Ground connection (in center plenum chamber)
(A2) - Plus connection (15), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness
(A101) - Plus connector -2- (15), in instrument panel wiring harness

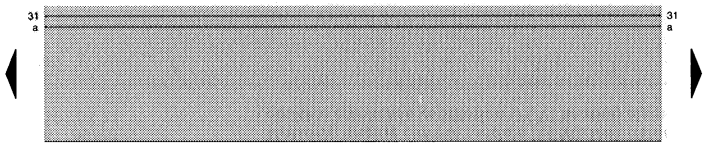


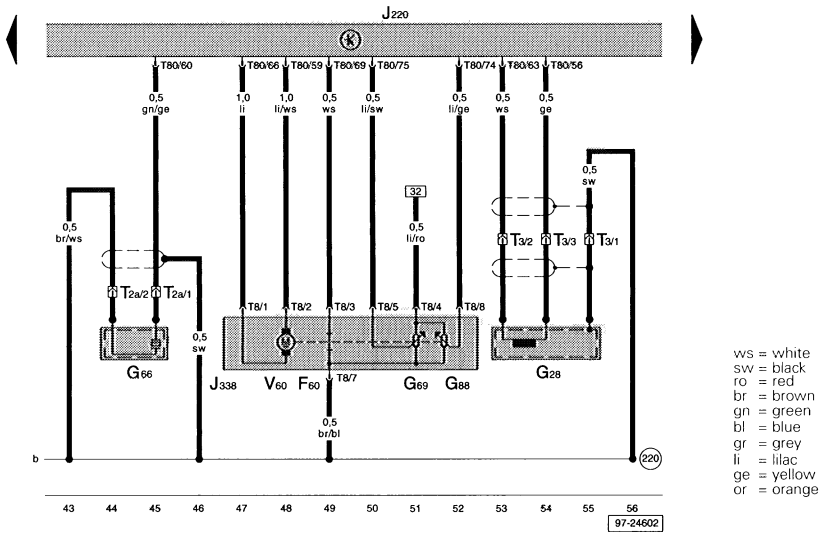
G2 - Engine Coolant Temperature (ECT) Sensor
G40 - Camshaft Position (CMP) Sensor
G61 - Knock Sensor (KS) 1
G62 - Engine Coolant Temperature (ECT) Sensor
J217 - Transmission Control Module (TCM), in plenum chamber, center
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
T2 - Double Connector, in engine compartment, rear
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, near battery
T68 - 68-Pin Connector, on Transmission Control Module (TCM)
T80 - Connector, 80 point

(220) - Ground connection (sensor ground), in engine compartment wiring harness
(D101) - Wire connection -1-, in engine compartment wiring harness

** - A/C connection
--- Automatic transmission only

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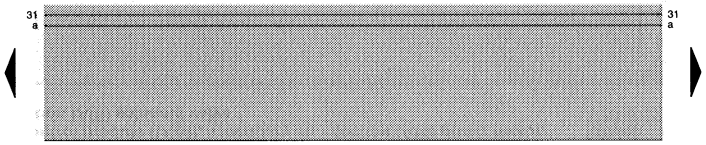


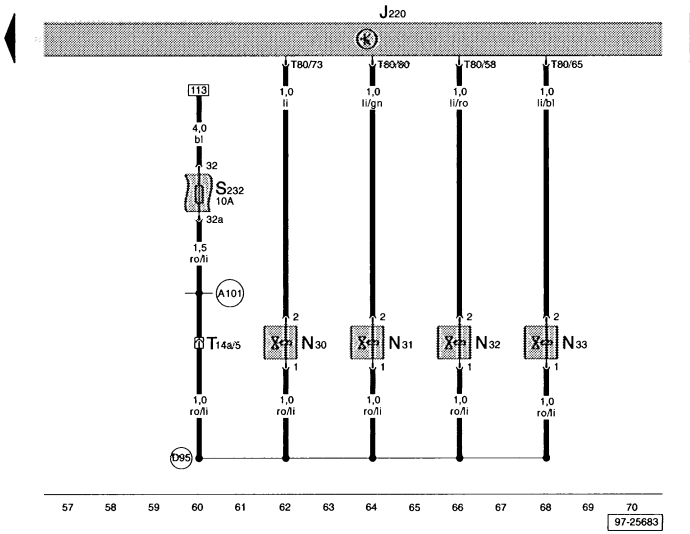
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F60 - Closed Throttle Position (CTP) Switch
G28 - Engine Speed (RPM) Sensor
G66 - Knock Sensor (KS) 2
G69 - Throttle Position (TP) Sensor
G88 - Throttle Position (TP) Sensor
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J338 - Throttle Valve Control Module***
T2a - Double Connector, in engine compartment, front
T3 - 3-Pin Connector, near intake manifold
T8 - 8-Pin Connector***
T80 - Connector, 80 point
V60 - Throttle Position (TP) Actuator

(220) - Ground connection (sensor ground), in engine compartment wiring harness

*** - Vehicles with cruise control see also wiring diagram Cruise Control No. 44/1

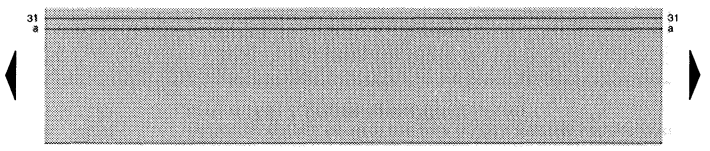


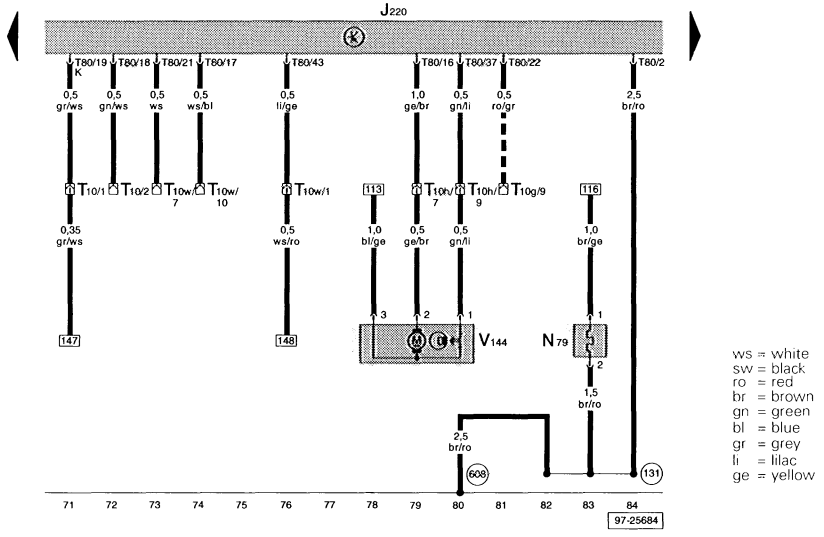


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N30 - Cylinder 1 Fuel Injector
N31 - Cylinder 2 Fuel Injector
N32 - Cylinder 3 Fuel Injector
N33 - Cylinder 4 Fuel Injector
S232 - Fuse 32 in fuse holder
T14a - 14-Pin Connector, near battery
T80 - Connector, 80 point

(D95) - Wire connection (injectors), in engine compartment wiring harness
(A101) - Connector -3- (87a), in instrument panel wiring harness





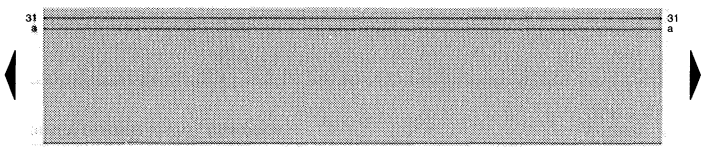
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N79 - Positive Crankcase Ventilation (PCV) Heating Element
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
T80 - Connector, 80 point
V144 - Leak detection pump (LDP)

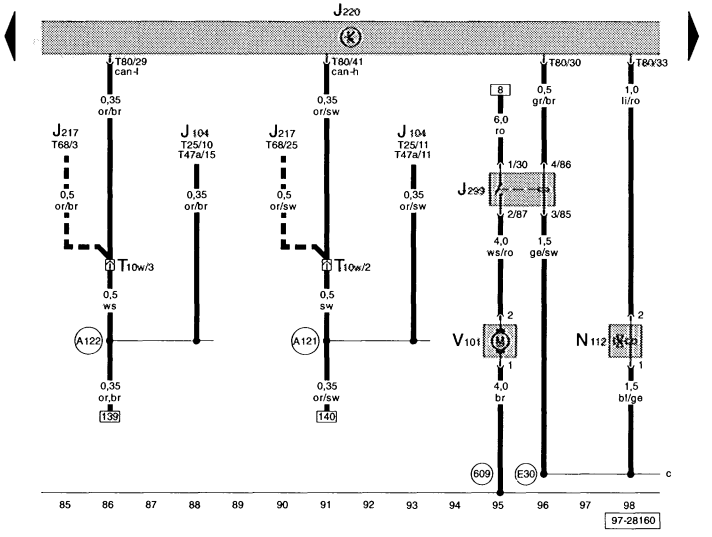
(131) - Ground connection -2-, in engine compartment wiring harness
(608) - Ground Connection (in center plenum chamber)

--- Automatic transmission only

Edition 09/00
USA.5102.08.21

Motronic engine control module (ECM), leak detection pump (LDP), positive crankcase ventilation (PCV) heating element





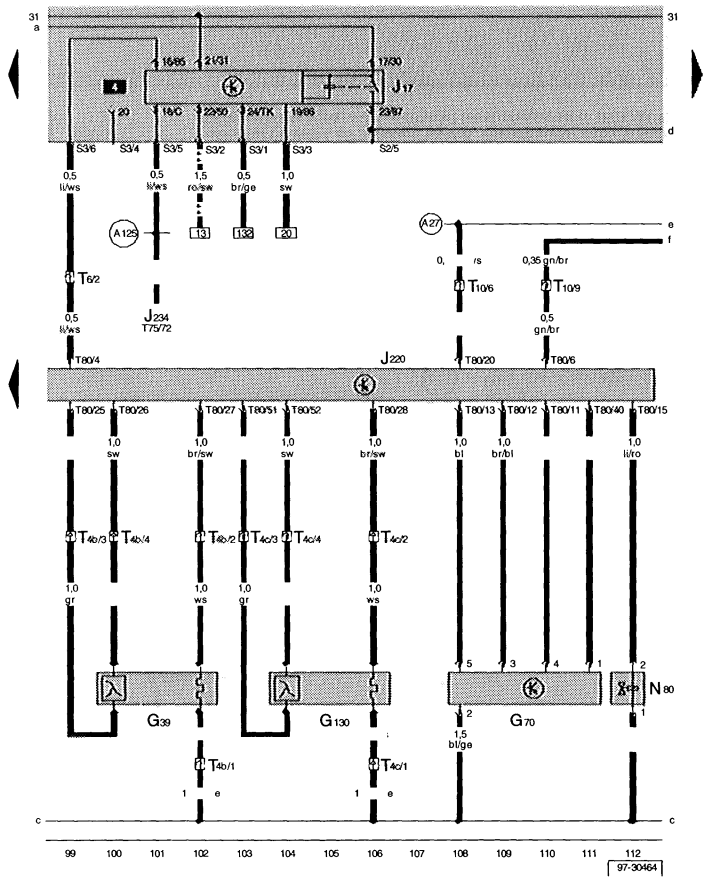
J104 - ABS Control Module (w/EDL), in engine compartment, left
J217 - Transmission Control Module (TCM), in plenum chamber, center
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J299 - Secondary Air Injection (AIR) Pump Relay, in protective housing, in engine compartment, left, production control number (100)
N112 - Secondary Air Injection (AIR) Solenoid Valve
T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
T25 - 25-Pin Connector, on ABS Control Module (through July 2000)
T47a - 47-Pin Connector, on ABS Control Module (beginning August 2000)
T68 - 68-Pin Connector, on Transmission Control Module (TCM)
T80 - Connector, 80 point
V101 - Secondary Air Injection (AIR) Pump Motor

(609) - Ground Connection (in right plenum chamber)
(A121) - Connection (high bus), in instrument panel wiring harness
(A122) - Connection (low bus), in instrument panel wiring harness
(E30) - Connector (87a), in wiring harness engine

--- Automatic transmission only

Motronic engine control module (ECM), secondary air injection (AIR) pump motor, secondary air injection (AIR) solenoid valve

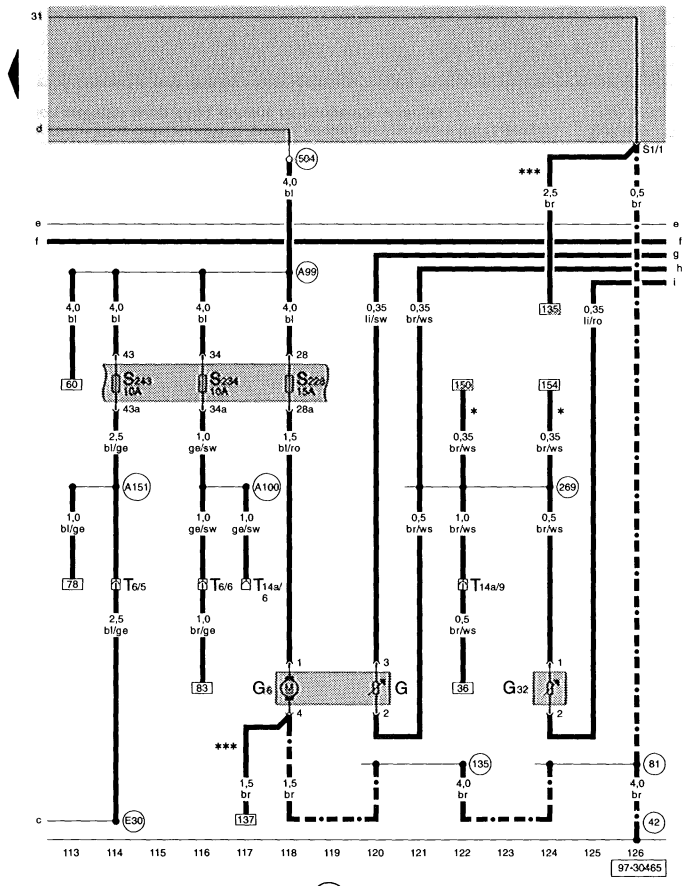
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G39 - Heated Oxygen Sensor (HO2S)
G70 - Mass Air Flow (MAF) Sensor
G130 - Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC)
J17 - Fuel Pump (FP) Relay
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J234 - Airbag Control Module
N80 - Evaporative Emission (EVAP) Canister Purge Regulator Valve
T4b - 4-Pin Connector, in protective housing for connectors under right floor
T4c - 4-Pin Connector, in protective housing for connectors under right floor
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T75 - 75-Pin Connector
T80 - Connector, 80 point
(A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness
(A125) - Connection (crash signal) in instrument panel wiring harness
-•••- - Through April 2001

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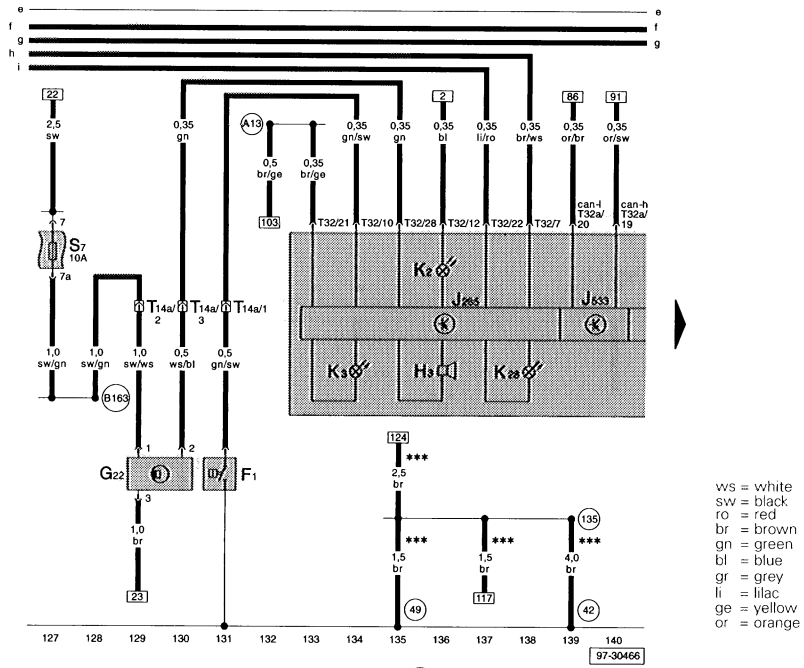
Motronic engine control module (ECM), mass air flow (MAF) sensor, heated oxygen sensor (HO2S), evaporative emission (EVAP) canister purge regulator valve



G - Fuel Level Sensor
G6 - Fuel Pump (FP)
G32 - Engine Coolant Level (ECL) Sensor
S228 - Fuse 28 in fuse holder
S234 - Fuse 34 in fuse holder
S243 - Fuse 43 in fuse holder
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, near battery
(42) - Ground connection, beside steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
(504) - Threaded connection -1- (87) on the relay plate
(A99) - Connector -1- (87), in instrument panel wiring harness
(A100) - Connector -2- (87), in instrument panel wiring harness
(A151) - Connector -4- (87), in instrument panel wiring harness
(E30) - Connector (87a), in wiring harness engine
* - Vehicles with Multi-Function Indicator (MFI) only
-•••- - Through April 2000
*** - Beginning May 2000

Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor

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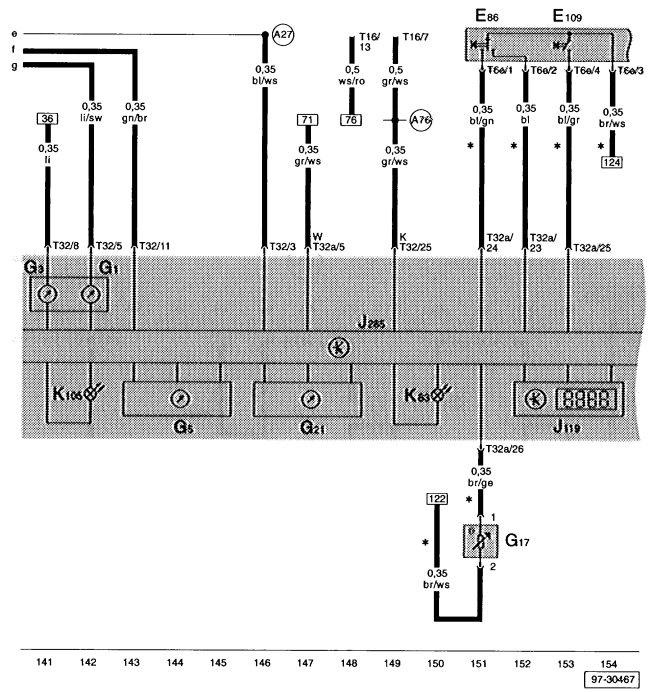


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F1 - Oil Pressure Switch
G22 - Speedometer Vehicle Speed Sensor (VSS)
H3 - Warning Buzzer
J285 - Control module with indicator unit in instrument panel insert
J533 - Data Bus On Board Diagnostic Interface
K2 - Generator (GEN) Warning Light
K3 - Oil Pressure Warning Light
K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
S7 - Fuse 7 in fuse holder
T14a - 14-Pin Connector, near battery
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(42) - Ground connection, beside steering column
(49) - Ground connection, on steering column
(135) - Ground connection -2-, in instrument panel wiring harness
(A13) - Wire connection (door contact switch) in instrument panel wiring harness
(B163) - Plus connector -1- (15) in wiring harness interior
*** - Beginning May 2000

Instrument cluster, oil pressure switch, speedometer vehicle speed sensor, generator (GEN) warning light, engine coolant level/temperature (ECL/ECT) warning light



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E86 - Multi-Function Indicator Mode Select Switch*
E109 - Multi-Function Indicator Memory Switch*
G1 - Fuel gauge
G3 - Engine Coolant Temperature (ECT) Gauge
G5 - Tachometer
G17 - Outside Air Temperature Sensor*
G21 - Speedometer
J119 - Multi-function Indicator (MFI)
J285 - Control module with indicator unit in instrument panel insert
K83 - Malfunction Indicator Lamp (MIL)
K105 - Low Fuel Level Warning Light
T6e - 6-Pin Connector
T16 - Data Link Connector (DLC), below instrument panel, left
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness
(A76) - Connector (K-diagnosis wire), in instrument panel wiring harness

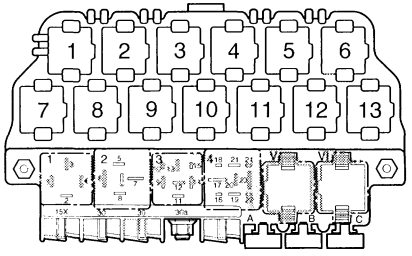
* - Vehicles with Multi-Function Indicator (MFI) only

Instrument cluster, multi-function indicator (MFI), engine coolant temperature (ECT) gauge, fuel gauge, malfunction indicator lamp (MIL), outside air temperature sensor

2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/130 kW, code AFP,

from May 1999

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97-14163

Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

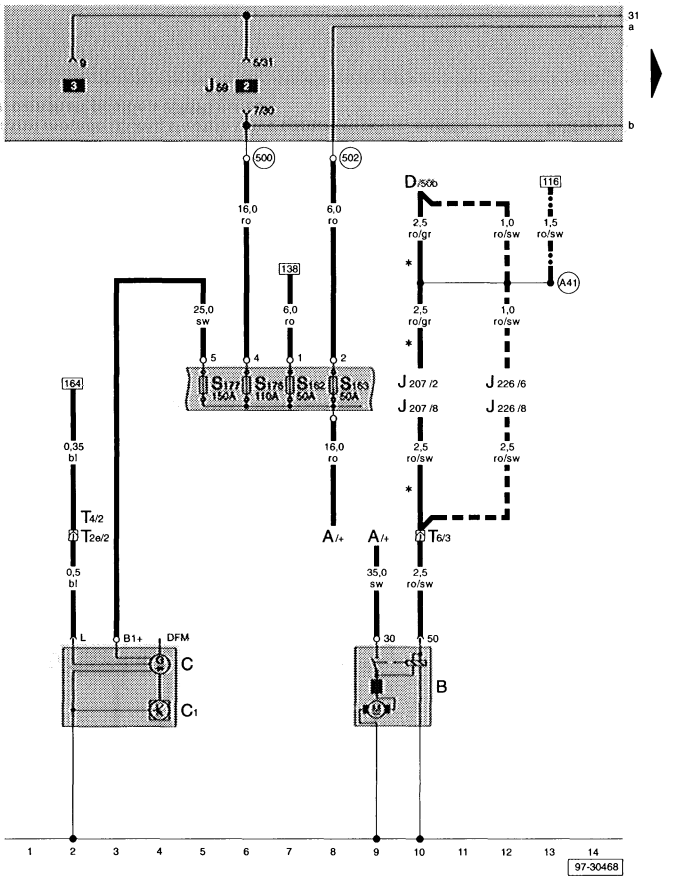
2 Load Reduction Relay (100)

4 Fuel Pump (FP) Relay (409)

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

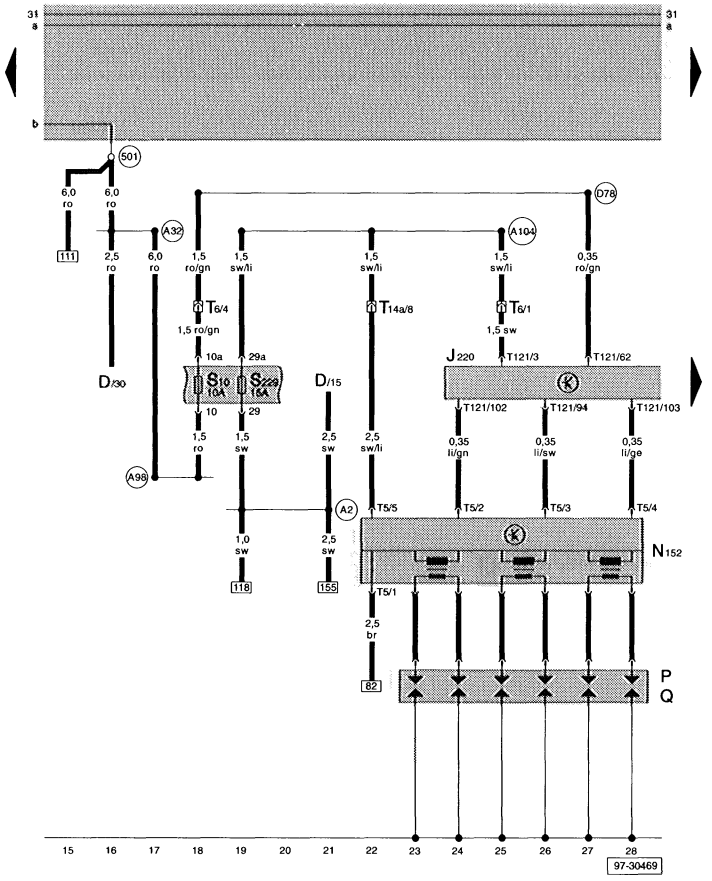


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

A - Battery
B - Starter
C - Generator (GEN)
C1 - Voltage Regulator (VR)
D - Ignition/Starter Switch
J59 - Load Reduction Relay
J207 - Starting Interlock Relay
J226 - Park/Neutral Position (PNP) Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
T2e - Double Connector, near starter (vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left

(500) - Threaded connection -1- (30) on the relay plate
(502) - Threaded connection -1- (30a) on the relay plate
(A41) - Plus connection (50), in instrument panel wiring harness (through April 2001)

* - Manual transmission only
--- - Automatic transmission only
-•-•- - Through April 2001



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

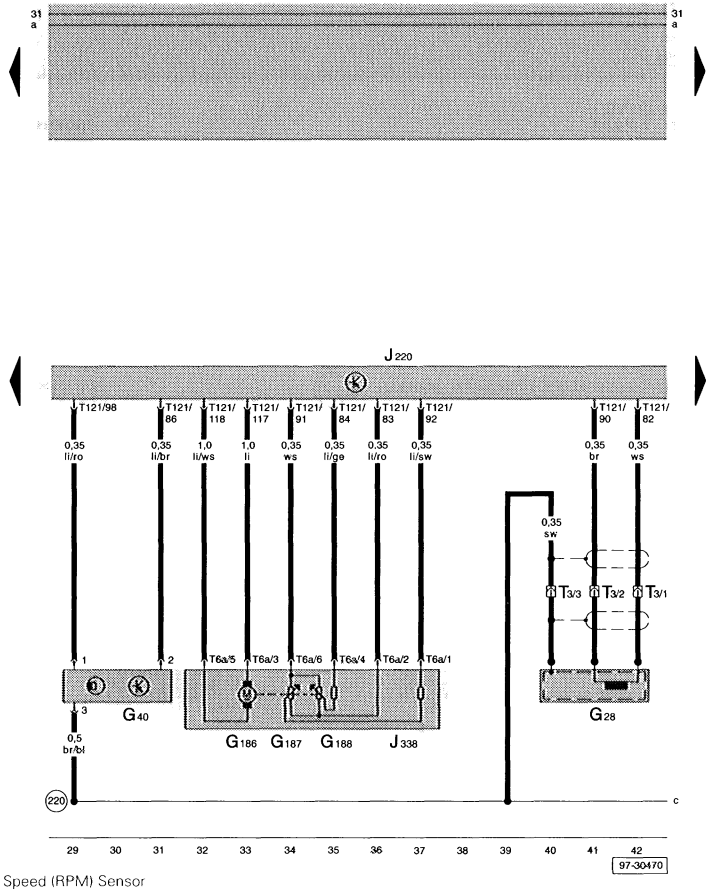
D - Ignition/Starter Switch
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N152 - Ignition Coil
P - Spark Plug Connectors
Q - Spark Plugs
S10 - Fuse 10 in fuse holder
S229 - Fuse 29 in fuse holder
T5 - 5-Pin Connector
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, near battery
T121 - Connector, 121 point

(501) - Threaded connection -2- (30) on the relay plate

(A2) - Plus connection (15), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness
(A104) - Plus connector -2- (15), in instrument panel wiring harness
(D78) - plus connection -1- (30a), in engine compartment wiring harness

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Motronic engine control module (ECM), ignition system



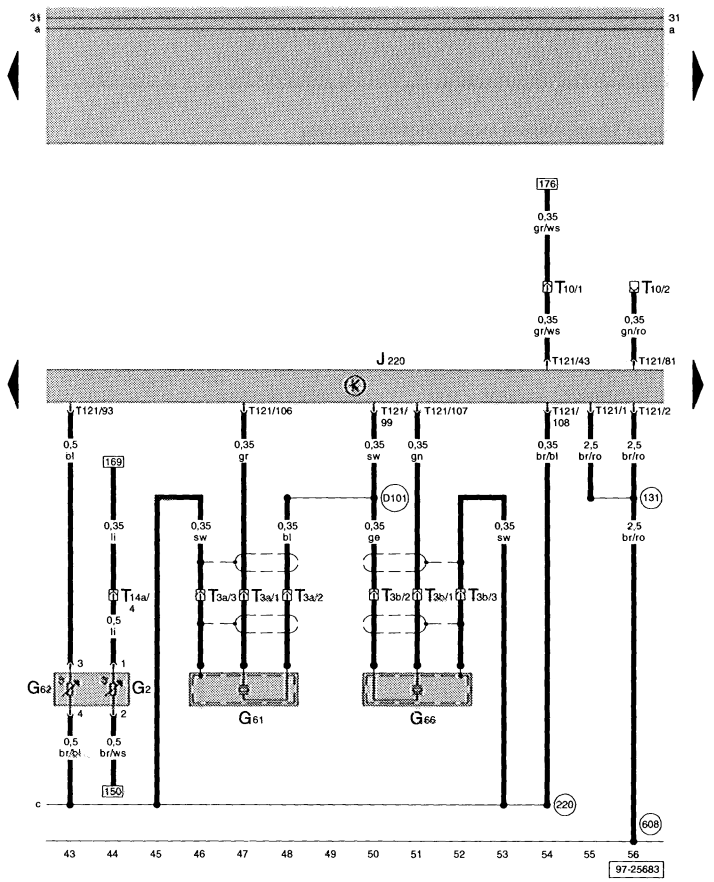
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

G28 - Engine Speed (RPM) Sensor
G40 - Camshaft Position (CMP) Sensor
G186 - Throttle drive (power accelerator actuation)
G187 - Angle sensor -1- for throttle drive (power accelerator actuation)
G188 - Angle sensor -2- for throttle drive (power accelerator actuation)
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J338 - Throttle Valve Control Module
T3 - 3-Pin Connector, near intake manifold
T6a - 6-Pin Connector
T121 - Connector, 121 point

(220) - Ground connection (sensor ground), in engine compartment wiring harness

Motronic engine control module (ECM), throttle valve control module, engine speed (RPM) sensor, camshaft position (CMP) sensor

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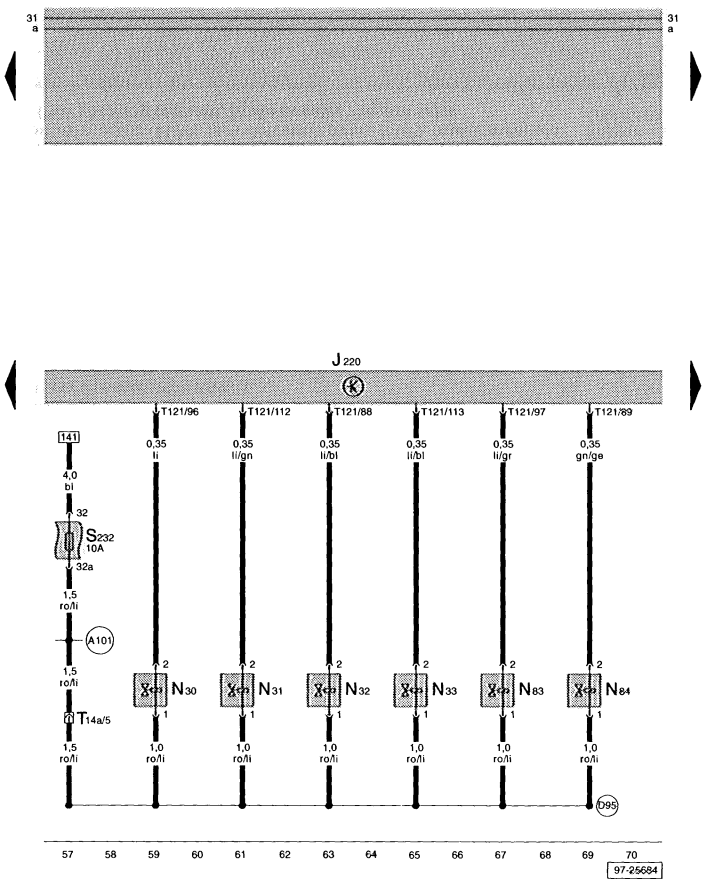


G2 - Engine Coolant Temperature (ECT) Sensor
G61 - Knock Sensor (KS) 1
G62 - Engine Coolant Temperature (ECT) Sensor
G66 - Knock Sensor (KS) 2
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
T3a - 3-Pin Connector, in engine compartment, rear
T3b - 3-Pin Connector, in engine compartment, front
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, near battery
T121 - Connector, 121 point

(131) - Ground connection -2-, in engine compartment wiring harness
(220) - Ground connection (sensor ground), in engine compartment wiring harness
(608) - Ground connection (in center plenum chamber)
(D101) - Wire connection -1-, in engine compartment wiring harness

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Motronic engine control module (ECM), knock sensor (KS) 1, knock sensor (KS) 2, engine coolant temperature (ECT) sensor

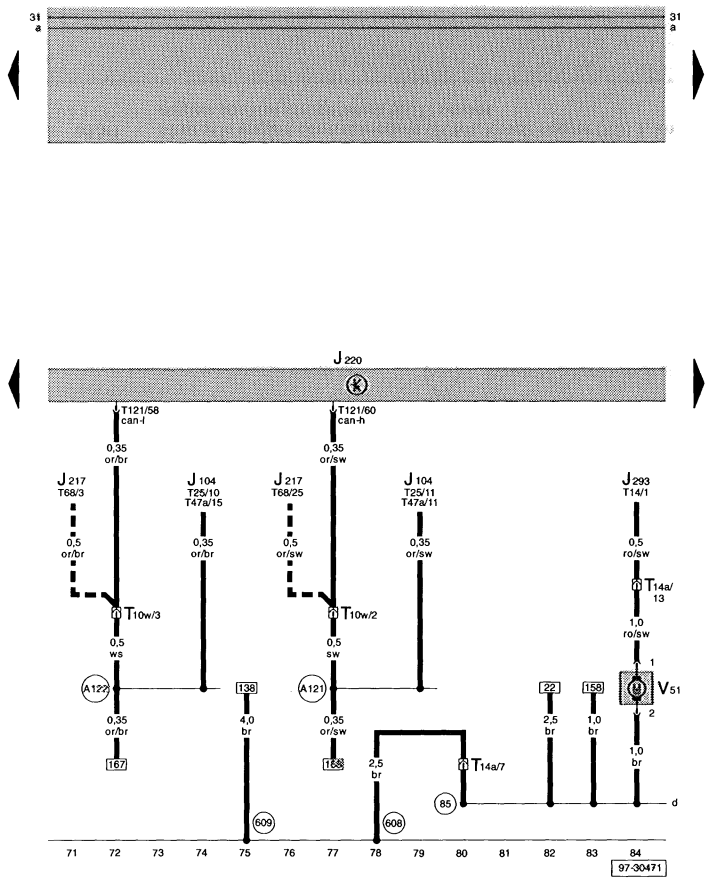


J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N30 - Cylinder 1 Fuel Injector
N31 - Cylinder 2 Fuel Injector
N32 - Cylinder 3 Fuel Injector
N33 - Cylinder 4 Fuel Injector
N83 - Cylinder 5 Fuel Injector
N84 - Cylinder 6 Fuel Injector
S232 - Fuse 32 in fuse holder
T14a - 14-Pin Connector, near battery
T121 - Connector, 121 point

(A101) - Connector -3- (87a), in instrument panel wiring harness
(D95) - Wire connection (injectors), in engine compartment wiring harness

Motronic engine control module (ECM), injectors

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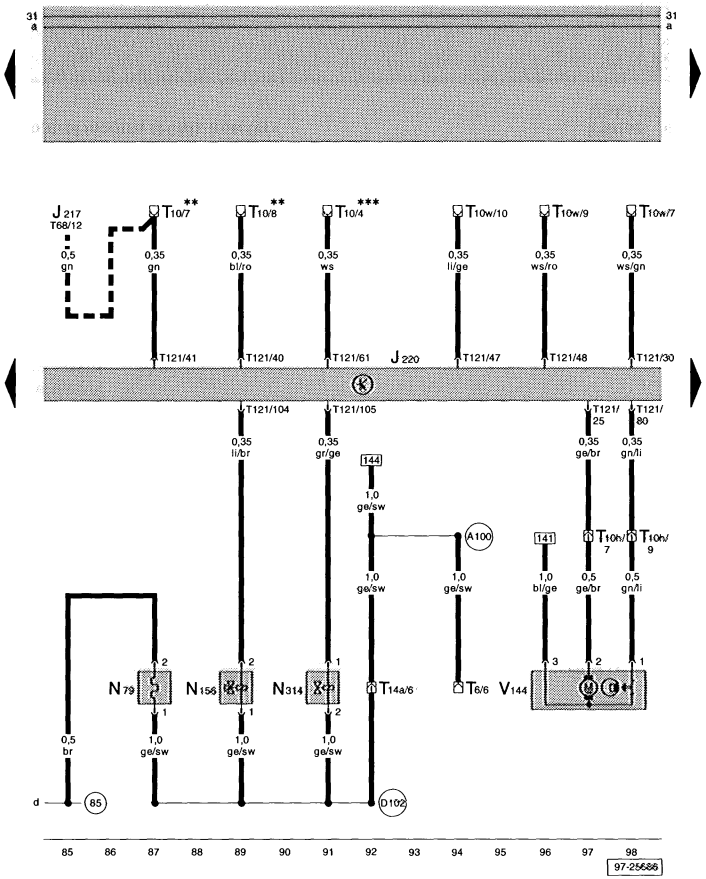


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

J104 - ABS Control Module (w/EDL)
J217 - Transmission Control Module (TCM), in plenum chamber, center
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J293 - Coolant FC (Fan Control) Control Module
T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
T14 - 14-Pin Connector, on Coolant FC (Fan Control) Control Module
T14a - 14-Pin Connector, near battery
T25 - 25-Pin Connector, on ABS Control Module (through July 2000)
T47a - 47-Pin Connector, on ABS Control Module (beginning August 2000)
T68 - 68-Pin Connector, on Transmission Control Module (TCM)
T121 - Connector, 121 point
V51 - After-Run Coolant Pump
(85) - Ground connection -1-, in engine compartment wiring harness
(608) - Ground connection (in center plenum chamber)
(609) - Ground connection (in right plenum chamber)
(A121) - Connection (high bus), in instrument panel wiring harness
(A122) - Connection (low bus), in instrument panel wiring harness
--- Automatic transmission only

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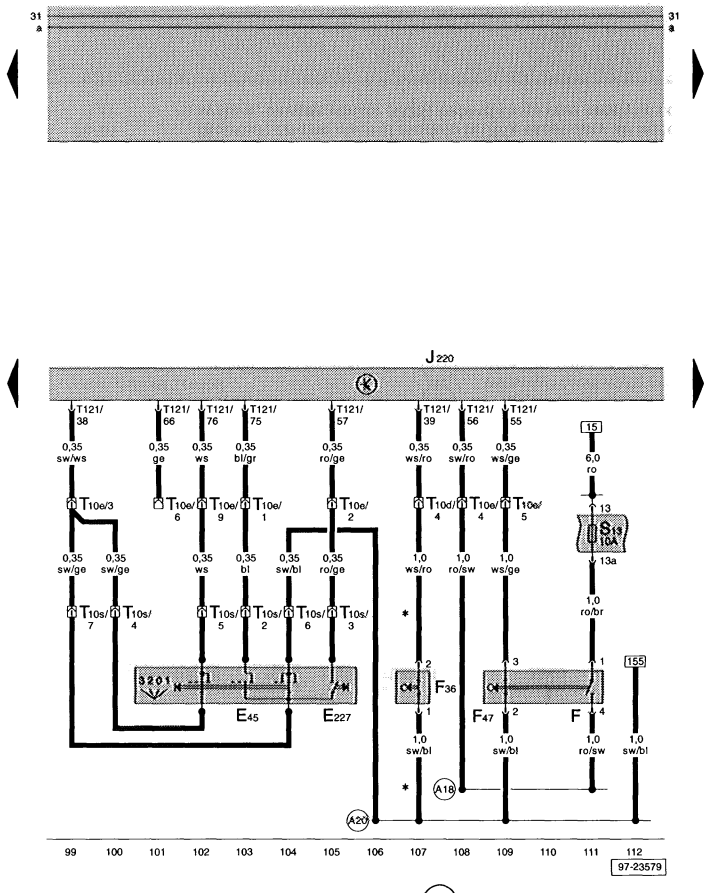
Motronic engine control module (ECM), after-run coolant pump



J217 - Transmission Control Module (TCM), in plenum chamber, center
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N79 - Positive Crankcase Ventilation (PCV) Heating Element
N156 - Intake Manifold Change-Over Valve
N314 - Brake Booster Vacuum Valve
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, near battery
T68 - 68-Pin Connector, on Transmission Control Module (TCM)
T121 - Connector, 121 point
V144 - Leak detection pump (LDP)
(85) - Ground connection -1-, in engine compartment wiring harness
(A100) - Connector -2- (87), in instrument panel wiring harness
(D102) - Wire connection -2-, in engine compartment wiring harness
** - A/C connection
*** - Coolant Fan Control Control Module connection
--- - Automatic transmission only

Motronic engine control module (ECM), leak detection pump (LDP), intake manifold change-over valve, (PCV) heating element, brake booster vacuum valve

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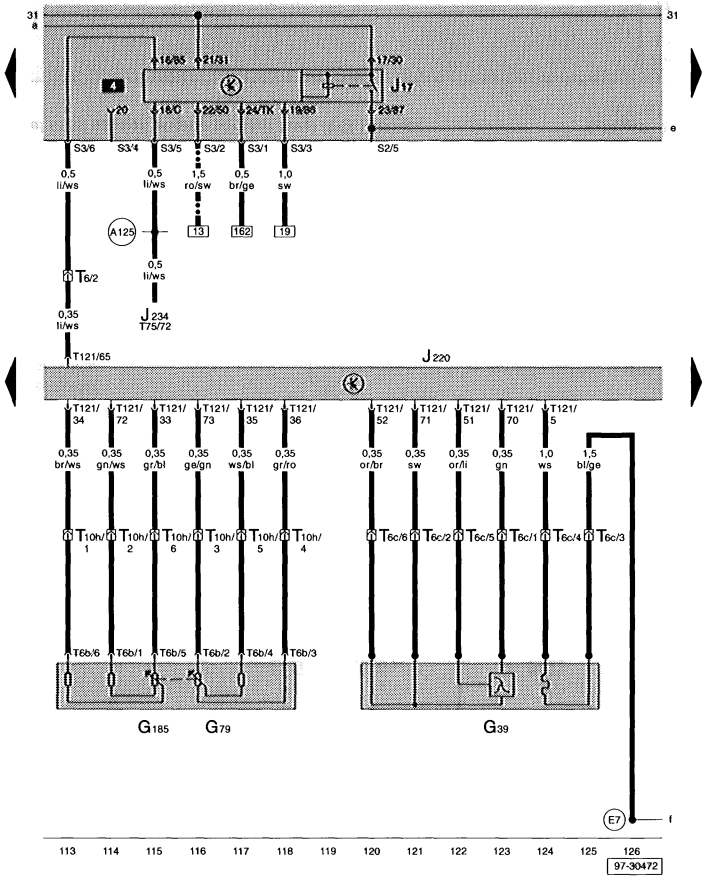


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E45 - Cruise Control Switch
E227 - Cruise Control Push Button (SET)
F - Brake Light Switch
F36 - Clutch Vacuum Vent Valve Switch
F47 - Brake Pedal Switch (cruise control/Diesel Direct Fuel Injection)
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
S13 - Fuse 13 in fuse holder
T10d - 10-Pin Connector, green, in protective housing for connectors, in plenum chamber, left
T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
T10s - 10-Pin Connector, near steering column
T121 - Connector, 121 point

(A18) - Wire connection (54), in instrument panel
(A20) - Wire connection (15a), in instrument panel wiring harness
* - Manual transmission only

Motronic engine control module (ECM), cruise control switch, brake light switch, clutch vacuum vent valve switch, brake pedal switch (cruise/DFI)

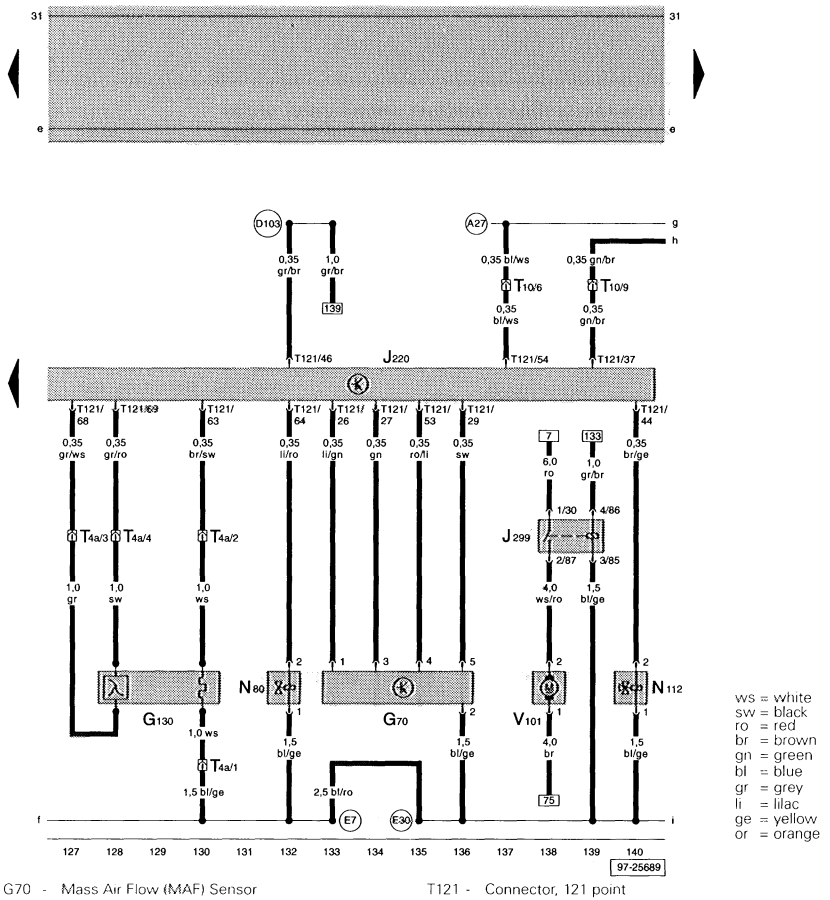


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

G39 - Heated Oxygen Sensor (HO2S)
G79 - Throttle Position (TP) Sensor
G185 - Sender -2- for accelerator pedal position
J17 - Fuel Pump (FP) Relay
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J234 - Airbag Control Module
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T6b - 6-Pin Connector
T6c - 6-Pin Connector, in protective housing for connectors, in protective housing for connectors under right floor
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T75 - 75-Pin Connector
T121 - Connector, 121 point

(A125) - Connection (crash signal) in instrument panel wiring harness
(E7) - Plus connection (87a), in Motronic Multiport Fuel Injection (MFI) wiring harness
-•••- - Through April 2001

Motronic engine control module (ECM), throttle position (TP) sensor, sender -2- for accelerator pedal position, heated oxygen sensor (HO2S)



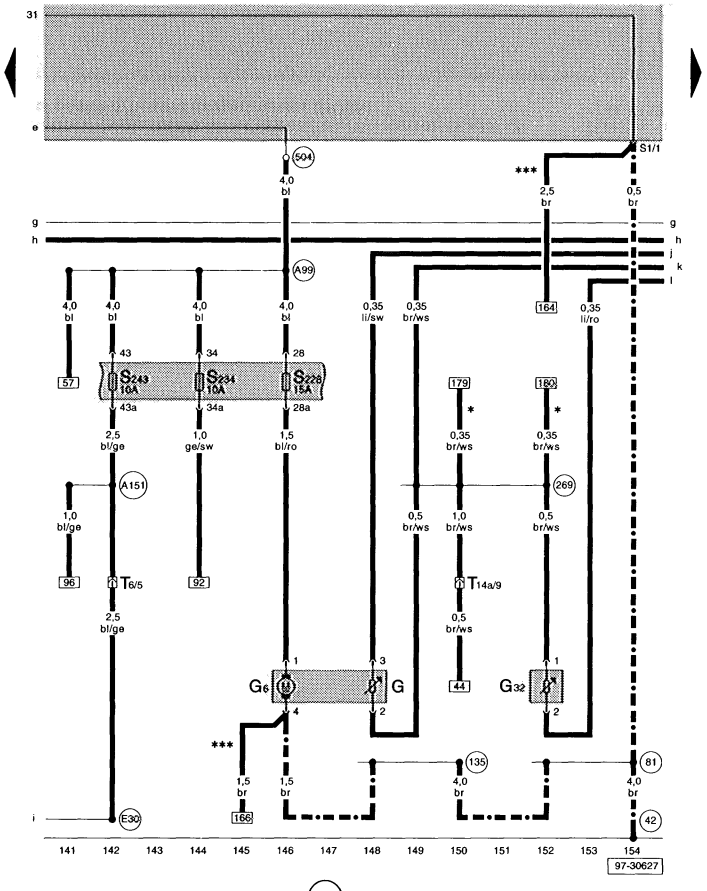
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

G70 - Mass Air Flow (MAF) Sensor
G130 - Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC)
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J299 - Secondary Air Injection (AIR) Pump Relay, in protective housing, in engine compartment, left, production control number (100)
N80 - Evaporative Emission (EVAP) Canister Purge Regulator Valve
N112 - Secondary Air Injection (AIR) Solenoid Valve
T4a - 4-Pin Connector, in protective housing for connectors, in protective housing for connectors under right floor
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T121 - Connector, 121 point
V101 - Secondary Air Injection (AIR) Pump Motor

(A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness
(D103) - Wire connection -3-, in engine compartment wiring harness
(E7) - Plus connection (87a), in Motronic Multiport Fuel Injection (MFI) wiring harness
(E30) - Connector (87a), in wiring harness engine

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Motronic engine control module (ECM), secondary air injection (AIR) pump system, oxygen sensor (O2S) behind three way catalytic converter (TWC)



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

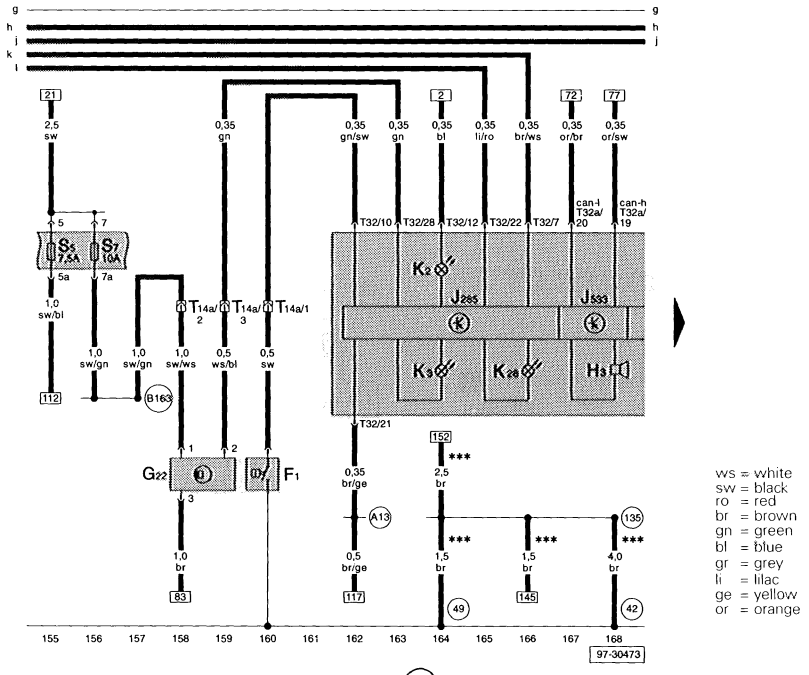
G - Fuel Level Sensor
G6 - Fuel Pump (FP)
G32 - Engine Coolant Level (ECL) Sensor
S228 - Fuse 28 in fuse holder
S234 - Fuse 34 in fuse holder
S243 - Fuse 43 in fuse holder
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, near battery

(42) - Ground connection, beside steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harnes
(269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
(504) - Threaded connection -1- (87) on the relay plate
(E30) - Connector (87a), in wiring harness engine
(A99) - Connector -1- (87), in instrument panel wiring harness
(A151) - Connector -4- (87), in instrument panel wiring harness

* - Vehicles with Multi-Function Indicator (MFI) only
-•-•- - Through April 2000
*** - Beginning May 2000

Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor

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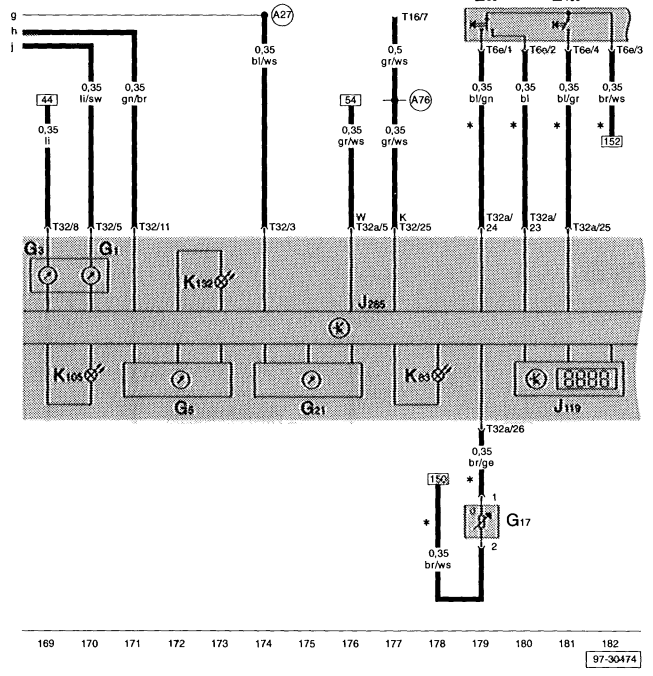


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F1 - Oil Pressure Switch
G22 - Speedometer Vehicle Speed Sensor (VSS)
H3 - Warning Buzzer
J285 - Control module with indicator unit in instrument panel insert
J533 - Data Bus On Board Diagnostic Interface
K2 - Generator (GEN) Warning Light
K3 - Oil Pressure Warning Light
K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
S5 - Fuse 5 in fuse holder
S7 - Fuse 7 in fuse holder
T14a - 14-Pin Connector, near battery
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(42) - Ground connection, beside steering column
(49) - Ground connection, on steering column
(135) - Ground connection -2-, in instrument panel wiring harnes
(A13) - Wire connection (door contact switch) in instrument panel wiring harness
(B163) - Plus connector -1- (15) in wiring harness interior
*** - Beginning May 2000

Instrument cluster, oil pressure switch, speedometer vehicle speed sensor, generator (GEN) warning light, engine coolant level/temperature (ECL/ECT) warning light



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E86 - Multi-Function Indicator Mode Select Switch*
E109 - Multi-Function Indicator Memory Switch*
G1 - Fuel gauge
G3 - Engine Coolant Temperature (ECT) Gauge
G5 - Tachometer
G17 - Outside Air Temperature Sensor*
G21 - Speedometer
J119 - Multi-function Indicator (MFI)
J285 - Control module with indicator unit in instrument panel insert
K83 - Malfunction Indicator Lamp (MIL)
K105 - Low Fuel Level Warning Light
K132 - Electronic Power control (EPC) Warning Lamp
T6e - 6-Pin Connector
T16 - Data Link Connector (DLC), below instrument panel, left
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness
(A76) - Connector (K-diagnosis wire), in instrument panel wiring harness

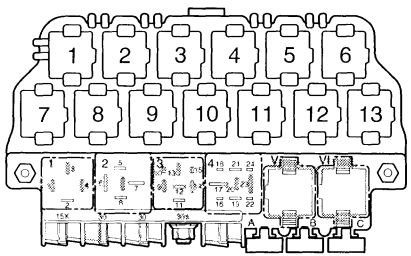
* - Vehicles with Multi-Function Indicator (MFI) only

Instrument cluster, multi-function indicator (MFI), engine coolant temperature (ECT) gauge, fuel gauge, malfunction indicator lamp (MIL), electronic power control (EPC) warning lamp

1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66KW, code ALH, (with manual transmission),

from May 1999

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

10 Glow Plug Relay (180)

12 Power Supply (Terminal 30, B+) Relay (109)

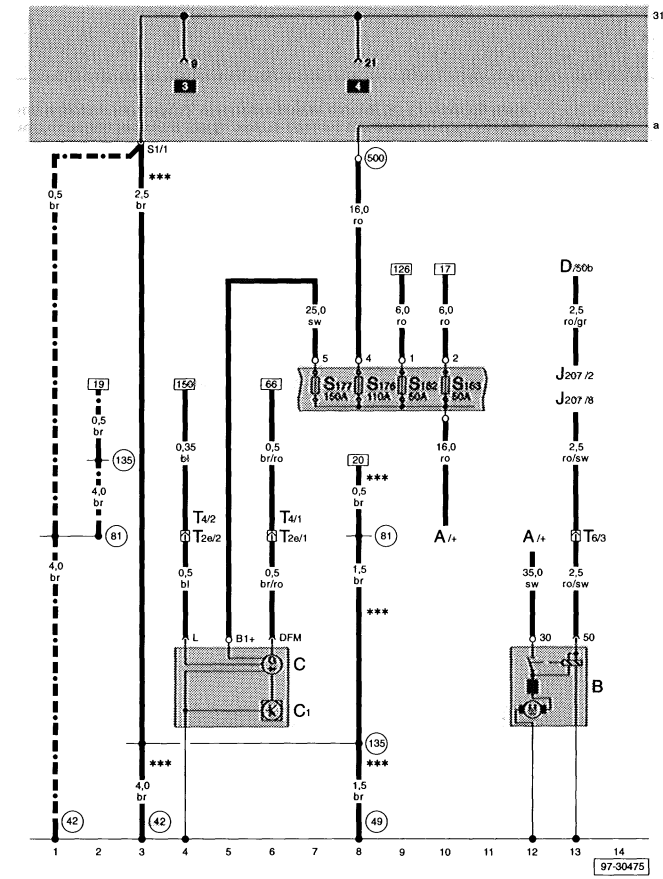
Relay panel:

2 Load Reduction Relay (100)

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



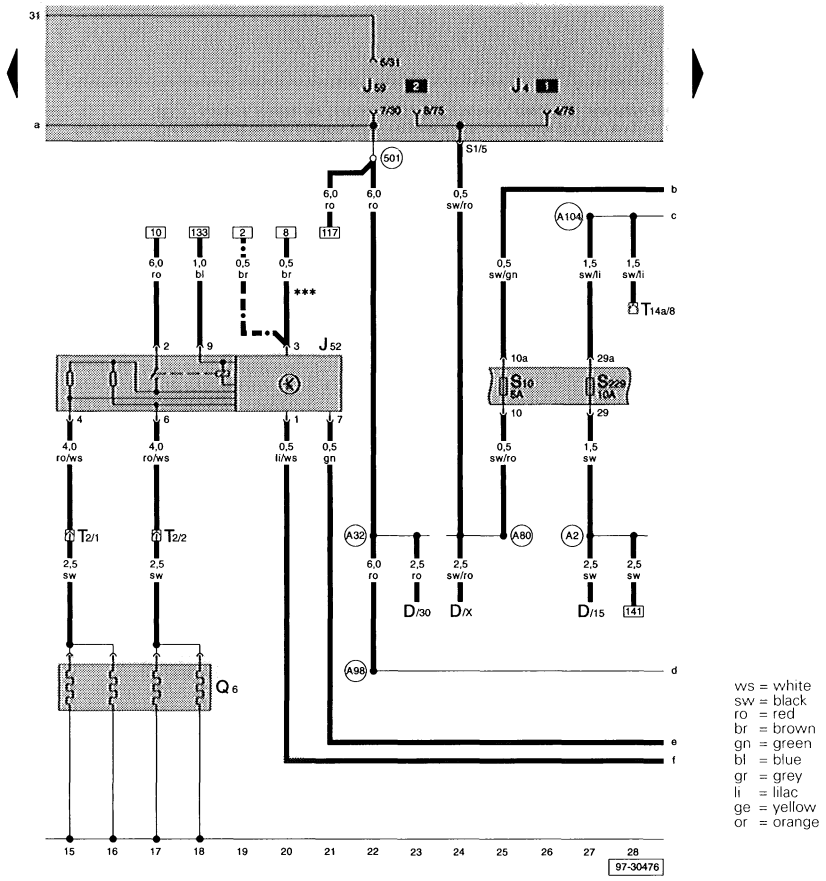
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

A - Battery
B - Starter
C - Generator (GEN)
C1 - Voltage Regulator (VR)
D - Ignition/Starter Switch
J207 - Starting Interlock Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
T2e - Double Connector, near starter (vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left

(42) - Ground connection, beside steering column
(49) - Ground connection, on steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(500) - Threaded connection -1- (30) on the relay plate

*** - Beginning May 2000
-•-- - Through April 2000

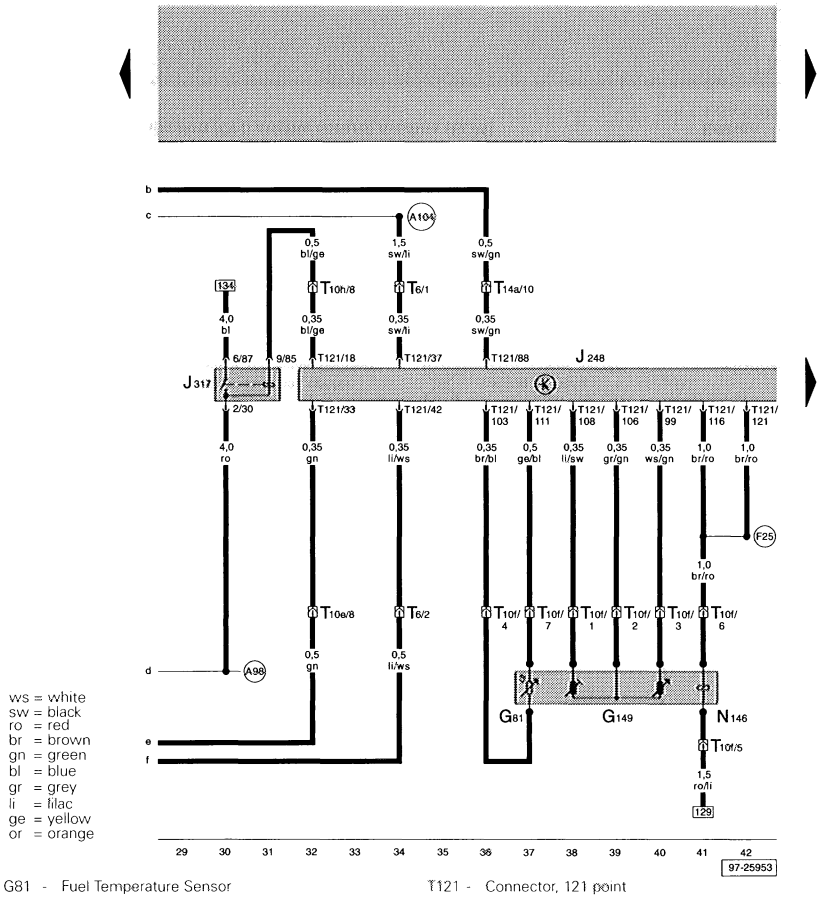
Generator (GEN), starter



D - Ignition/Starter Switch
J4 - Dual Horn Relay
J52 - Glow Plug Relay, on the thirteenfold auxiliary relay panel, above relay panel
J59 - Load Reduction Relay
Q6 - Glow plugs (engine)
S10 - Fuse 10 in fuse holder
S229 - Fuse 29 in fuse holder
T2 - Double Connector, in engine compartment, in wiring duct, left
T14a - 14-Pin Connector, near battery

(501) - Threaded connection -2- (30) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A80) - Connector -1- (X) in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness
(A104) - Plus connector -2- (15), in instrument panel wiring harness

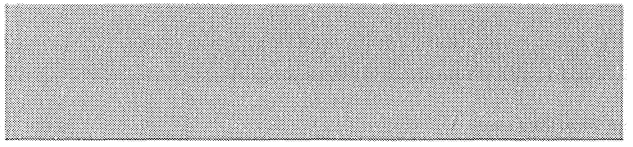
*** - Beginning May 2000
-•--- - Through April 2000

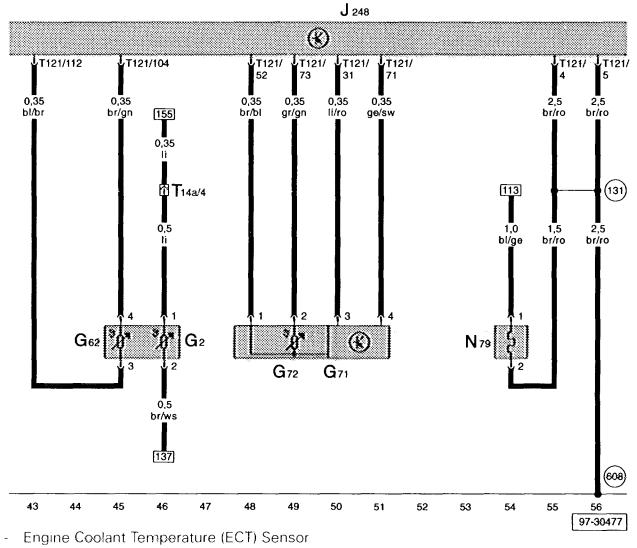


G81 - Fuel Temperature Sensor
G149 - Modulating Piston Displacement Sensor
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
J317 - Power Supply (Terminal 30, B+) Relay, on the thirteenfold auxiliary relay panel, above relay panel
N146 - Quantity Adjuster
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
T10f - 10-Pin Connector, in engine compartment, front
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, near battery
T121 - Connector, 121 point

(A98) - Plus connector -4- (30), in instrument panel wiring harness
(A104) - Plus connector -2- (15), in instrument panel wiring harness
(F25) - Wire connection -1-, in Diesel Direct Fuel Injection (DFI) system wiring harness

Repair Manual page number 97-300
Repair Manual page number 97-301



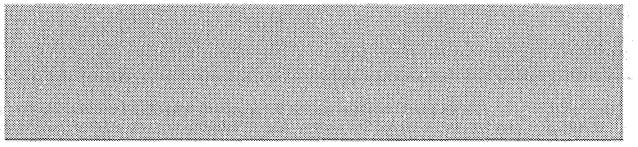


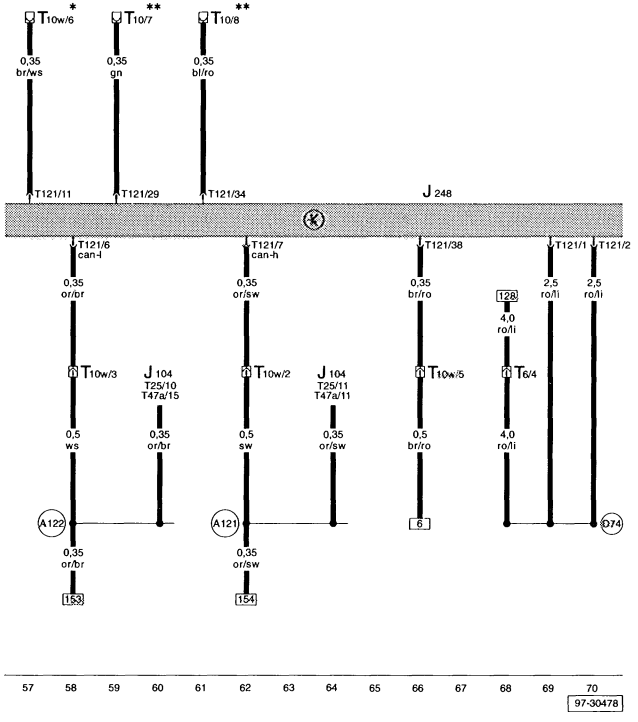
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

G2 - Engine Coolant Temperature (ECT) Sensor
G62 - Engine Coolant Temperature (ECT) Sensor
G71 - Manifold Absolute Pressure (MAP) Sensor
G72 - Intake Air Temperature (IAT) Sensor
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
N79 - Positive Crankcase Ventilation (PCV) Heating Element
T14a - 14-Pin Connector, near battery
T121 - Connector, 121 point

(131) - Ground connection -2-, in engine compartment wiring harness

(608) - Ground Connection (in center plenum chamber)



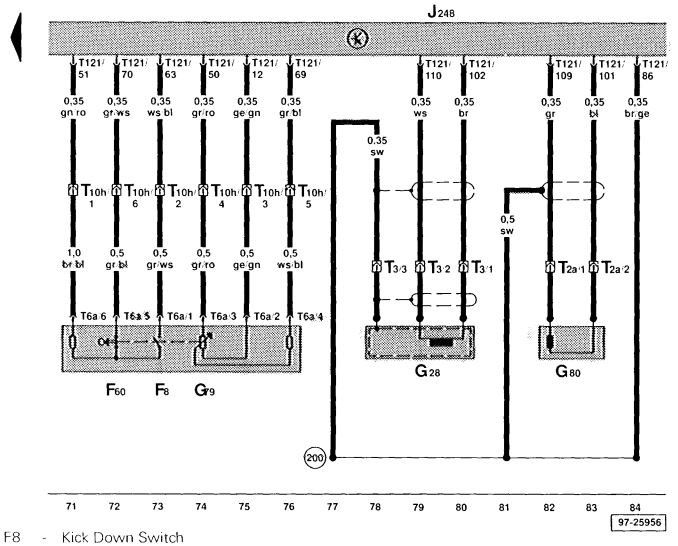


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

J104 - ABS Control Module (w/EDL), in engine compartment, left
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
T25 - 25-Pin Connector, on ABS Control Module (through July 2000)
T47a - 47-Pin Connector, on ABS Control Module (beginning August 2000)
T121 - Connector, 121 point

(A121) - Connection (high bus), in instrument panel wiring harness
(A122) - Connection (low bus), in instrument panel wiring harness
(D74) - Wire connection (86), in engine compartment wiring harness

* - Coolant Fan Control (FC) Control Module connection
** - A/C connection

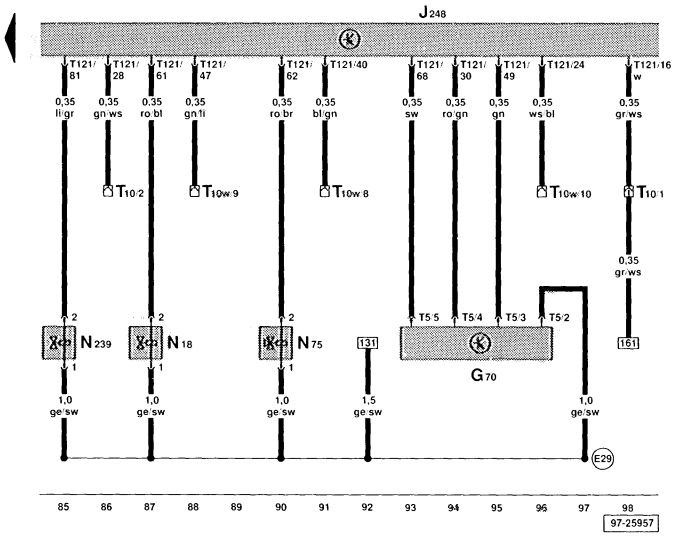


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

F8 - Kick Down Switch
F60 - Closed Throttle Position (CTP) Switch
G28 - Engine Speed (RPM) Sensor
G79 - Throttle Position (TP) Sensor
G80 - Needle Lift Sensor
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
T2a - Double Connector, in engine compartment, front
T3 - 3-Pin Connector, in engine compartment, front
T6a - 6-Pin Connector
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T121 - Connector, 121 point

(200) - Ground connection (shielding), in engine compartment wiring harness

Diesel direct fuel injection (DFI) engine control module (ECM), kick down switch, (CTP) switch, engine speed (RPM) sensor, throttle position (TP) sensor, needle lift sensor

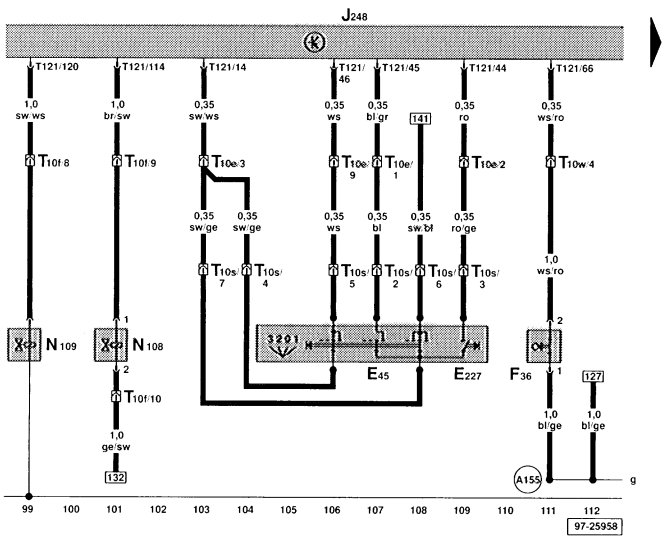


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

G70 - Mass Air Flow (MAF) Sensor
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
N18 - EGR Vacuum Regulator Solenoid Valve
N75 - Wastegate Bypass Regulator Valve
N239 - Change-over valve for intake manifold flap
T5 - 5-Pin Connector
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
T121 - Connector, 121 point

(E29) - Connector, in wiring harness engine

(DFI) engine control module (ECM), mass air flow sensor, change-over valve for intake manifold flap, wastegate bypass regulator valve, EGR vacuum regulator solenoid valve



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

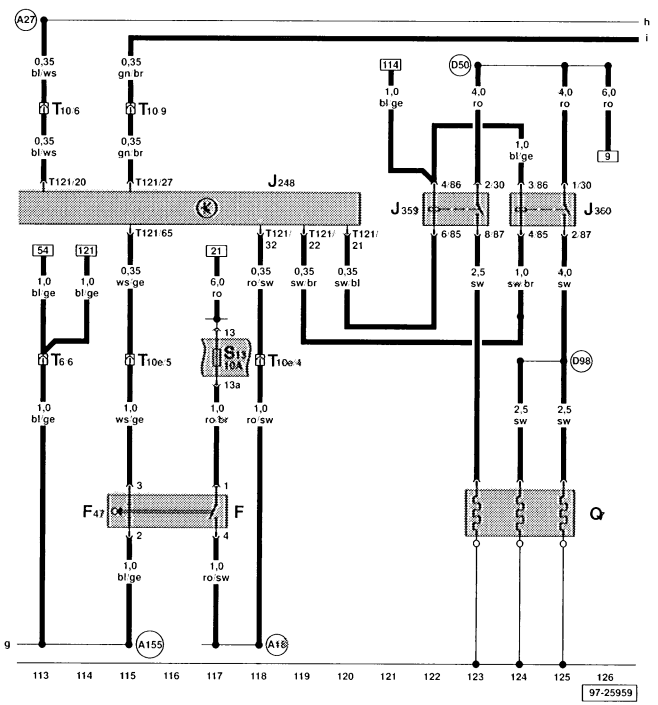
E45 - Cruise Control Switch**
E227 - Cruise Control Push Button (SET)**
F36 - Clutch Vacuum Vent Valve Switch
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
N108 - Cold Start Injector
N109 - Fuel Cut-off Valve
T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
T10f - 10-Pin Connector, in engine compartment, front
T10s - 10-Pin Connector, near steering column**
T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
T121 - Connector, 121 point

(A155) - Connector -2- (86), in instrument panel wiring harness

** - Vehicles with cruise control only

Edition 08/99
USA.5102.04.21

Diesel direct fuel injection (DFI) engine control module (ECM), cruise control switch, clutch vacuum vent valve switch, cold start injector, fuel cut-off valve



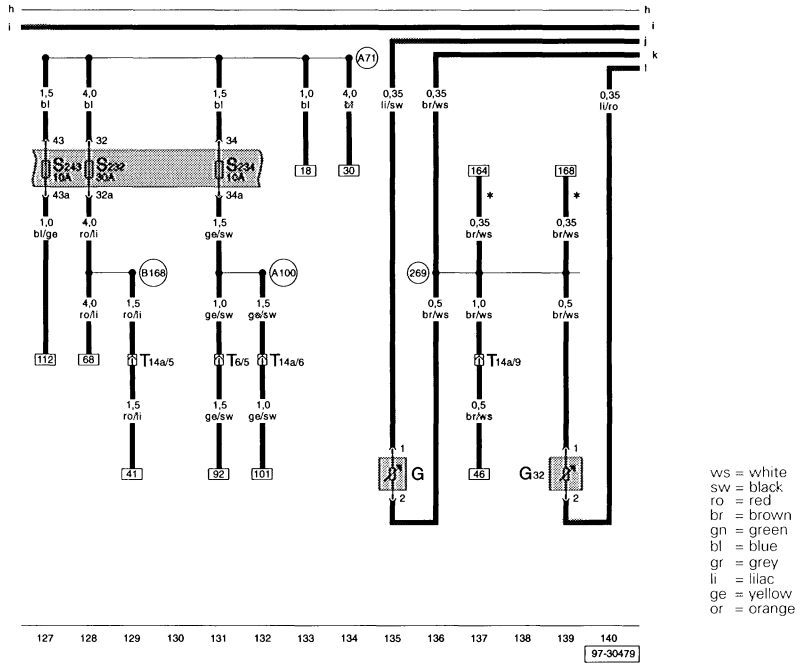
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

F - Brake Light Switch
F47 - Brake Vacuum Vent Valve Switch for cruise control/diesel
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
J359 - Relay for preheating coolant, low heat output, in protective housing, in engine compartment, left, production control number (53)
J360 - Relay for preheating coolant, high heat output, in protective housing, in engine compartment, left, production control number (53)
Q7 - Glow plugs (coolant)
S13 - Fuse 13 in fuse holder
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
T121 - Connector, 121 point

(A18) - Wire connection (54), in instrument panel wiring harness
(A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness
(A155) - Connector -2- (86), in instrument panel wiring harness
(D50) - Plus connection (30), in engine compartment wiring harness
(D98) - Wire connection (glow plugs), in engine compartment wiring harness

Diesel direct fuel injection (DFI) engine control module (ECM), brake light switch, brake vacuum vent valve switch for cruise control/diesel, glow plugs (coolant)

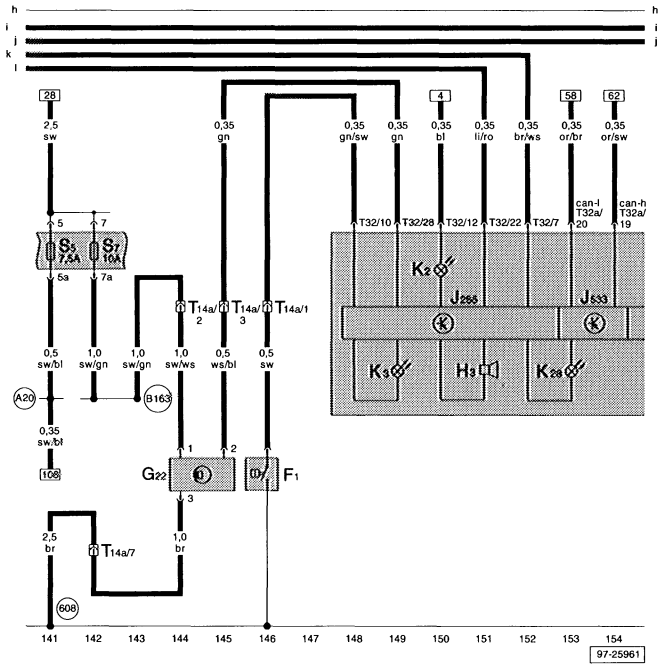
Edition 08/99
USA.5102.04.21



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

G - Fuel Level Sensor
G32 - Engine Coolant Level (ECL) Sensor
S232 - Fuse 32 in fuse holder
S234 - Fuse 34 in fuse holder
S243 - Fuse 43 in fuse holder
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, near battery

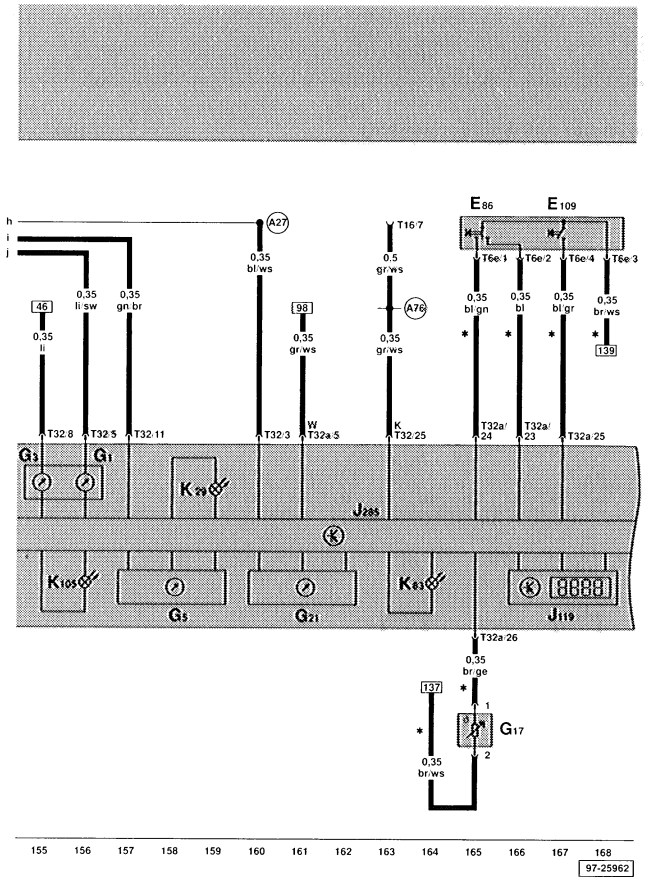
(269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
(A71) - Connector (86), in instrument panel wiring harness
(A100) - Connector -2- (87), in instrument panel wiring harness
(B168) - Connection (86) in passenger compartment wiring harness
* - Vehicles with Multi-Function Indicator (MFI) only



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F1 - Oil Pressure Switch
G22 - Speedometer Vehicle Speed Sensor (VSS)
H3 - Warning Buzzer
J285 - Control module with indicator unit in instrument panel insert
J533 - Data Bus On Board Diagnostic Interface
K2 - Generator (GEN) Warning Light
K3 - Oil Pressure Warning Light
K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
S5 - Fuse 5 in fuse holder
S7 - Fuse 7 in fuse holder
T14a - 14-Pin Connector, near battery
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(608) - Ground Connection (in center plenum chamber)
(A20) - Wire connection (15a), in instrument panel wiring harness
(B163) - Plus connector -1- (15) in wiring harness interior



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E86 - Multi-Function Indicator Mode Select Switch*
E109 - Multi-Function Indicator Memory Switch*
G1 - Fuel gauge
G3 - Engine Coolant Temperature (ECT) Gauge
G5 - Tachometer
G17 - Outside Air Temperature Sensor*
G21 - Speedometer
J119 - Multi-function Indicator (MFI)
J285 - Control module with indicator unit in instrument panel insert
K29 - Glow Plug Indicator Light
K83 - Malfunction Indicator Lamp (MIL)
K105 - Low Fuel Level Warning Light
T6e - 6-Pin Connector
T16 - Data Link Connector (DLC), below instrument panel, left

T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness
(A76) - Connector (K-diagnosis wire), in instrument panel wiring harness

* - Vehicles with Multi-Function Indicator (MFI) only

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USA.5102.04.21

Instrument cluster, engine coolant temperature (ECT) gauge, fuel gauge, tachometer, speedometer, glow plug indicator light

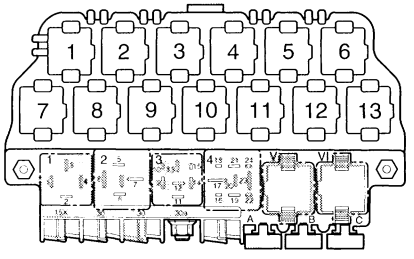
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1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66KW, code ALH, (with automatic transmission),

from May 1999

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97-14163

Relay location on the thirteenfold auxiliary relay panel, above relay panel:

10 Glow Plug Relay (180)

12 Power Supply (Terminal 30, B+) Relay (109)

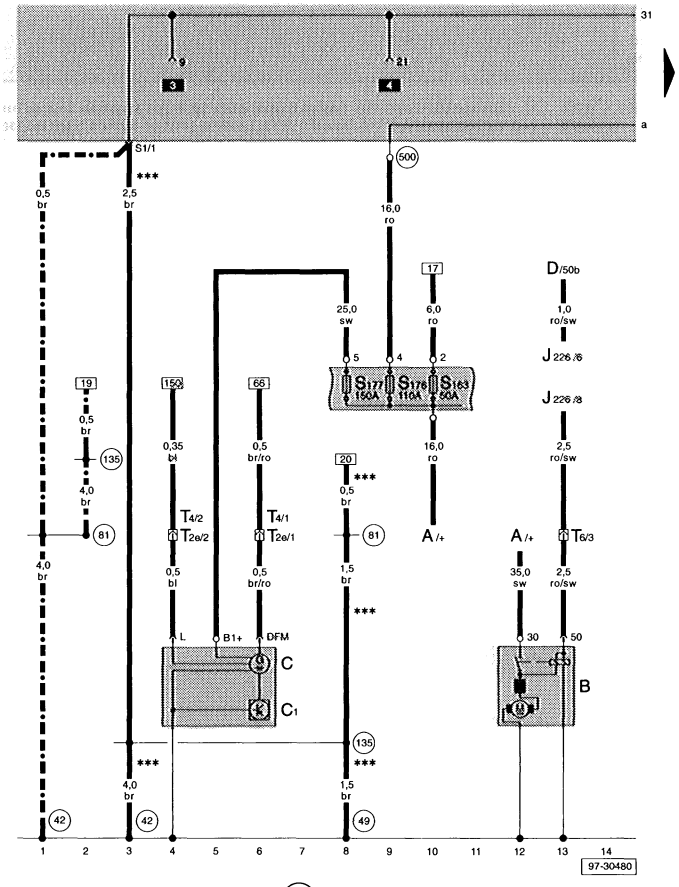
Relay panel:

2 Load Reduction Relay (100)

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

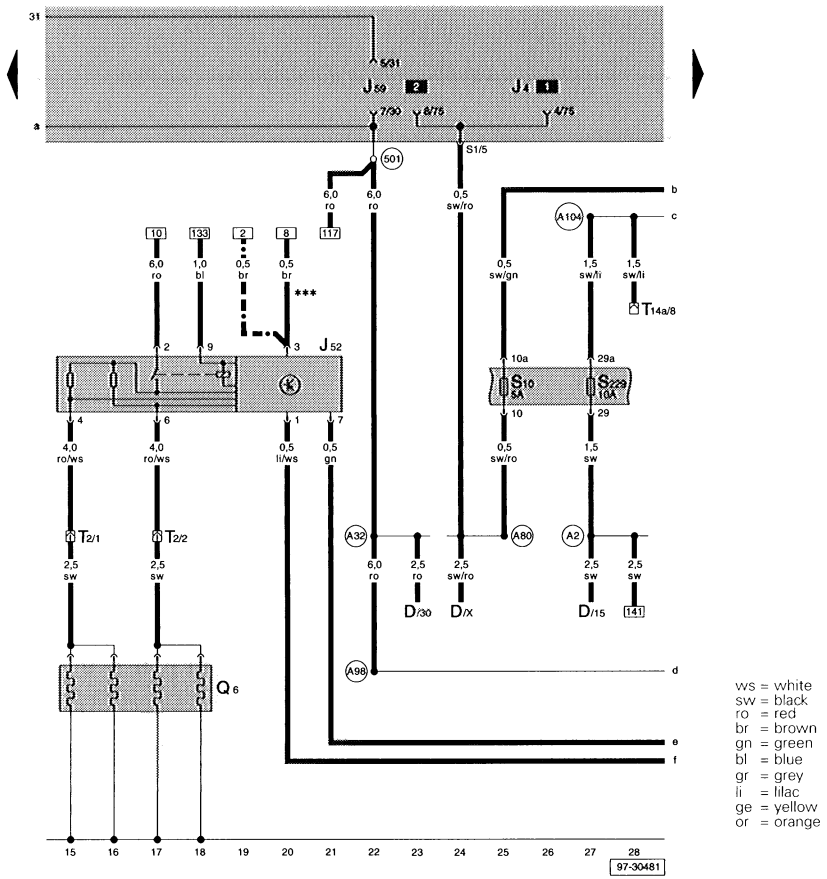


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

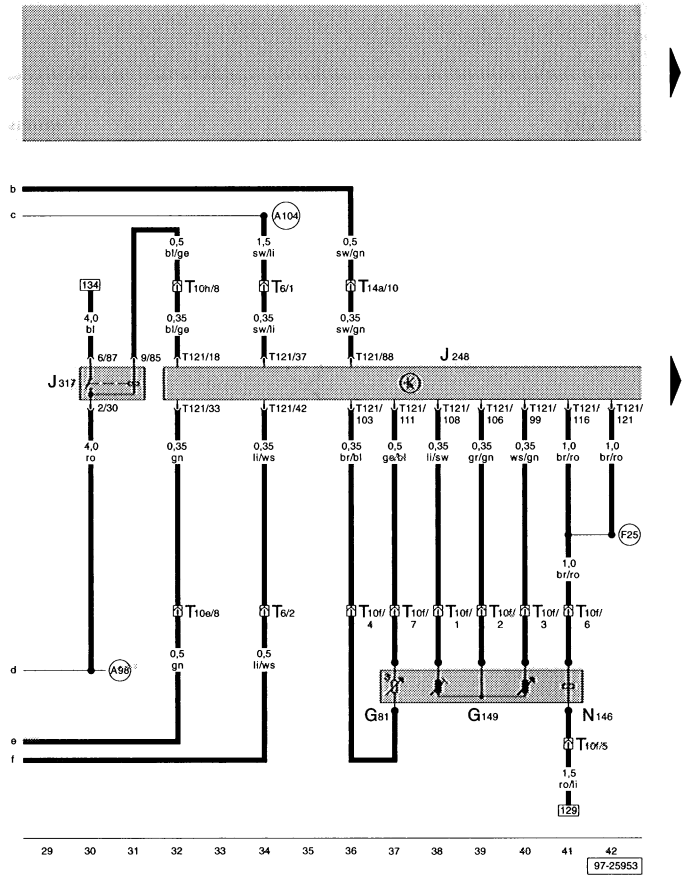
A - Battery
B - Starter
C - Generator (GEN)
C1 - Voltage Regulator (VR)
D - Ignition/Starter Switch
J226 - Park/Neutral Position (PNP) Relay
S163 - Fuse -2- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
T2e - Double Connector, near starter (vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left

(42) - Ground connection, beside steering column
(49) - Ground connection, on steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(500) - Threaded connection -1- (30) on the relay plate

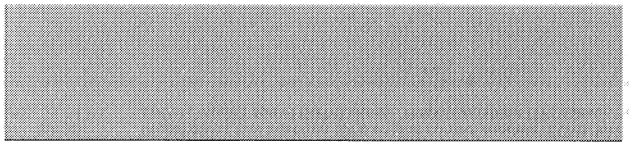
*** - Beginning May 2000
-•-•- - Through April 2000

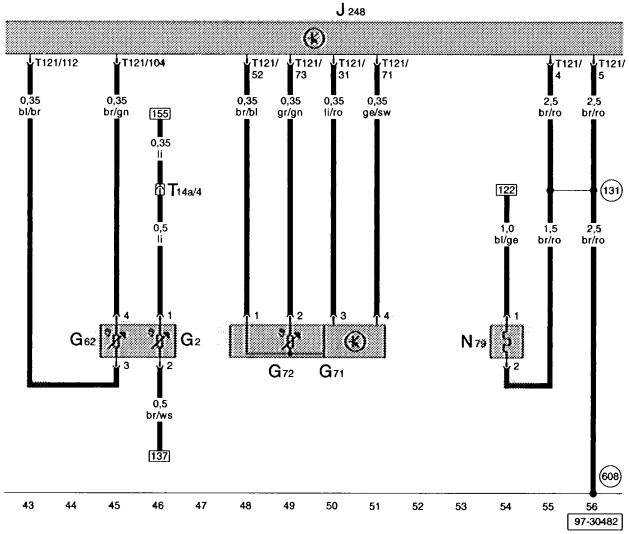


- D - Ignition/Starter Switch
- J4 - Dual Horn Relay
- J52 - Glow Plug Relay, on the thirteenfold auxiliary relay panel, above relay panel
- J59 - Load Reduction Relay
- Q6 - Glow plugs (engine)
- S10 - Fuse 10 in fuse holder
- S229 - Fuse 29 in fuse holder
- T2 - Double Connector, in engine compartment, in wiring duct, left
- T14a - 14-Pin Connector, near battery
- (501) - Threaded connection -2- (30) on the relay plate
- (A2) - Plus connection (15), in instrument panel wiring harness
- (A32) - Plus connection (30), in instrument panel wiring harness
- (A80) - Connector -1- (X) in instrument panel wiring harness
- (A98) - Plus connector -4- (30), in instrument panel wiring harness
- (A104) - Plus connector -2- (15), in instrument panel wiring harness
- *** - Beginning May 2000
- -•-- - Through April 2000



- G81 - Fuel Temperature Sensor
- G149 - Modulating Piston Displacement Sensor
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- J317 - Power Supply (Terminal 30, B+) Relay, on the thirteenfold auxiliary relay panel, above relay panel
- N146 - Quantity Adjuster
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T10f - 10-Pin Connector, in engine compartment, front
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- T121 - Connector, 121 point
- (A98) - Plus connector -4- (30), in instrument panel wiring harness
- (A104) - Plus connector -2- (15), in instrument panel wiring harness
- (F25) - Wire connection -1-, in Diesel Direct Fuel Injection (DFI) system wiring harness

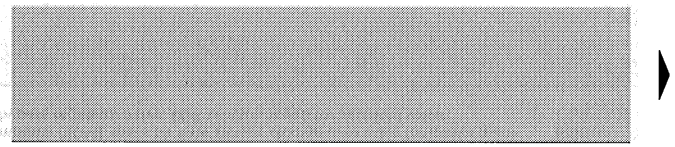


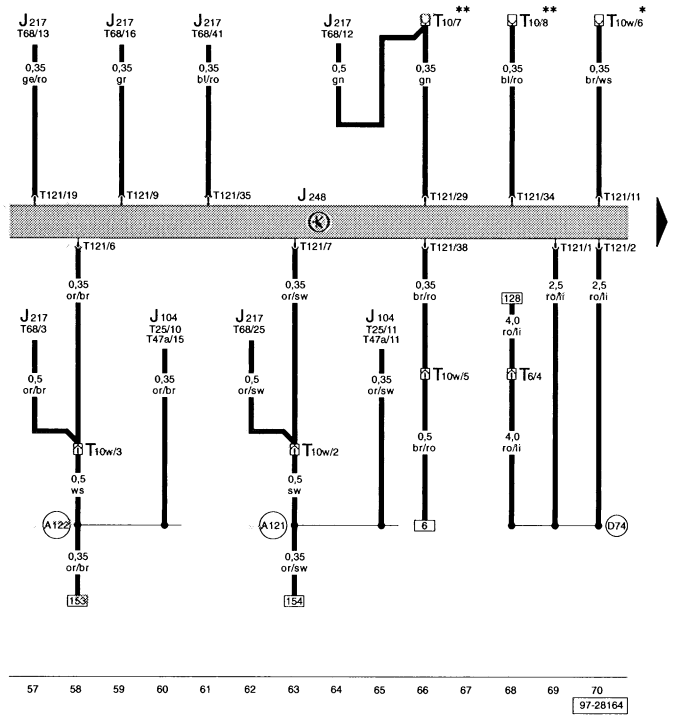


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

G2 - Engine Coolant Temperature (ECT) SensorPositive Crankcase Ventilation (PCV) Heating Element
G62 - Engine Coolant Temperature (ECT) Sensor
G71 - Manifold Absolute Pressure (MAP) Sensor
G72 - Intake Air Temperature (IAT) Sensor
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
N79 - Positive Crankcase Ventilation (PCV) Heating Element
T14a - 14-Pin Connector, near battery
T121 - Connector, 121 point

(131) - Ground connection -2-, in engine compartment wiring harness
(608) - Ground Connection (in center plenum chamber)



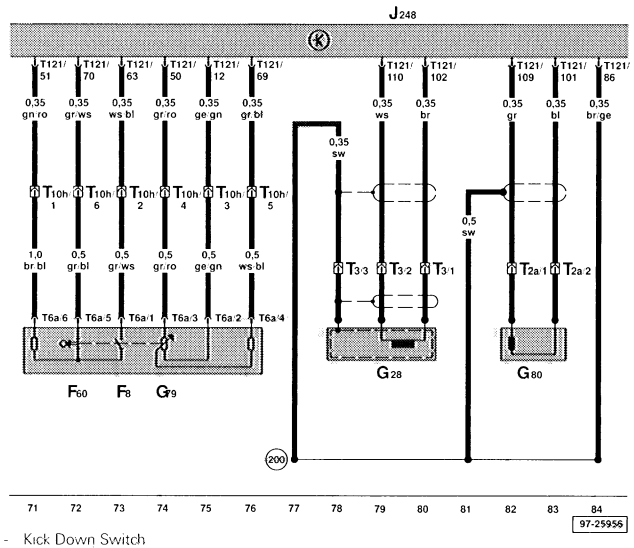


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

J104 - ABS Control Module (w/EDL), in engine compartment, left
J217 - Transmission Control Module (TCM), in plenum chamber, center
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
T25 - 25-Pin Connector, on ABS Control Module (through July 2000)
T47a - 47-Pin Connector, on ABS Control Module (beginning August 2000)
T68 - 68-Pin Connector
T121 - Connector, 121 point

(A121) - Connection (high bus), in instrument panel wiring harness
(A122) - Connection (low bus), in instrument panel wiring harness
(D74) - Wire connection (86), in engine compartment wiring harness

* - Coolant Fan Control (FC) Control Module connection
** - A/C connection

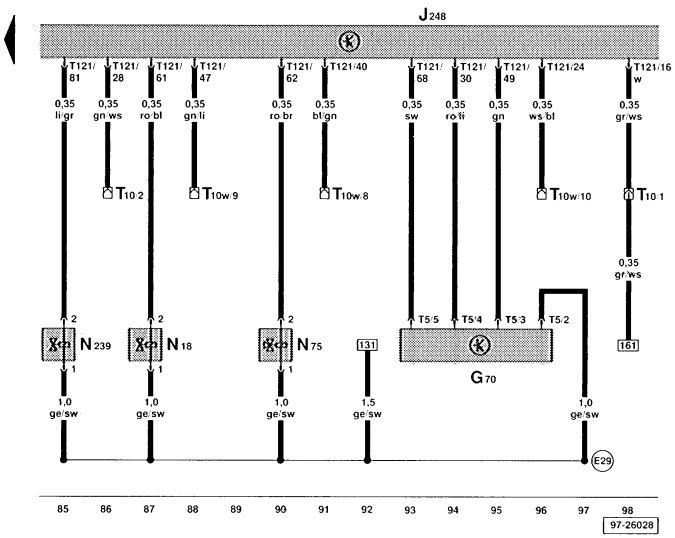


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

F8 - Kick Down Switch
F60 - Closed Throttle Position (CTP) Switch
G28 - Engine Speed (RPM) Sensor
G79 - Throttle Position (TP) Sensor
G80 - Needle Lift Sensor
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
T2a - Double Connector, in engine compartment, front
T3 - 3-Pin Connector, in engine compartment, front
T6a - 6-Pin Connector
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T121 - Connector, 121 point

(200) - Ground connection (shielding), in engine compartment wiring harness

Diesel direct fuel injection (DFI) engine control module (ECM), kick down switch, (CTP) switch, engine speed (RPM) sensor, throttle position (TP) sensor, needle lift sensor

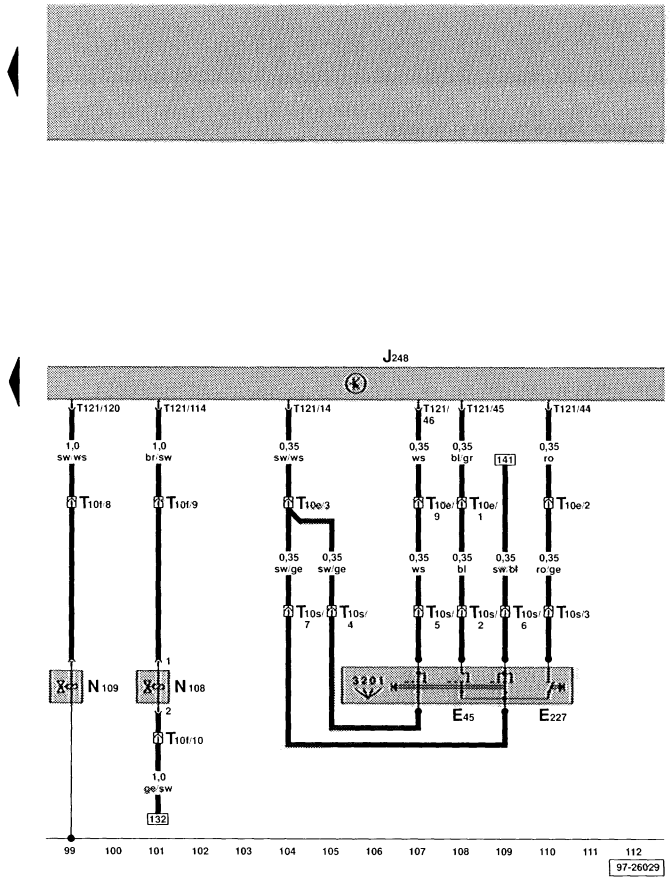


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

G70 - Mass Air Flow (MAF) Sensor
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
N18 - EGR Vacuum Regulator Solenoid Valve
N75 - Wastegate Bypass Regulator Valve
N239 - Change-over valve for intake manifold flap
T5 - 5-Pin Connector
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
T121 - Connector, 121 point

(E29) - Connector, in wiring harness engine

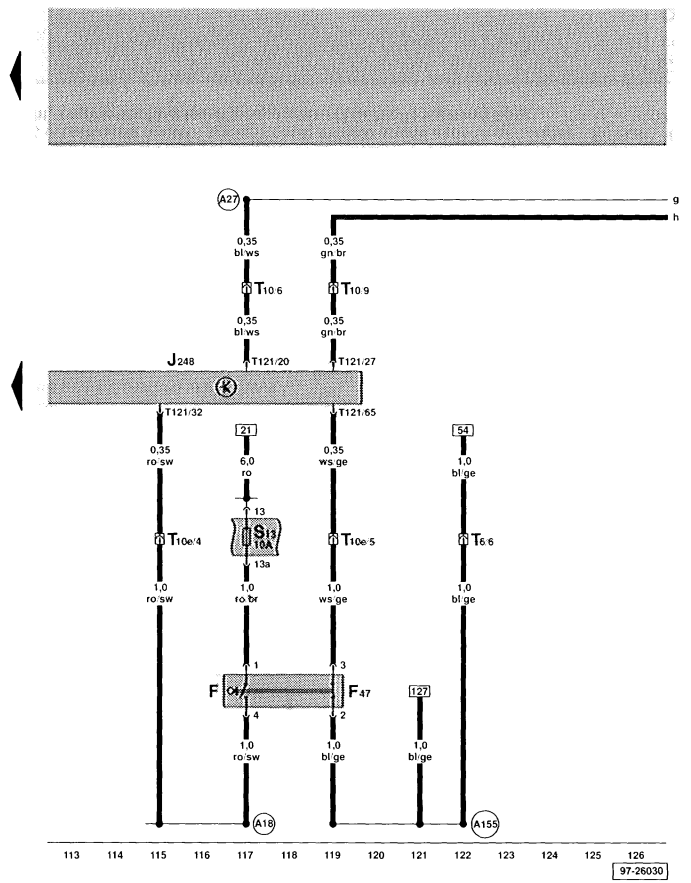
(DFI) engine control module (ECM), mass air flow sensor, change-over valve for intake manifold flap, wastegate bypass regulator valve, EGR vacuum regulator solenoid valve



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E45 - Cruise Control Switch**
E227 - Cruise Control Push Button (SET)**
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
N108 - Cold Start Injector
N109 - Fuel Cut-off Valve
T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
T10f - 10-Pin Connector, in engine compartment, front
T10s - 10-Pin Connector, near steering column**
T121 - Connector, 121 point

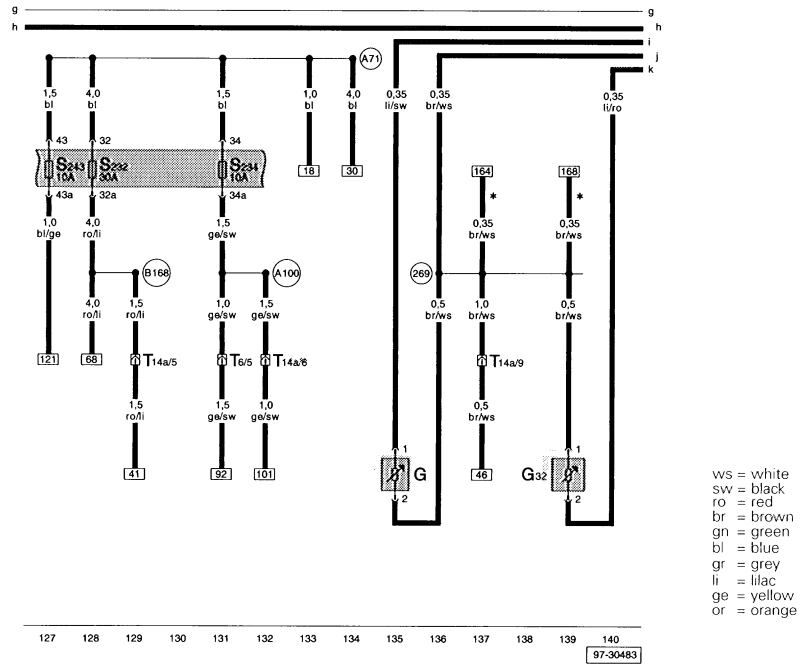
** - Vehicles with cruise control only



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

F - Brake Light Switch
F47 - Brake Vacuum Vent Valve Switch for cruise control/diesel
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
S13 - Fuse 13 in fuse holder
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
T121 - Connector, 121 point

(A18) - Wire connection (54), in instrument panel wiring harness
(A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness
(A155) - Connector -2- (86), in instrument panel wiring harness

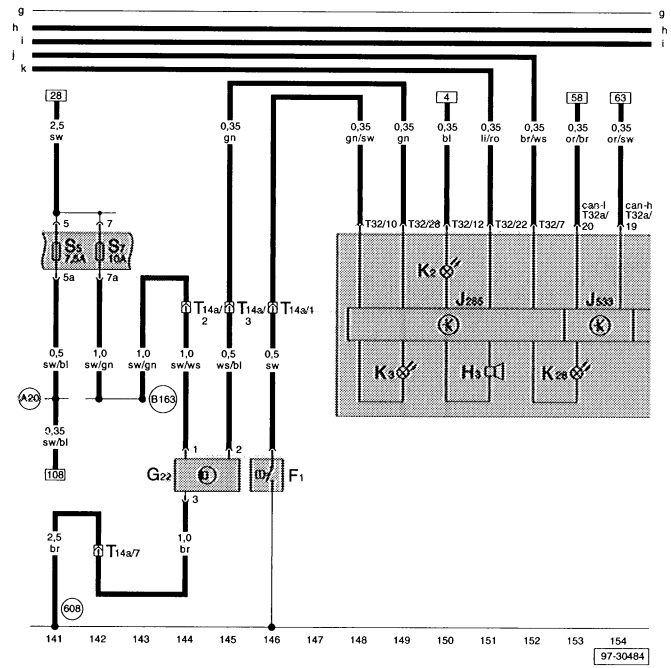


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

G - Fuel Level Sensor
G32 - Engine Coolant Level (ECL) Sensor
S232 - Fuse 32 in fuse holder
S234 - Fuse 34 in fuse holder
S243 - Fuse 43 in fuse holder
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, near battery

(269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
(A71) - Connector (86), in instrument panel wiring harness
(A100) - Connector -2- (87), in instrument panel wiring harness
(B168) - Connection (86) in passenger compartment wiring harness

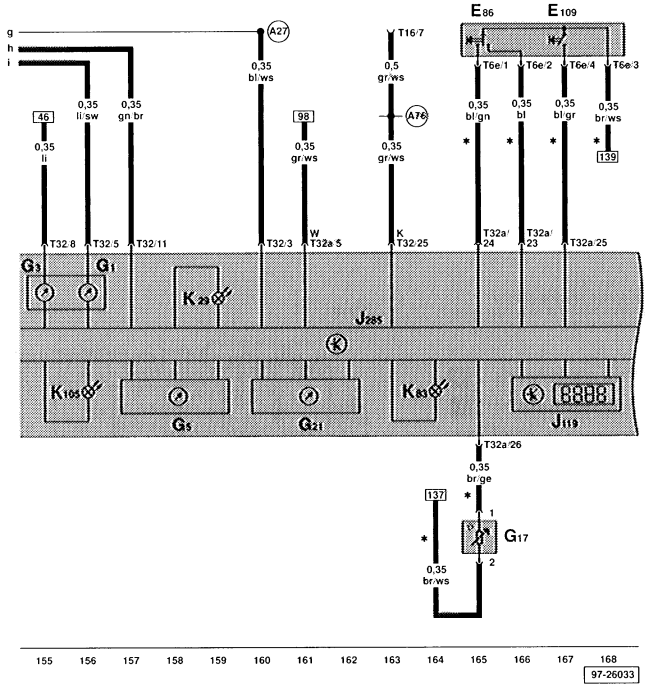
* - Vehicles with Multi-Function Indicator (MFI) only



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F1 - Oil Pressure Switch
G22 - Speedometer Vehicle Speed Sensor (VSS)
H3 - Warning Buzzer
J285 - Control module with indicator unit in instrument panel insert
J533 - Data Bus On Board Diagnostic Interface
K2 - Generator (GEN) Warning Light
K3 - Oil Pressure Warning Light
K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
S5 - Fuse 5 in fuse holder
S7 - Fuse 7 in fuse holder
T14a - 14-Pin Connector, near battery
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(608) - Ground Connection (in center plenum chamber)
(A20) - Wire connection (15a), in instrument panel wiring harness
(B163) - Plus connector -1- (15) in wiring harness interior



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E86 - Multi-Function Indicator Mode Select Switch*
E109 - Multi-Function Indicator Memory Switch*
G1 - Fuel gauge
G3 - Engine Coolant Temperature (ECT) Gauge
G5 - Tachometer
G17 - Outside Air Temperature Sensor*
G21 - Speedometer
J119 - Multi-function Indicator (MFI)
J285 - Control module with indicator unit in instrument panel insert
K29 - Glow Plug Indicator Light
K83 - Malfunction Indicator Lamp (MIL)
K105 - Low Fuel Level Warning Light
T6e - 6-Pin Connector
T16 - Data Link Connector (DLC), below instrument panel, left
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green
(A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness
(A76) - Connector (K-diagnosis wire), in instrument panel wiring harness
* - Vehicles with Multi-Function Indicator (MFI) only

Edition 08/99
USA.5102.04.21

Instrument cluster, engine coolant temperature (ECT) gauge, fuel gauge, tachometer, speedometer, glow plug indicator light

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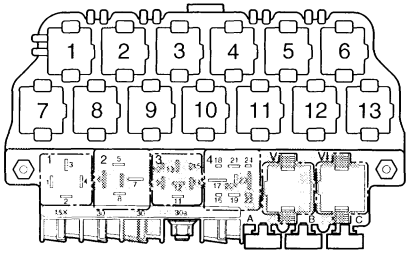
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Airbag systems,

from May 1999

- Driver- and front passsenger airbag
- Head airbag
- Side airbag
- Seat belt tensioner
- Seat belt control

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97-14163

Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

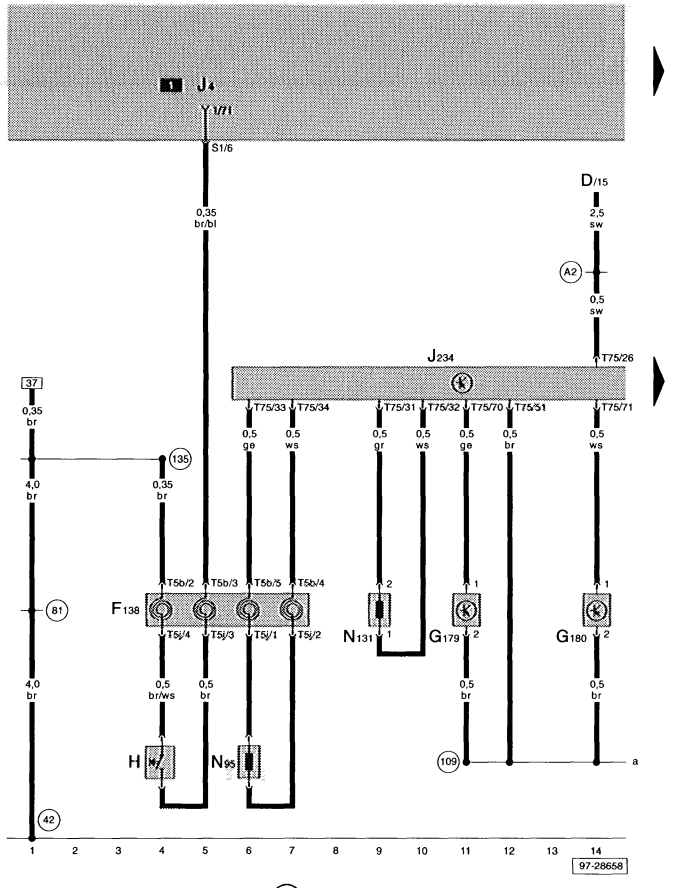
1 Dual Horn Relay (53)

4 Fuel Pump (FP) Relay (409)

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

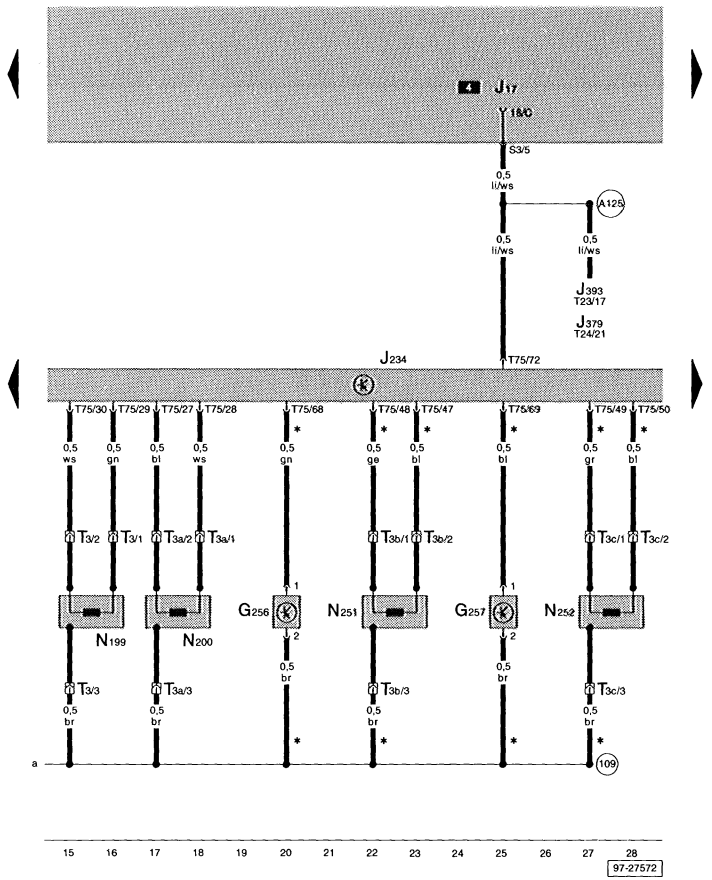


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

D - Ignition/Starter Switch
F138 - Airbag Spiral Spring/Return Spring With Slip Ring
G179 - Crash sensor for side airbag, driver's side
G180 - Crash sensor for side airbag, passenger side
H - Signal horn activation
J4 - Dual Horn Relay
J234 - Airbag Control Module, behind console, lower part
N95 - Driver's Side Airbag Igniter
N131 - Passenger's Side Airbag Igniter 1
T5b - 5-Pin Connector
T5j - 5-Pin Connector
T75 - 75-Pin Connector

(42) - Ground connection, beside steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(109) - Ground connection, in airbag wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(A2) - Plus connection (15), in instrument panel wiring harness

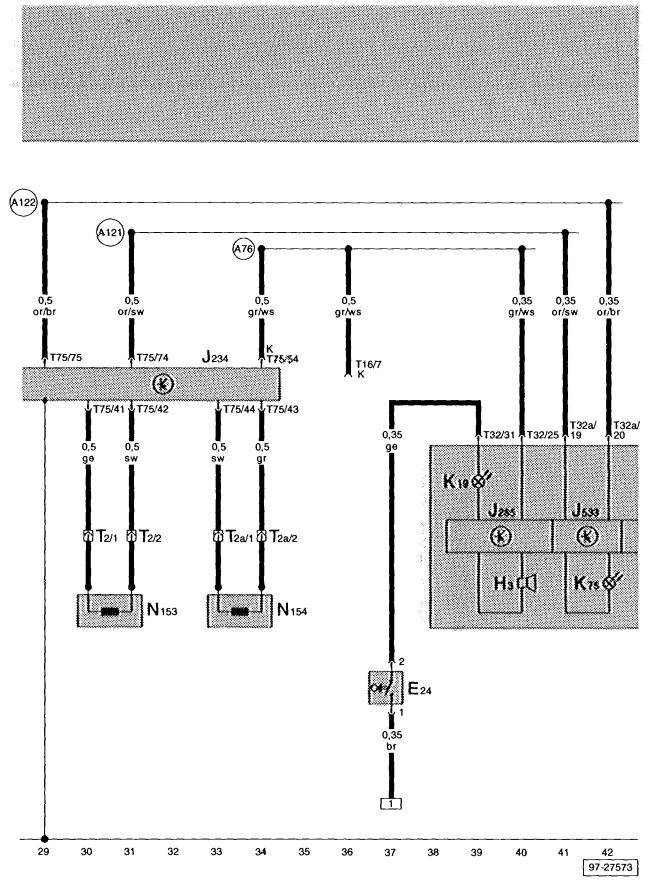
Airbag control module, airbag spiral spring/return spring with slip ring, crash sensor for side airbag, airbag igniter, signal horn activation



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

G256 - Left Rear Side Airbag Crash Sensor*
G257 - Right Rear Side Airbag Crash Sensor*
J17 - Fuel Pump (FP) Relay (gasoline engine only)
J234 - Airbag Control Module, behind console, lower part
J379 - Control module for central locking and anti-theft-system
J393 - Central control module for comfort system
N199 - Igniter for side airbag, driver's side
N200 - Igniter for side airbag, passenger side
N251 - Igniter for head airbag, driver side*
N252 - Detonator for head airbag, passenger side*
T3 - 3-Pin Connector, below driver's seat
T3a - 3-Pin Connector, below passenger's seat
T3b - 3-Pin Connector, behind C-pillar trim, left
T3c - 3-Pin Connector, behind C-pillar trim, right
T23 - 23-Pin Connector
T24 - 24-Pin Connector
T75 - 75-Pin Connector
(109) - Ground connection, in airbag wiring harness
(A125) - Connection (crash signal) in instrument panel wiring harness
* - Vehicles with head airbag only (beginning May 2000)

Airbag control module, igniter for side airbag, left and right rear side airbag crash sensors, igniter for head airbag (driver side), detonator for head airbag (passenger side)



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E24 - Left Seat Belt Switch
H3 - Warning Buzzer
J234 - Airbag Control Module, behind console, lower part
J285 - Control module with indicator unit in instrument panel insert
J533 - Data Bus On Board Diagnostic Interface
K19 - Seat Belt Warning Light
K75 - Airbag Malfunction Indicator Lamp (MIL)
N153 - Left Seat Belt Tensioner Igniter
N154 - Right Seat Belt Tensioner Igniter
T2 - Double Connector, below driver's seat
T2a - Double Connector, below passenger's seat
T16 - Data Link Connector (DLC), below instrument panel, left
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green
T75 - 75-Pin Connector
(A76) - Connection (K-diagnosis wire) in instrument panel wiring harness
(A121) - Connection (high bus), in instrument panel wiring harness
(A122) - Connection (low bus), in instrument panel wiring harness

Airbag control module, left seat belt switch, seat belt tensioner igniter, seat belt warning light, airbag malfunction indicator lamp (MIL)

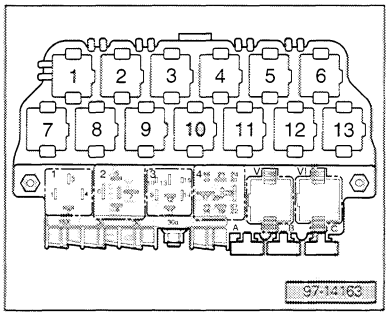
Repair Manual page number 97-331

Automatic transmission, 4 speed automatic,

from May 1999

- 1.8L - Engine - Motronic Multiport Fuel Injection (MFI)/110 kW, code AWD, AWW
- 2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code AEG, AVH, AZG
- 2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/130 kW, code AFP

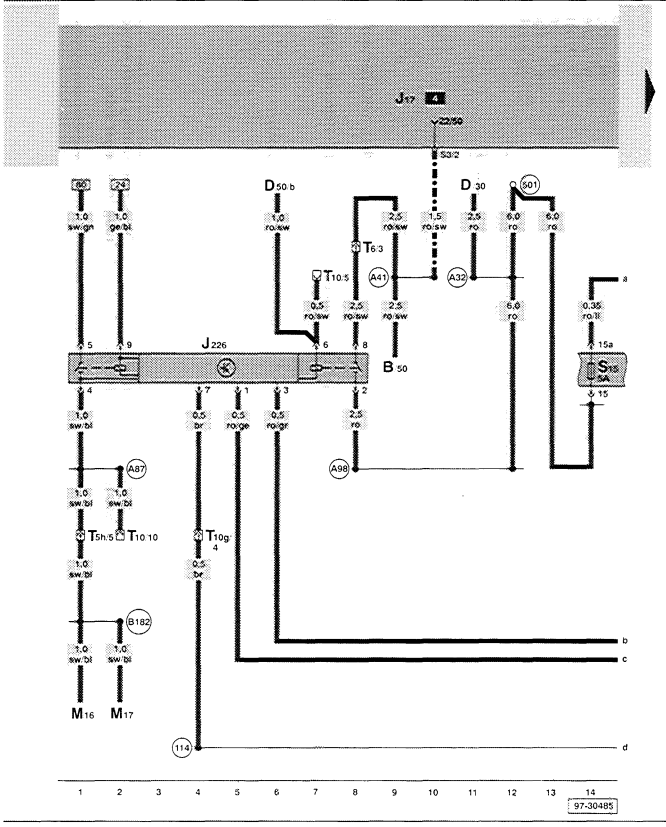
Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations"



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

11 J317 - Park/Neutral Position (PNP) Relay (175)

Relay panel:



Park/neutral position (PNP) relay

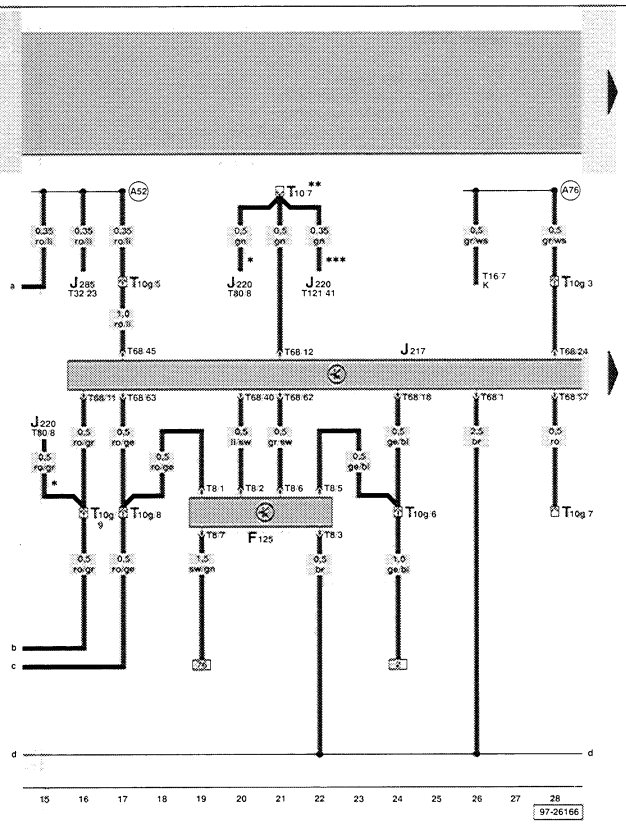
B - Starter
D - Ignition/Starter Switch
J17 - Fuel Pump (FP) Relay
J226 - Park/Neutral Position (PNP) Relay, on the thirteenfold auxiliary relay panel, above relay panel
M16 - Left Back-Up Light
M17 - Right Back-Up Light
S15 - Fuse 15 in fuse holder
T5h - 5-Pin Connector, near left A-pillar, lower part, in harness
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left

(114) - Ground connection, in automatic transmission wiring harness
(501) - Threaded connection -2- (30) on the relay plate
(A32) - Plus connection (30), in instrument panel wiring harness
(A41) - Plus connection (50), in instrument panel wiring harness (through April 2001)
(A87) - Connector (RF), in instrument panel wiring harness
(A98) - Plus connection -4- (30), in instrument panel wiring harness
(B182) - Connection (RF), in passenger compartment wiring harness

-•-•- Through April 2001

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Repair Manual page number 97-330



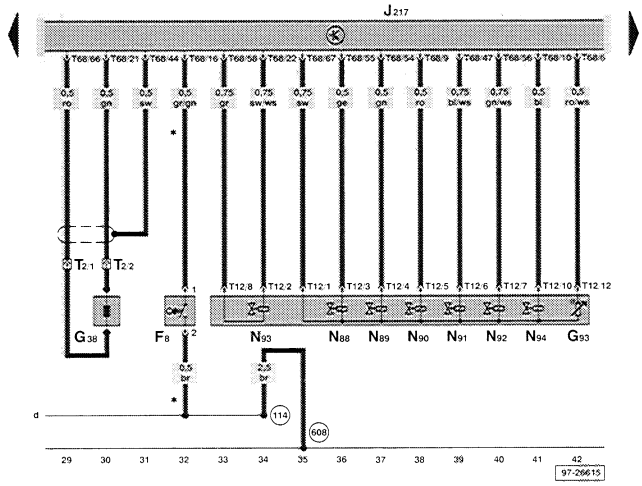
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Transmission control module (TCM), multi-function transmission range (TR) switch

- F125 - Multi-Function Transmission Range (TR) Switch
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J285 - Control module with indicator unit in instrument panel insert
- T8 - 8-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
- T16 - Data Link Connector (DLC), below instrument panel, left
- T32 - 32-Pin Connector, blue
- T68 - 68-Pin Connector
- T80 - 80-Pin Connector
- T121 - 121-Pin Connector

- (A52) - Plus connection (30a), in instrument panel wiring harness
- (A76) - Connection (K-diagnosis wire) in instrument panel wiring harness

- * - 2.0L-Engine - code AEG only
- ** - A/C connection
- *** - 1.8L-Engine - code AWD, AWW only
  2.0L-Engine - code AVH, AZG only
  2.8L-Engine - code AFP only



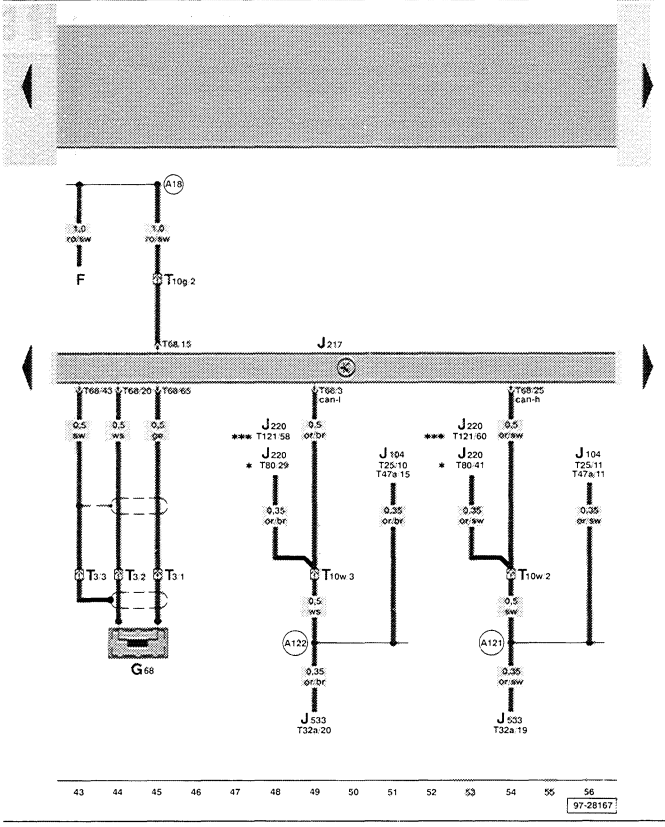
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Transmission control module (TCM), solenoid valves, transmission vehicle speed sensor (VSS), transmission fluid temperature sensor, kick down switch

- F8 - Kick Down Switch*
- G38 - Transmission Vehicle Speed Sensor (VSS)
- G93 - Transmission Fluid Temperature Sensor
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- N88 - Solenoid Valve 1
- N89 - Solenoid Valve 2
- N90 - Solenoid Valve 3
- N91 - Solenoid Valve 4
- N92 - Solenoid Valve 5
- N93 - Solenoid Valve 6
- N94 - Solenoid Valve 7
- T2 - Double Connector, on transmission
- T12 - 12-Pin Connector
- T68 - 68-Pin Connector

- (114) - Ground connection, in automatic transmission wiring harness
- (608) - Ground connection (in center plenum chamber)

- * - 2.0L-Engine - code AEG only



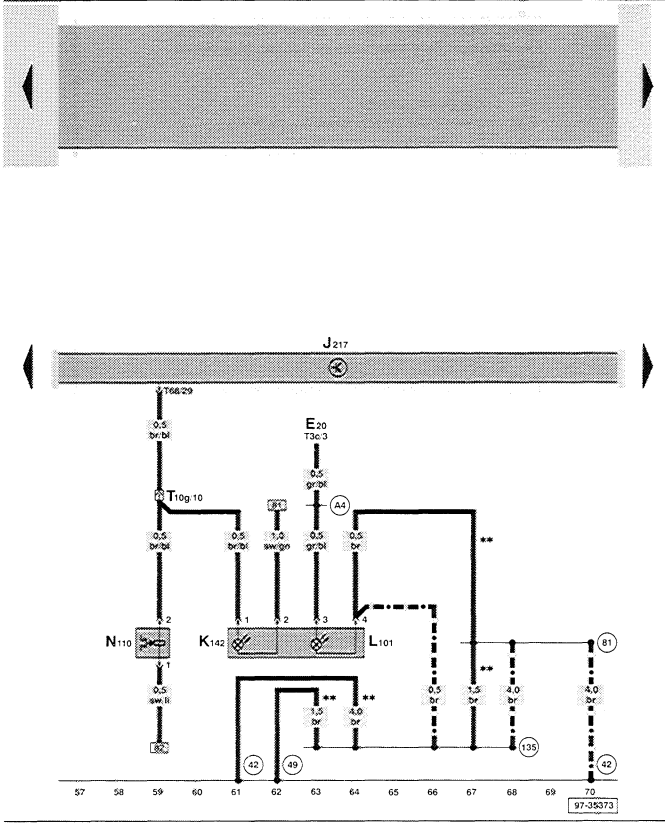
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Transmission control module (TCM), vehicle speed sensor (VSS)

- F - Brake Light Switch
- G68 - Vehicle Speed Sensor (VSS)
- J104 - ABS Control Module (w/EDL)
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J533 - Data Bus On Board Diagnostic Interface
- T3 - 3-Pin Connector, on transmission
- T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T25 - 25-Pin Connector, on ABS Control Module (through July 2000)
- T32a - 32-Pin Connector, green, on instrument cluster
- T47a - 47-Pin Connector, on ABS Control Module (beginning August 2000)
- T68 - 68-Pin Connector
- T80 - 80-Pin Connector*
- T121 - 121-Pin Connector***

- (A18) - Wire connection (54), in instrument panel wiring harness
- (A121) - Connection (high bus), in instrument panel wiring harness
- (A122) - Connection (low bus), in instrument panel wiring harness

- * - 2.0L-Engine - code AEG only
- *** - 1.8L-Engine - code AWD, AWW only
  2.0L-Engine - code AVH, AZG only
  2.8L-Engine - code AFP only



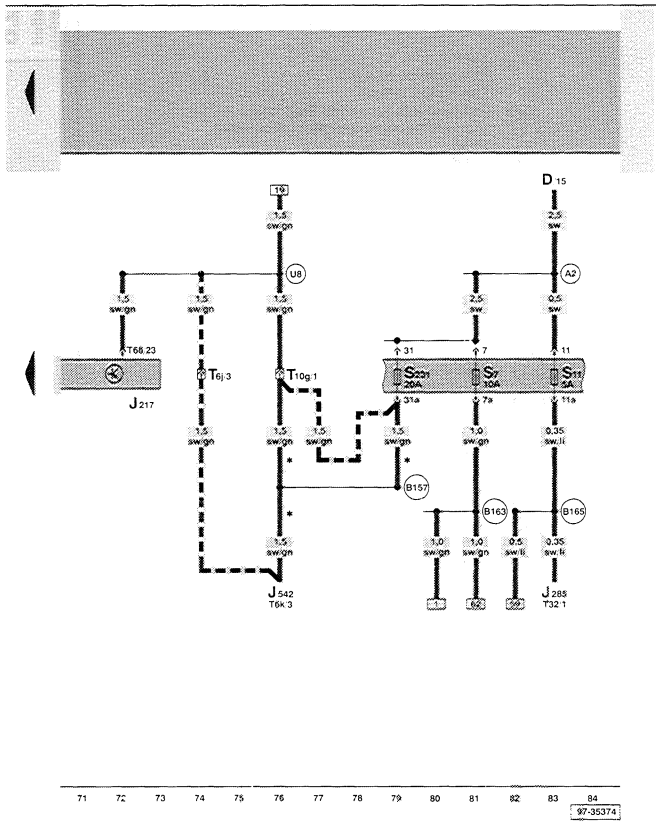
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Transmission control module (TCM), shift lock solenoid, warning light for selector lever position P/N

- E20 - Instrument Panel Light Dimmer Switch
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- K142 - Warning light for selector lever position P/N
- L101 - Illumination for selector lever scale
- N110 - Shift Lock Solenoid
- T3c - 3-Pin Connector
- T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
- T68 - 68-Pin Connector

- (42) - Ground connection, beside steering column
- (49) - Ground connection, on steering column
- (81) - Ground connection -1-, in instrument panel wiring harness
- (135) - Ground connection -2-, in instrument panel wiring harness
- (A4) - Plus connection (58b), in instrument panel wiring harness

- ** - Beginning May 2000
- -•-- Through April 2000



Transmission control module (TCM)

- D - Ignition/Starter Switch
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- J285 - Control module with indicator unit in instrument panel insert
- J542 - Brake Booster Control Module
- S7 - Fuse 7 in fuse holder
- S11 - Fuse 11 in fuse holder
- S231 - Fuse 31 in fuse holder
- T6j - 6-Pin Connector, in engine compartment left
- T6k - 6-Pin Connector
- T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
- T32 - 32-Pin Connector, blue
- T68a - 68-Pin Connector

- (A2) - Plus connection (15), in instrument panel wiring harness
- (B157) - Plus connection -3- (15a) in wiring harness interior
- (B163) - Plus connector -1- (15) in wiring harness interior
- (B165) - Plus connection -2- (15) in wiring harness interior
- (U8) - Plus connection (15a) in automatic transmission wiring harness

* - Beginning May 2002

--- Through April 2002

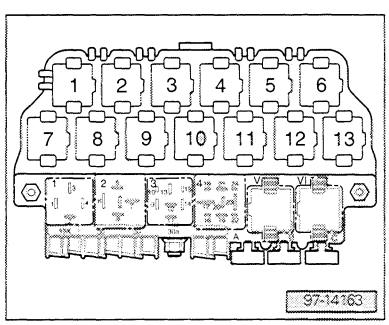
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Automatic transmission, 4 speed automatic,

from May 1999

● 1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66 kW, code ALH

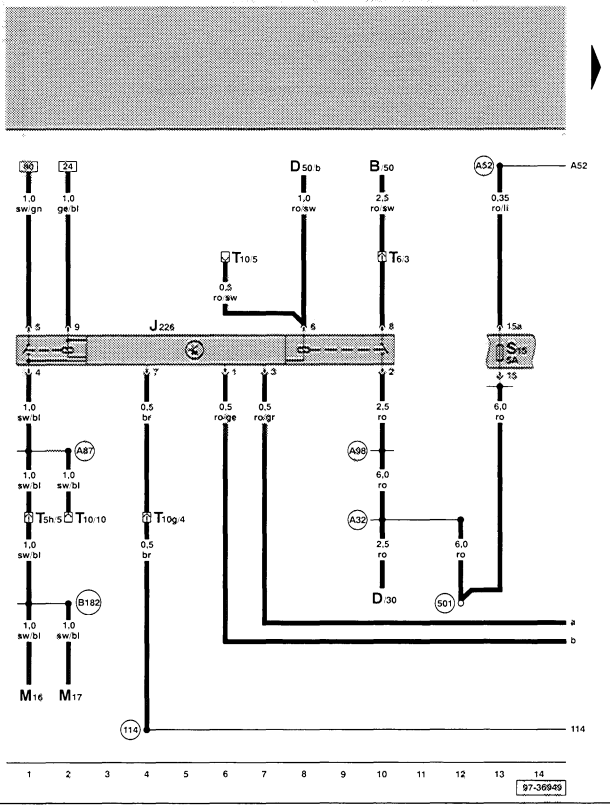
Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations"



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

11 J317 - Park/Neutral Position (PNP) Relay (175)

Relay panel:

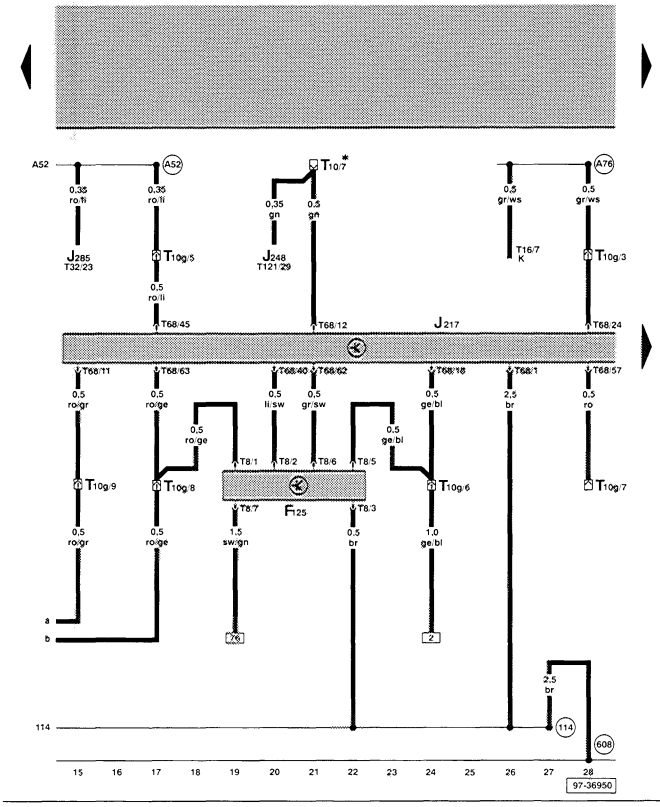


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Park/neutral position (PNP) relay

- B - Starter
- D - Ignition/Starter Switch
- J17 - Fuel Pump (FP) Relay
- J226 - Park/Neutral Position (PNP) Relay, on the thirteenfold auxiliary relay panel, above relay panel
- M16 - Left Back-Up Light
- M17 - Right Back-Up Light
- S15 - Fuse 15 in fuse holder
- T5h - 5-Pin Connector, near left A-pillar, lower part, in harness
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left

- (114) - Ground connection, in automatic transmission wiring harness
- (501) - Threaded connection -2- (30) on the relay plate
- (A32) - Plus connection (30), in instrument panel wiring harness
- (A87) - Connector (RF), in instrument panel wiring harness
- (A98) - Plus connection -4- (30), in instrument panel wiring harness
- (B182) - Connection (RF), in passenger compartment wiring harness



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Transmission control module (TCM), multi-function transmission range (TR) switch

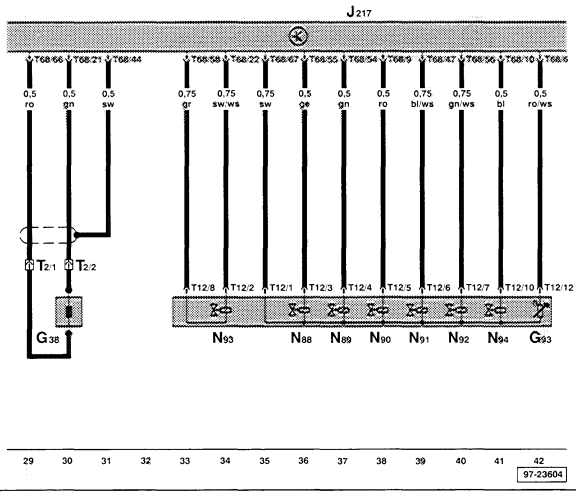
- F125 - Multi-Function Transmission Range (TR) Switch
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- J285 - Control module with indicator unit in instrument panel insert
- T8 - 8-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
- T16 - Data Link Connector (DLC), below instrument panel, left
- T32 - 32-Pin Connector, blue
- T68 - 68-Pin Connector
- T121 - 121-Pin Connector

- (114) - Ground connection, in automatic transmission wiring harness
- (608) - Ground connection (in center plenum chamber)
- (A52) - Plus connection (30a), in instrument panel wiring harness
- (A76) - Connection (K-diagnosis wire) in instrument panel wiring harness

* - A/C connection

Transmission control module (TCM), solenoid valves, transmission vehicle speed sensor (VSS), transmission fluid temperature sensor

- G38 - Transmission Vehicle Speed Sensor (VSS)
- G93 - Transmission Fluid Temperature Sensor
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- N88 - Solenoid Valve 1
- N89 - Solenoid Valve 2
- N90 - Solenoid Valve 3
- N91 - Solenoid Valve 4
- N92 - Solenoid Valve 5
- N93 - Solenoid Valve 6
- N94 - Solenoid Valve 7
- T2 - Double Connector, on transmission
- T12 - 12-Pin Connector
- T68 - 68-Pin Connector

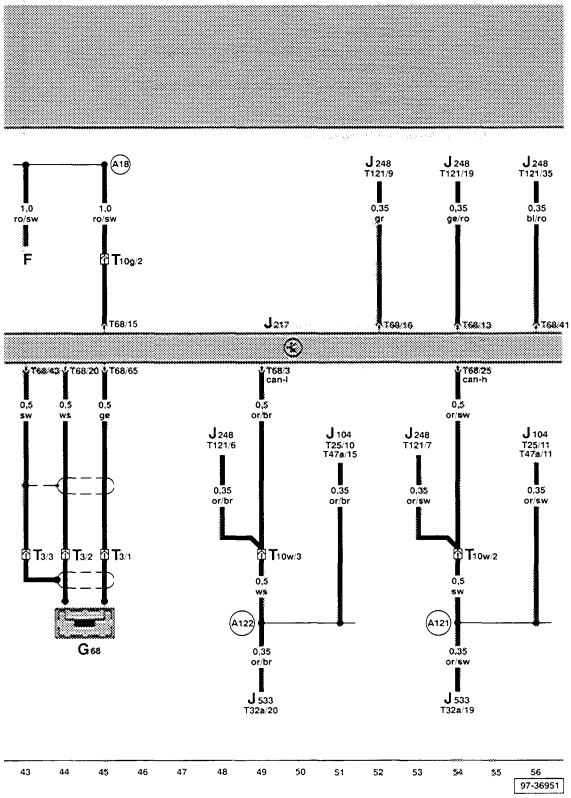


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Transmission control module (TCM), vehicle speed sensor (VSS)

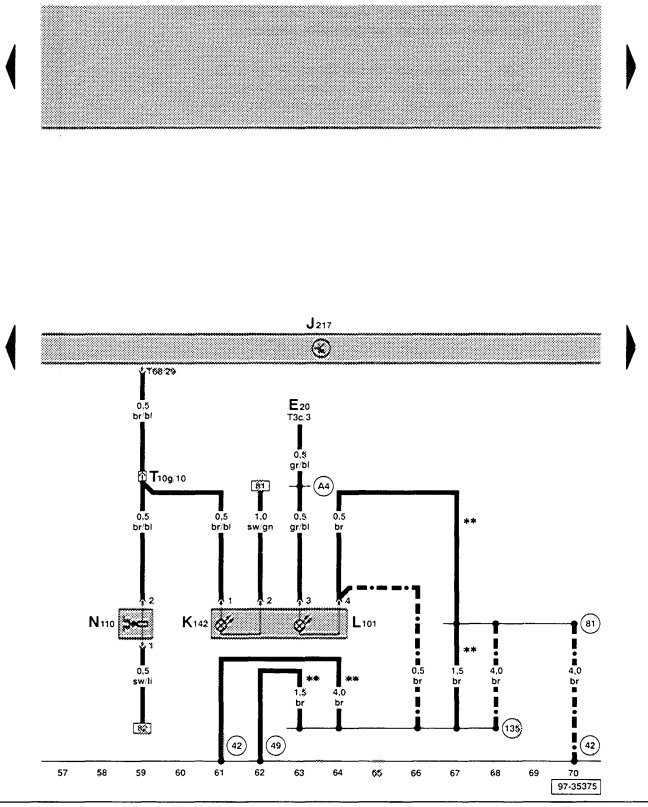
- F - Brake Light Switch
- G68 - Vehicle Speed Sensor (VSS)
- J104 - ABS Control Module (w/EDL)
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- J533 - Data Bus On Board Diagnostic Interface
- T3 - 3-Pin Connector, on transmission
- T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T25 - 25-Pin Connector, on ABS Control Module (through July 2000)
- T32a - 32-Pin Connector, green, on Instrument cluster
- T47a - 47-Pin Connector, on ABS Control Module (beginning August 2000)
- T68 - 68-Pin Connector
- T121 - 121-Pin Connector

- (A18) - Wire connection (54), in instrument panel wiring harness
- (A121) - Connection (high bus), in instrument panel wiring harness
- (A122) - Connection (low bus), in instrument panel wiring harness



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Transmission control module (TCM), shift lock solenoid, warning light for selector lever position P/N



E20 - Instrument Panel Light Dimmer Switch
J217 - Transmission Control Module (TCM), in plenum chamber, center
K142 - Warning light for selector lever position P/N
L101 - Illumination for selector lever scale
N110 - Shift Lock Solenoid
T3c - 3-Pin Connector
T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
T68 - 68-Pin Connector

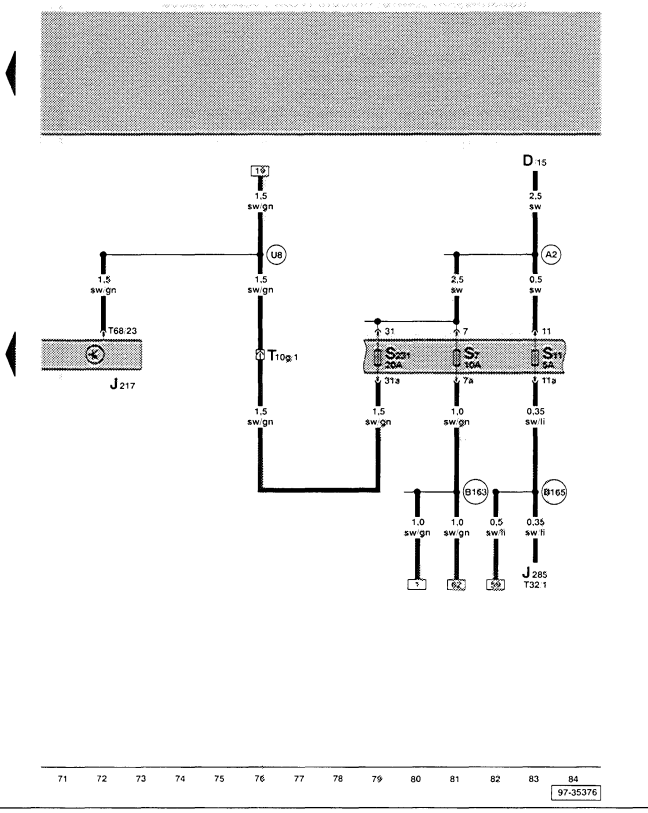
(42) - Ground connection, beside steering column
(49) - Ground connection, on steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(A4) - Plus connection (58b), in instrument panel wiring harness

** - Beginning May 2000
-•-- - Through April 2000

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03

Transmission control module (TCM)



D - Ignition/Starter Switch
J217 - Transmission Control Module (TCM), in plenum chamber, center
J285 - Control module with indicator unit in instrument panel insert
S7 - Fuse 7 in fuse holder
S11 - Fuse 11 in fuse holder
S231 - Fuse 31 in fuse holder
T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
T32 - 32-Pin Connector, blue
T68a - 68-Pin Connector

(A2) - Plus connection (15), in instrument panel wiring harness
(B163) - Plus connector -1- (15) in wiring harness interior
(B165) - Plus connection -2- (15) in wiring harness interior
(U8) - Plus connection (15a) in automatic transmission wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

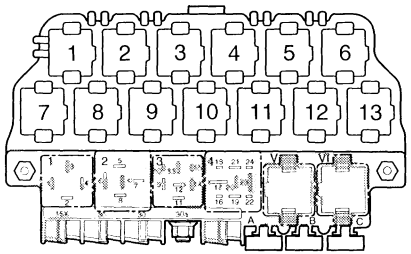
Edition 04.03

Coolant Fans,

from May 1999

- 2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/130 kW, code AFP
- 2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/147 kW, code BDF

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97-14163

Relay location on the thirteenfold auxiliary relay panel, above relay panel:

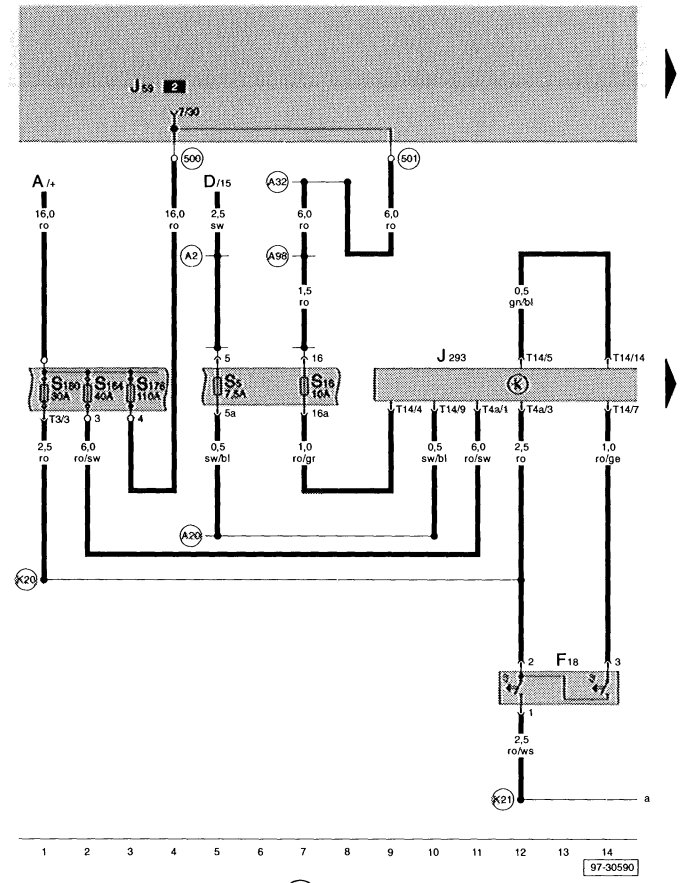
Relay panel:

2 Load Reduction Relay (100)

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

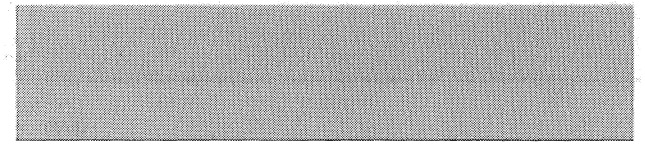
30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

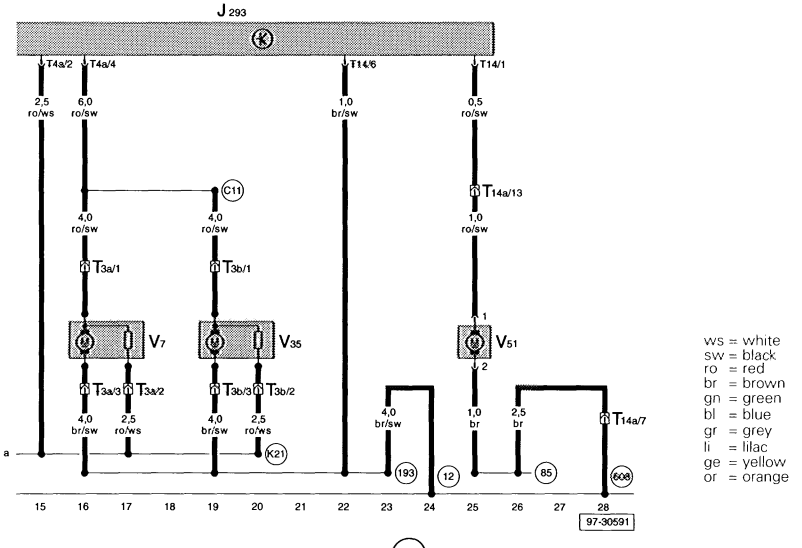


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

A - Battery
D - Ignition/Starter Switch
F18 - Coolant Fan Control (FC) Thermal Switch
J59 - Load Reduction Relay
J293 - Coolant Fan Control (FC) Control Module, in engine compartment, left
S5 - Fuse 5 in fuse holder
S16 - Fuse 16 in fuse holder
S164 - Fuse -3- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S180 - Fuse -8- (30) in fuse bracket/battery
T4a - 4-Pin Connector
T14 - 14-Pin Connector

(500) - Threaded connection -1- (30) on the relay plate
(501) - Threaded connection -2- (30) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A20) - Wire connection (15a), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness
(K20) - Plus connection -1- (30), in coolant fan wiring harness
(K21) - Wire connection -1-, in coolant fan wiring harness





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

J293 - Coolant Fan Control (FC) Control Module, in engine compartment, left
T3a - 3-Pin Connector, in engine compartment, left
T3b - 3-Pin Connector, in engine compartment, left
T4a - 4-Pin Connector
T14 - 14-Pin Connector
T14a - 14-Pin Connector, near battery
V7 - Left Coolant Fan
V35 - Right Coolant Fan
V51 - After-Run Coolant Pump

(12) - Ground connection, in engine compartment, left
(85) - Ground connection -1-, in engine compartment wiring harness
(193) - Ground connection -1-, in coolant fan wiring harness
(608) - Ground Connection (in center plenum chamber)
(C11) - Wire connection, in coolant fan wiring harness
(K21) - Wire connection -1-, in coolant fan wiring harness

Edition 09/01 **Coolant fan control (FC) control module, after-run coolant pump, coolant fan**
USA.5102.11.21

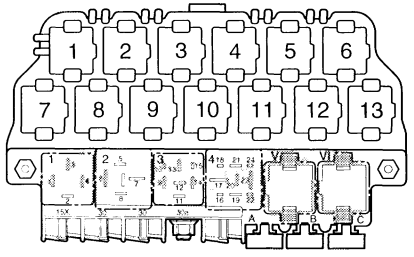
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Air conditioning (manual control)

from May 1999

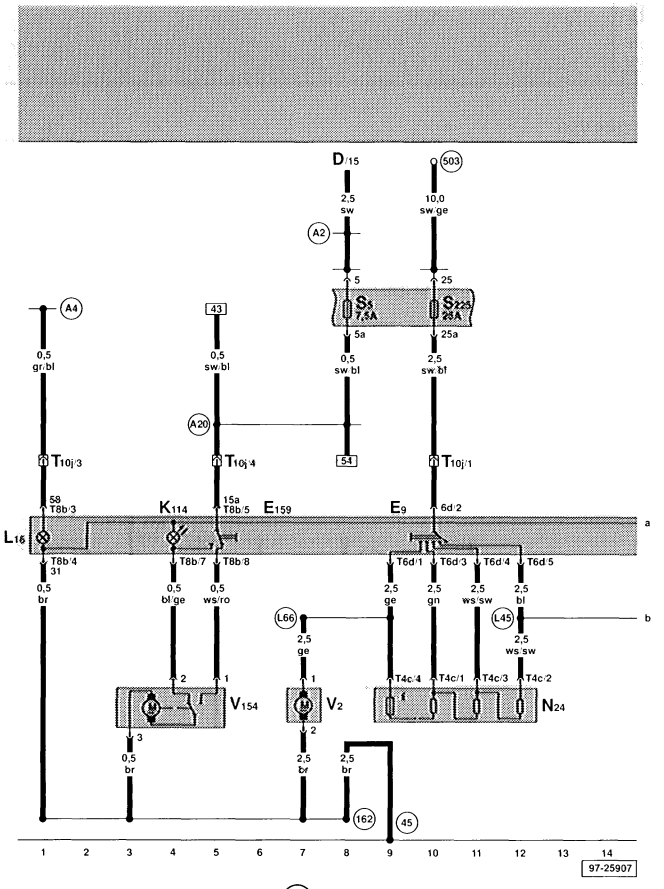
Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97-14163

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

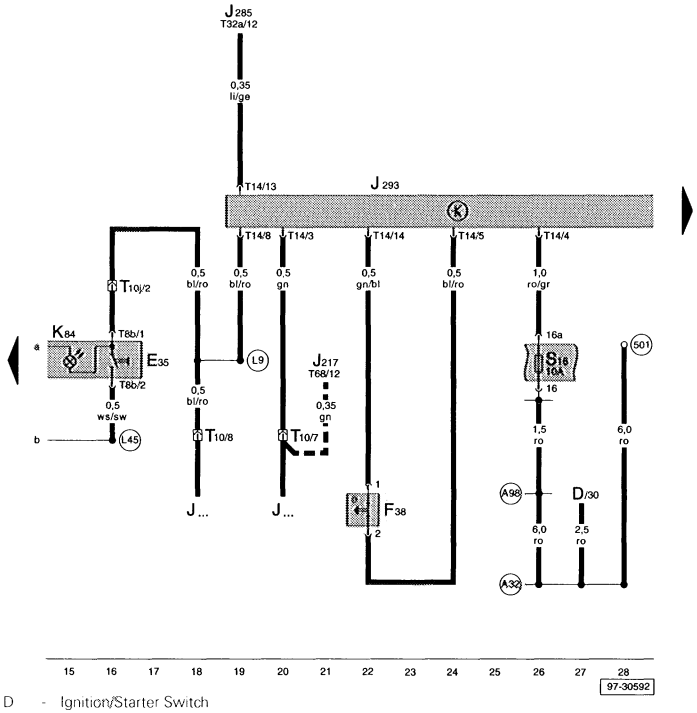


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

D - Ignition/Starter Switch
E9 - Fresh Air Blower Switch
E159 - Fresh Air/Recirculating Flap Switch
K114 - Fresh Air and Recirculating Air Mode Indicator Light
L16 - Fresh Air Control Lever Light
N24 - Fresh Air Blower Series Resistance with Fuse
S5 - Fuse 5 in fuse holder
S225 - Fuse 25 in fuse holder
T4c - 4-Pin Connector
T6d - 6-Pin Connector
T8b - 8-Pin Connector
T10j - 10-Pin Connector, behind instrument panel, center
V2 - Fresh Air Blower
V154 - Servo motor for fresh-/recirculating air flap

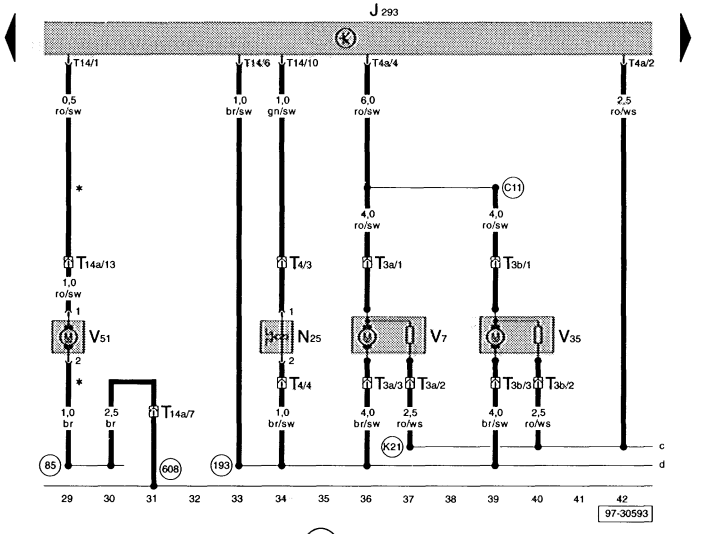
(45) - Ground connection, behind instrument panel, center
(162) - Ground connection, in blower motor wiring harness
(503) - Threaded connection -2- (75x) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A4) - Plus connection (58b), in instrument panel wiring harness
(A20) - Wire connection (15a), in instrument panel wiring harness
(L45) - Wire connection, in A/C system wiring harness
(L66) - Connector, in wiring harness heater blower

Fresh air blower switch, fresh air/recirculating flap switch, fresh air blower, servo motor for fresh-/recirculating air flap



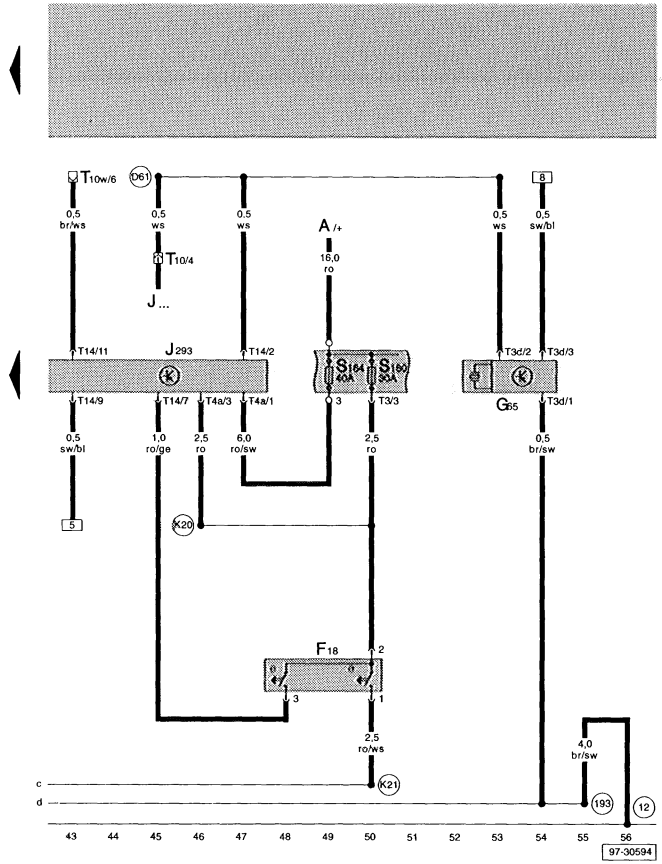
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

D - Ignition/Starter Switch
E35 - A/C Switch
F38 - Ambient Temperature Switch
J217 - Transmission Control Module (TCM)
J285 - Control module with indicator unit in instrument panel insert
J293 - Coolant Fan Control (FC) Control Module, in engine compartment, left
J... - Engine Control Module (ECM)
K84 - A/C Indicator Light
S16 - Fuse 16 in fuse holder
T8b - 8-Pin Connector
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10j - 10-Pin Connector, behind instrument panel, center
T14 - 14-Pin Connector
T32a - 32-Pin Connector, green
T68 - 68-Pin Connector
(501) - Threaded connection -2- (30) on the relay plate
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness
(L9) - Wire connection -1-, in A/C wiring harness
(L45) - Wire connection, in A/C system wiring harness
--- Automatic transmission only (4 speed autom.)



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

J293 - Coolant Fan Control (FC) Control Module, in engine compartment, left
N25 - A/C Clutch
T3a - 3-Pin Connector, in engine compartment, left
T3b - 3-Pin Connector, in engine compartment, left
T4 - 4-Pin Connector, near starter
T4a - 4-Pin Connector
T14 - 14-Pin Connector
T14a - 14-Pin Connector, near battery
V7 - Left Coolant Fan
V35 - Right Coolant Fan
V51 - After-Run Coolant Pump*
(85) - Ground connection -1-, in engine compartment wiring harness
(193) - Ground connection -1-, in coolant fan wiring harness
(608) - Ground connection (in center plenum chamber)
(C11) - Wire connection, in coolant fan wiring harness
(K21) - Wire connection -1-, in coolant fan wiring harness
* - Code AFP, BDF only



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

A - Battery
F18 - Coolant Fan Control (FC) Thermal Switch
G65 - High Pressure Sensor
J293 - Coolant Fan Control (FC) Control Module, in engine compartment, left
J... - Engine Control Module (ECM)
S164 - Fuse -3- (30) in fuse bracket/battery
S180 - Fuse -8- (30) in fuse bracket/battery
T3 - 3-Pin Connector
T3d - 3-Pin Connector
T4a - 4-Pin Connector
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
T14 - 14-Pin Connector

(12) - Ground connection, in engine compartment, left
(193) - Ground connection -1-, in coolant fan wiring harness
(K20) - Plus connection -1- (30), in coolant fan wiring harness
(K21) - Wire connection -1-, in coolant fan wiring harness
(D61) - wire connection (A/C), in engine compartment wiring harness

Edition 09/01
USA.5102.11.21

Coolant fan control (FC) control module, coolant fan control (FC) thermal switch, high pressure sensor

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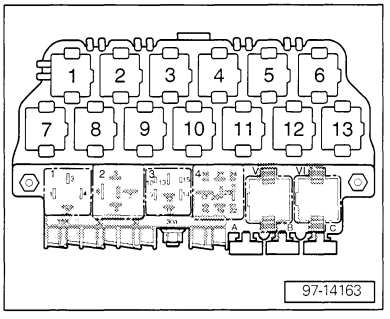
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Climatronic (automatic climate control),

from May 1999

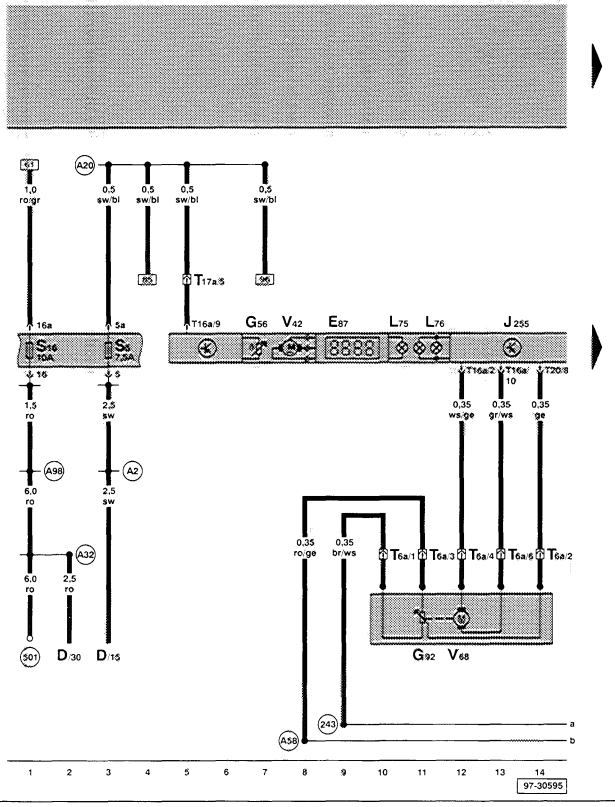
- 2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/130 kW, code AFP
- 2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/147 kW, code BDF
- 3.2L - Engine - Motronic Multiport Fuel Injection (MFI)/177 kW, code BJS

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations"



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

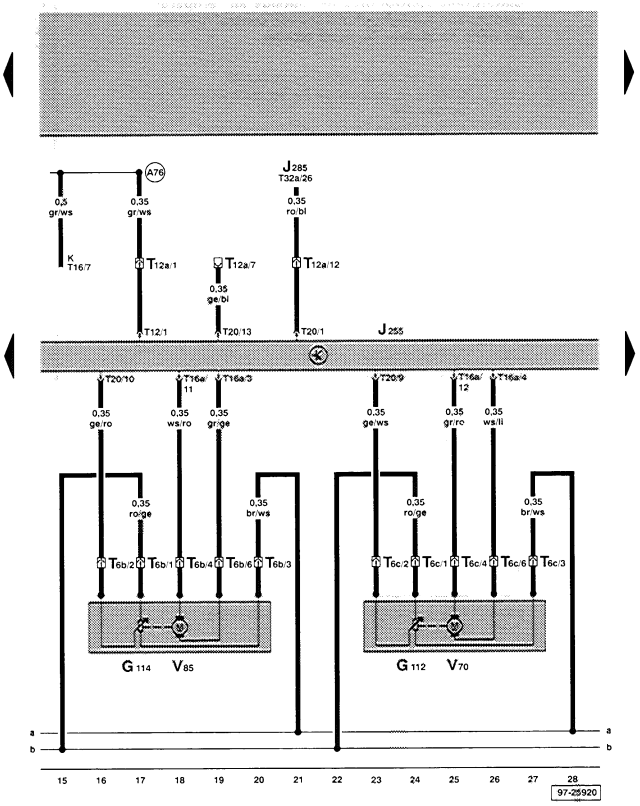


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Climatronic control module, temperature regulator flap motor position sensor, temperature regulator flap motor

- D - Ignition/Starter Switch
- E87 - A/C Control Head
- G56 - Instrument Panel Interior Temperature Sensor
- G92 - Temperature Regulator Flap Motor Position Sensor
- J255 - Climatronic Control Module
- L75 - Digital Display Light
- L76 - Push Button Light
- S5 - Fuse 5 in fuse holder
- S16 - Fuse 16 in fuse holder
- T6a - 6-Pin Connector, behind instrument panel, center
- T16a - 16-Pin Connector
- T17a - 17-Pin Connector, behind instrument panel, center
- T20 - 20-Pin Connector
- V42 - Interior Temperature Sensor Fan
- V68 - Temperature Regulator Flap Motor

- (243) - Ground connection -1- in wiring harness, Climatronic
- (501) - Threaded connection -2- (30) on the relay plate
- (A2) - Plus connection (15), in instrument panel wiring harness
- (A20) - Wire connection (15a), in instrument panel wiring harness
- (A32) - Plus connection (30), in instrument panel wiring harness
- (A58) - Wire connection (5 V), in instrument cluster wiring harness
- (A98) - Plus connection -4- (30), in instrument panel wiring harness

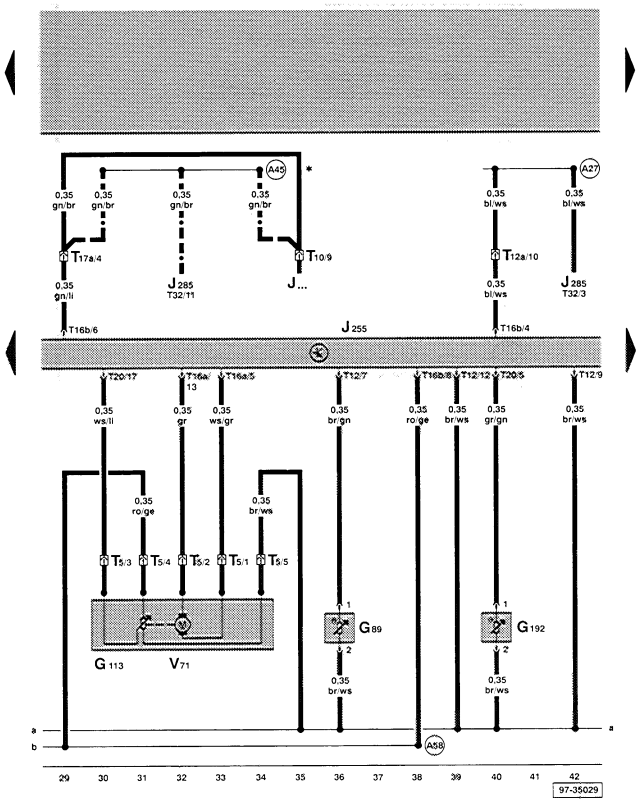


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Climatronic control module, central flap motor position sensor, central air flap motor, footwell/defrost flap motor position sensor, footwell/defrost flap motor

G112 - Central Flap Motor Position Sensor
G114 - Footwell/Defrost Flap Motor Position Sensor
J255 - Climatronic Control Module
J285 - Control module with indicator unit in instrument panel insert
T6b - 6-Pin Connector, behind instrument panel, center
T6c - 6-Pin Connector, behind instrument panel, center
T12 - 12-Pin Connector
T12a - 12-Pin Connector, behind instrument panel, center
T16 - Data Link Connector (DLC), below instrument panel, left
T16a - 16-Pin Connector
T20 - 20-Pin Connector
T32a - 32-Pin Connector, green
V70 - Central Air Flap Motor
V85 - Footwell/Defroster Flap Motor

(A76) - Connection (K-diagnosis wire) in instrument panel wiring harness



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Climatronic control module, fresh air intake duct temperature sensor, sender for outlet temperature, air flow flap motor, back pressure flap motor position sensor

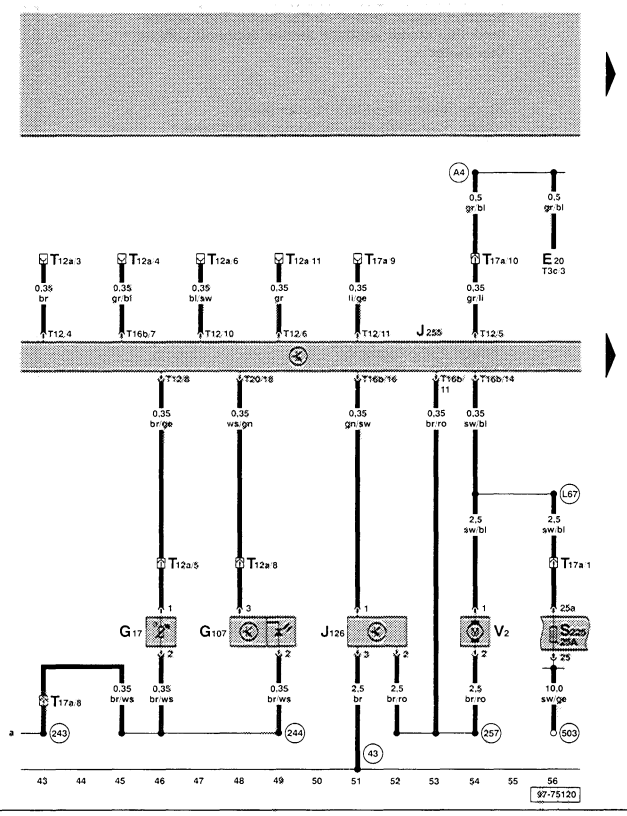
G89 - Fresh Air Intake Duct Temperature Sensor, below instrument panel, right
G113 - Back Pressure Flap Motor Position Sensor
G192 - Sender for outlet temperature, floor outlet
J255 - Climatronic Control Module
J285 - Control module with indicator unit in instrument panel insert
J... - Engine Control Module (ECM)
T5 - 5-Pin Connector, behind instrument panel, center
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T12 - 12-Pin Connector
T12a - 12-Pin Connector, behind instrument panel, center
T16a - 16-Pin Connector
T16b - 16-Pin Connector
T17a - 17-Pin Connector, behind instrument panel, center
T20 - 20-Pin Connector
T32 - 32-Pin Connector, blue
V71 - Air Flow Flap Motor

(A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness
(A45) - Wire connection (RPM-signal), in instrument panel wiring harness
(A58) - Wire connection (5 V), in instrument cluster wiring harness

* - Beginning May 2002
-•-•- Through April 2002

Repair Manual page number 97-357

Repair Manual page number 97-356

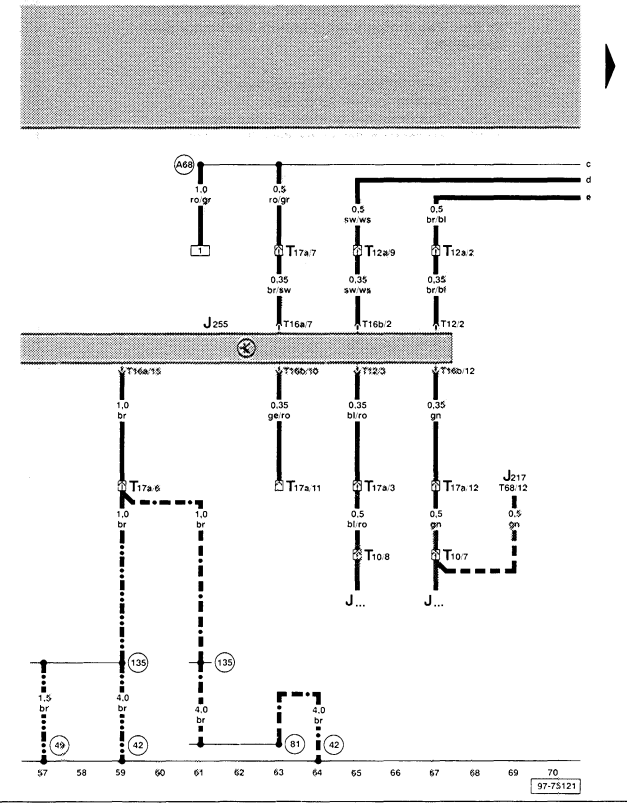


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Climatronic control module, outside air temperature sensor, sunlight photo sensor, control module for fresh air blower, fresh air blower

- E20 - Instrument Panel Light Dimmer Switch
- G17 - Outside Air Temperature Sensor, on front bumper, left
- G107 - Sunlight Photo Sensor, on instrument panel, center
- J126 - Control module for fresh air blower, below instrument panel, right
- J255 - Climatronic Control Module
- S225 - Fuse 25 in fuse holder
- T3c - 3-Pin Connector
- T12 - 12-Pin Connector
- T12a - 12-Pin Connector, behind instrument panel, center
- T16b - 16-Pin Connector
- T17a - 17-Pin Connector, behind instrument panel, center
- T20 - 20-Pin Connector
- V2 - Fresh Air Blower

- (43) - Ground connection, on right A-pillar, lower part
- (243) - Ground connection -1- in wiring harness, Climatronic
- (244) - Ground connection (Sensor ground), in wiring harness Climatronic
- (257) - Ground connection -2-, in wirning harness Climatronic
- (503) - Threaded connection -2- (75x) on the relay plate
- (A4) - Plus connection (58b), in instrument panel wiring harness
- (L67) - Plus connection (75x) in Climatronic wiring harness



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Climatronic control module

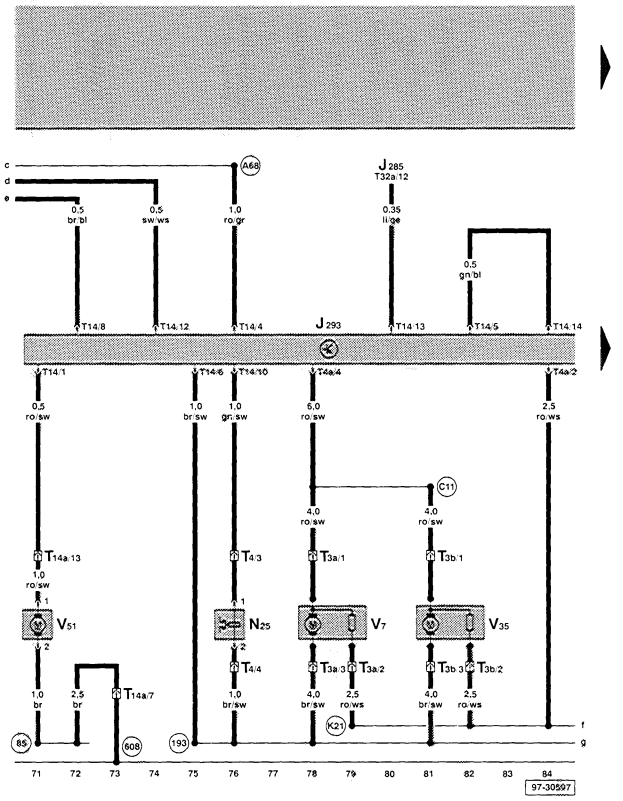
- J217 - Transmission Control Module (TCM)
- J255 - Climatronic Control Module
- J... - Engine Control Module (ECM)
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T12 - 12-Pin Connector
- T12a - 12-Pin Connector, behind instrument panel, center
- T16a - 16-Pin Connector
- T16b - 16-Pin Connector
- T17a - 17-Pin Connector, behind instrument panel, center
- T68 - 68-Pin Connector

- (42) - Ground connection, beside steering column
- (49) - Ground connection, on steering column
- (81) - Ground connection -1-, in instrument panel wiring harness
- (135) - Ground connection -2-, in instrument panel wiring harness
- (A68) - Connection (30, A/C), in instrument panel wiring harness

-•••- Beginning May 2000
-•-•- Through April 2000
- - - Automatic transmission only (4 speed autom.)

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Repair Manual page number 97-358

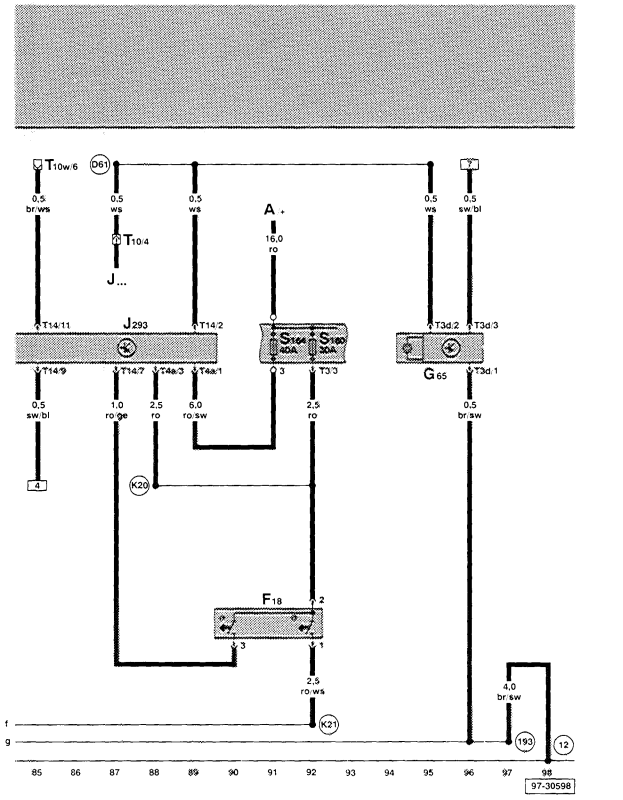


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Coolant fan control (FC) module, A/C clutch, coolant fan, after-run coolant pump

- J285 - Control module with indicator unit in instrument panel insert
- J293 - Coolant Fan Control (FC) Control Module, in engine compartment, left
- N25 - A/C Clutch
- T3a - 3-Pin Connector, in engine compartment, left
- T3b - 3-Pin Connector, in engine compartment, left
- T4 - 4-Pin Connector, near starter
- T4a - 4-Pin Connector
- T14 - 14-Pin Connector
- T14a - 14-Pin Connector, near battery
- T32a - 32-Pin Connector, green
- V7 - Left Coolant Fan
- V35 - Right Coolant Fan
- V51 - After-Run Coolant Pump

- (85) - Ground connection -1-, in engine compartment wiring harness
- (193) - Ground connection -1-, in coolant fan wiring harness
- (608) - Ground connection (in center plenum chamber)
- (A68) - Connection (30, A/C), in instrument panel wiring harness
- (C11) - Wire connection, in coolant fan wiring harness
- (K21) - Wire connection -1-, in coolant fan wiring harness



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Coolant fan control (FC) module, coolant fan control (FC) thermal switch, high pressure sensor

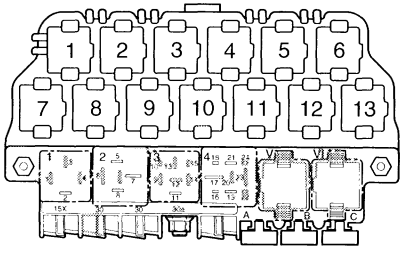
- A - Battery
- F18 - Coolant Fan Control (FC) Thermal Switch
- G65 - High Pressure Sensor
- J293 - Coolant Fan Control (FC) Control Module, in engine compartment, left
- J... - Engine Control Module (ECM)
- S164 - Fuse -3- (30) in fuse bracket/battery
- S180 - Fuse -8- (30) in fuse bracket/battery
- T3 - 3-Pin Connector
- T3d - 3-Pin Connector
- T4a - 4-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T14 - 14-Pin Connector

- (12) - Ground connection, in engine compartment, left
- (193) - Ground connection -1-, in coolant fan wiring harness
- (D61) - Wire connection (A/C), in engine compartment wiring harness
- (K20) - Plus connection -1- (30), in coolant fan wiring harness
- (K21) - Wire connection -1-, in coolant fan wiring harness

Radio system "Monsoon" (with CD changer wiring preparation)

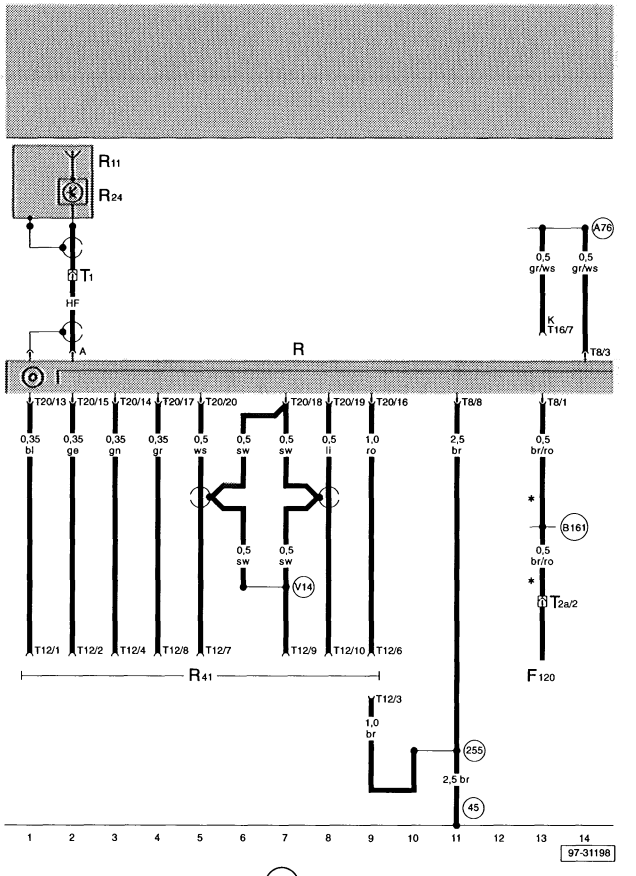
from May 1999

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

*F120 - Hood Alarm Switch**
R - Radio
R11 - Antenna
R24 - Antenna Amplifier
R41 - CD Changer Unit
T1 - Single Connector
T2a - Double Connector, near headlight, right
T8 - 8-Pin Connector
T12 - 12-Pin Connector
T16 - Data Link Connector (DLC), below instrument panel, left
T20 - 20-Pin Connector, on Radio

(45) - Ground connection, behind instrument panel, center

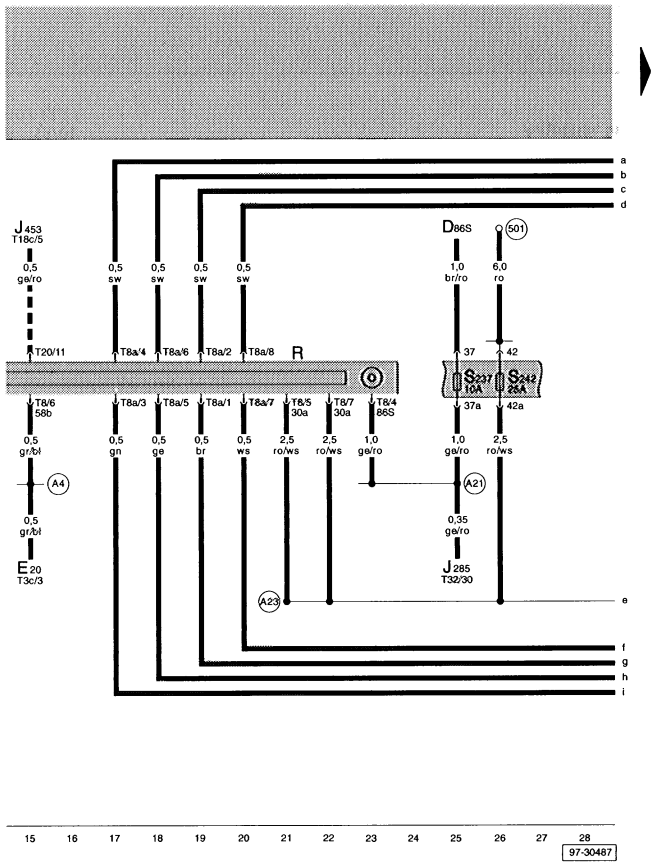
(255) - Ground connection, -1-, in wiring harness radio
(A76) - Connector (K-diagnosis wire) in instrument panel wiring harness
*(B161) - Connector (anti-theft warning system), in wiring harness interior**
(V14) - Wire connection (shielding), in CD-changer wiring harness

** - Vehicles with anti-theft warning system only (see wiring diagram comfort system/ central locking)*

Radio, wiring harness from radio to CD changer unit

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Repair Manual page number 97-363

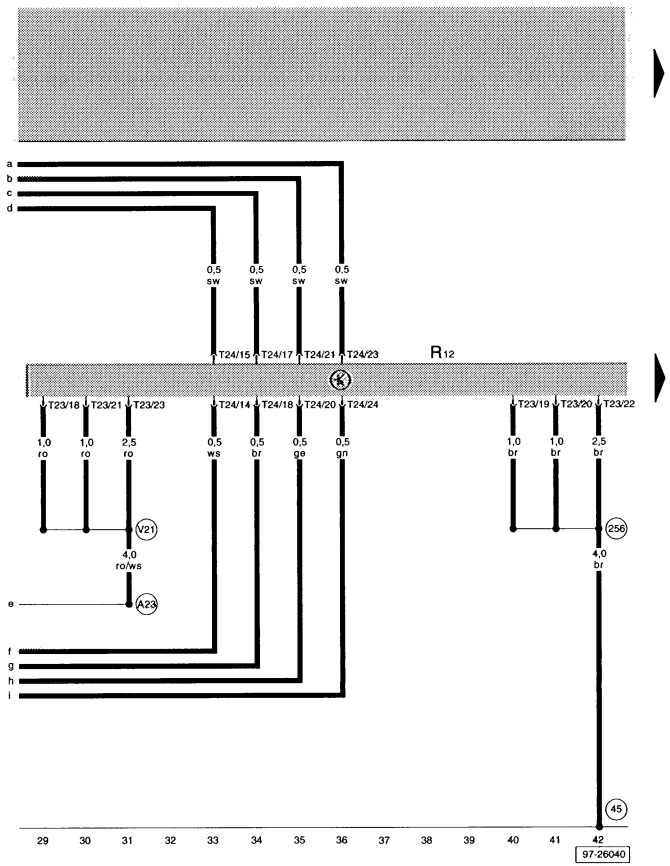


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

D - Ignition/Starter Switch
E20 - Instrument Panel Light Dimmer Switch
J285 - Control module with indicator unit in instrument panel insert
J453 - Control module for multi-function steering wheel
R - Radio
S237 - Fuse 37 in fuse holder
S242 - Fuse 42 in fuse holder
T3c - 3-Pin Connector
T8 - 8-Pin Connector
T8a - 8-Pin Connector
T18c - 18-Pin Connector
T20 - 20-Pin Connector, on Radio
T32 - 32-Pin Connector, blue

(501) - Threaded connection -2- (30) on the relay plate
(A4) - Plus connection (58b), in instrument panel wiring harness
(A21) - Wire connection (86s), in instrument panel wiring harness
(A23) - Wire connection (30a), in instrument panel wiring harness

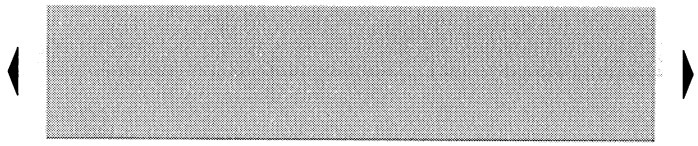
--- Vehicles with multi-function steering wheel only

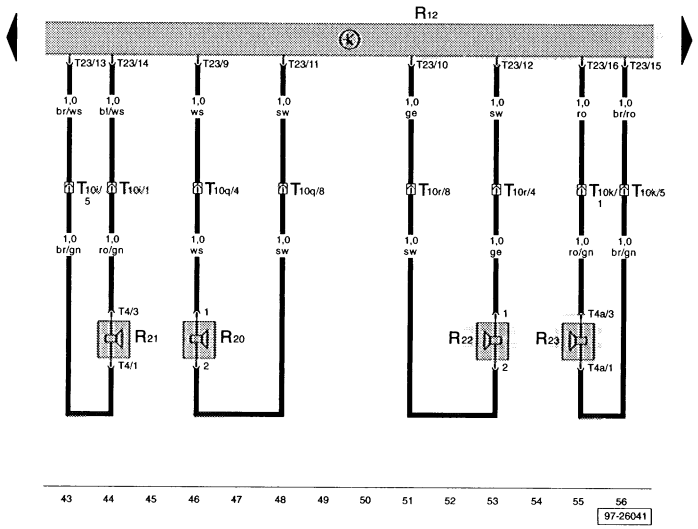


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

T23 - 23-Pin Connector
T24 - 24-Pin Connector
R12 - Amplifier, (Golf: in luggage compartment, left), (Jetta: below rear window shelf, right)

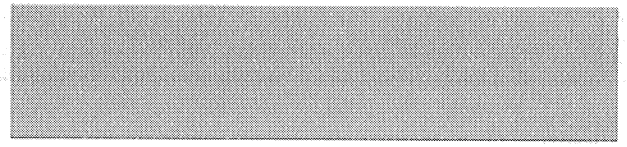
(45) - Ground connection, behind instrument panel, center
(256) - Ground connection, -2-, in wiring harness radio
(A23) - Wire connection (30a), in instrument panel wiring harness
(V21) - Plus connector (30), in wiring harness Radio-Amplifier

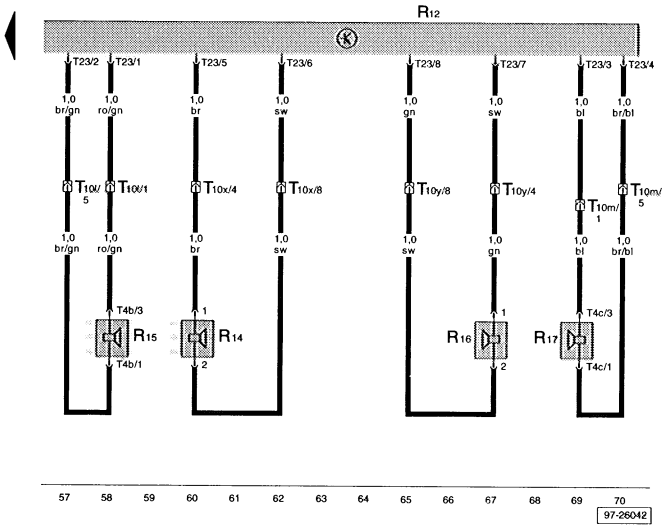




ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

R12 - Amplifier, (Golf: in luggage compartment, left), (Jetta: below rear window shelf, right)
R20 - Treble speaker, left front
R21 - Bass speaker, left front
R22 - Treble speaker, right front
R23 - Bass speaker, right front
T4 - 4-Pin Connector
T4a - 4-Pin Connector
T10l - 10-Pin Connector, black, connector station A-pillar, left
T10k - 10-Pin Connector, black, connector station A-pillar, right
T10q - 10-Pin Connector, blue, connector station A-pillar, left
T10r - 10-Pin Connector, blue, connector station A-pillar, right
T23 - 23-Pin Connector





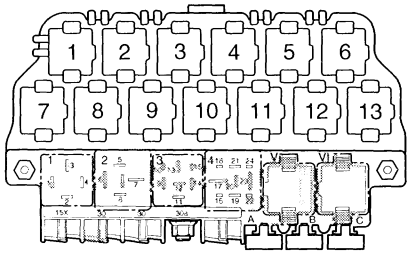
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

R12 - Amplifier, (Golf: in luggage compartment, left), (Jetta: below rear window shelf, right)
R14 - Treble speaker, left rear
R15 - Bass speaker, left rear
R16 - Treble speaker, right rear
R17 - Bass speaker, right rear
T4b - 4-Pin Connector
T4c - 4-Pin Connector
T10l - 10-Pin Connector, black, connector station B-pillar, left
T10m - 10-Pin Connector, black, connector station B-pillar, right
T10x - 10-Pin Connector, blue, connector station B-pillar, left
T10y - 10-Pin Connector, blue, connector station B-pillar, right
T23 - 23-Pin Connector

1.8L - Engine - Motronic Multiport Fuel Injection (MFI)/110 kW, code AWD,

from November 1999

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

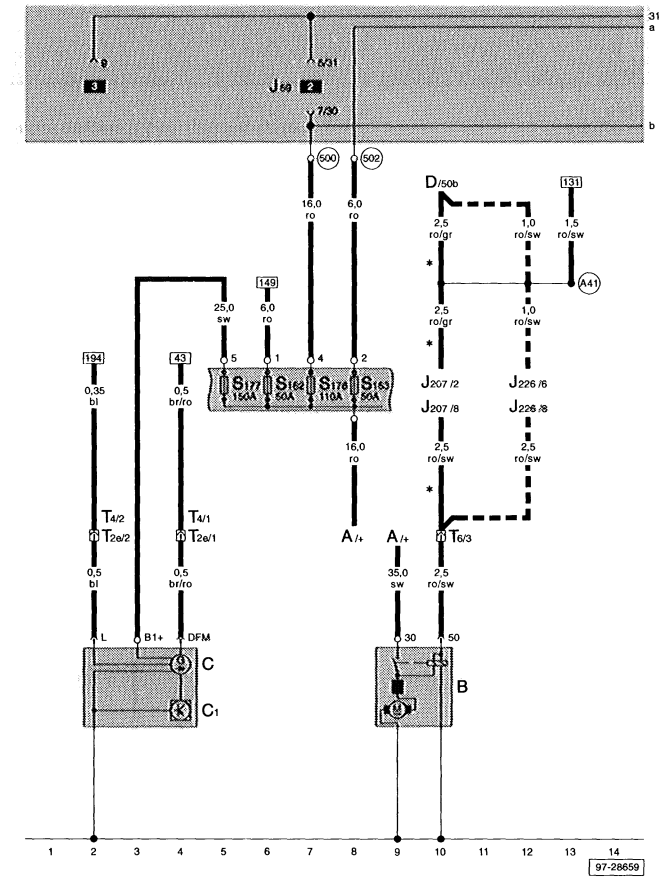
2 Load Reduction Relay (100)

4 Fuel Pump (FP) Relay (409)

Note: Number in parentheses indicates production control number stamped on relay housing.

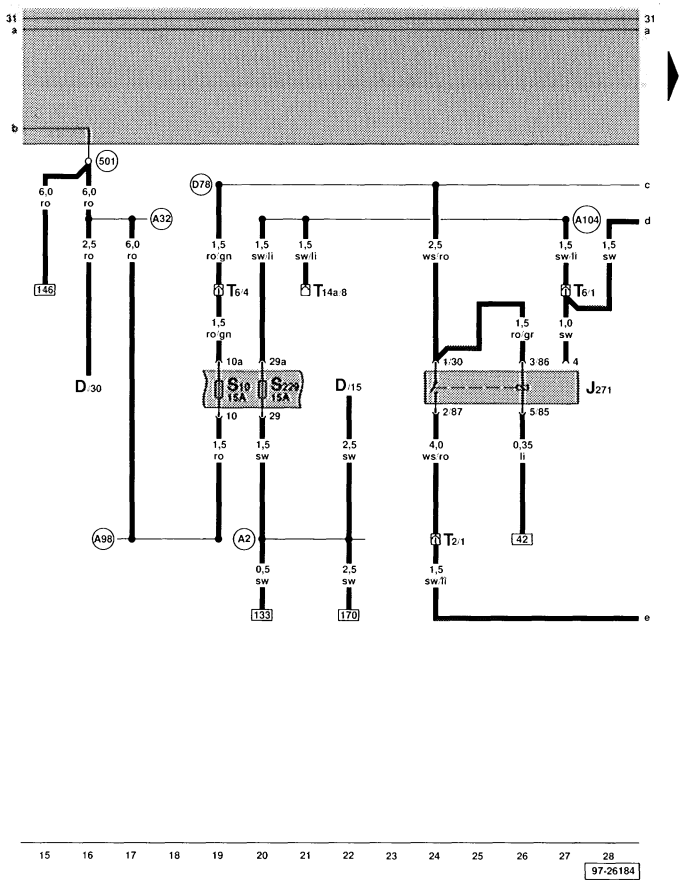
Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

A - Battery
B - Starter
C - Generator (GEN)
C1 - Voltage Regulator (VR)
D - Ignition/Starter Switch
J59 - Load Reduction Relay
J207 - Starting Interlock Relay
J226 - Park/Neutral Position (PNP) Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
T2e - Double Connector, near starter (vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
(500) - Threaded connection -1- (30) on the relay plate
(502) - Threaded connection -1- (30a) on the relay plate
(A41) - Plus connection (50), in instrument panel wiring harness
* - Manual transmission only
--- Automatic transmission only

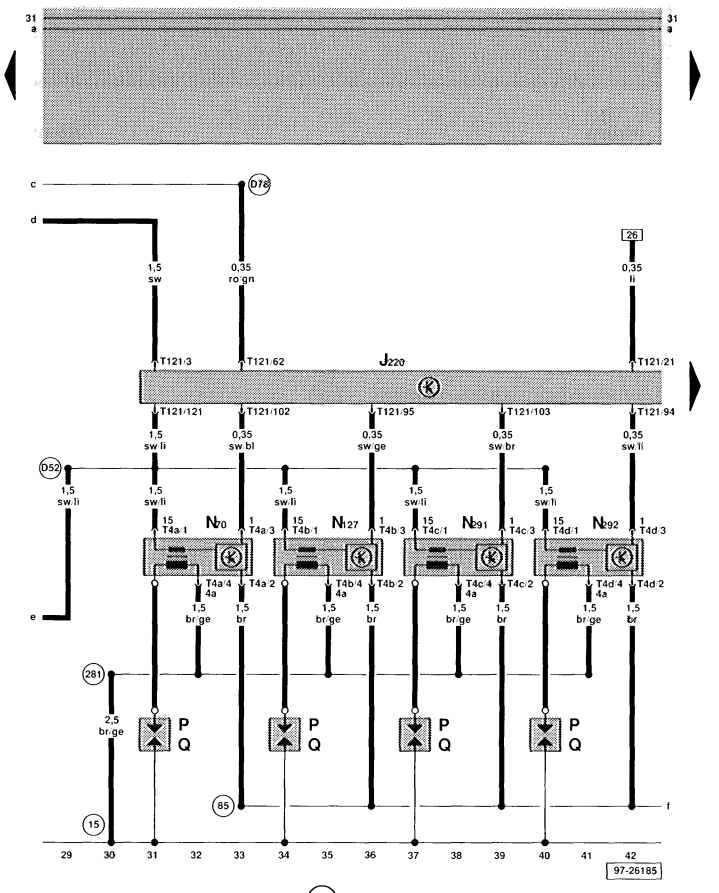


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

D - Ignition/Starter Switch
J271 - Motronic engine control module (ECM) power supply relay, in protective housing, in engine compartment, left, production control number (428)
S10 - Fuse 10 in fuse holder
S229 - Fuse 29 in fuse holder
T2 - 2-Pin Connector, in engine compartment, left
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, in engine compartment, in wiring duct, left

(501) - Threaded connection -2- (30) on the relay plate

(A2) - Plus connection (15), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness
(A104) - Plus connector -2- (15), in instrument panel wiring harness
(D78) - Plus connector -1- (30a), in engine compartment wiring harness

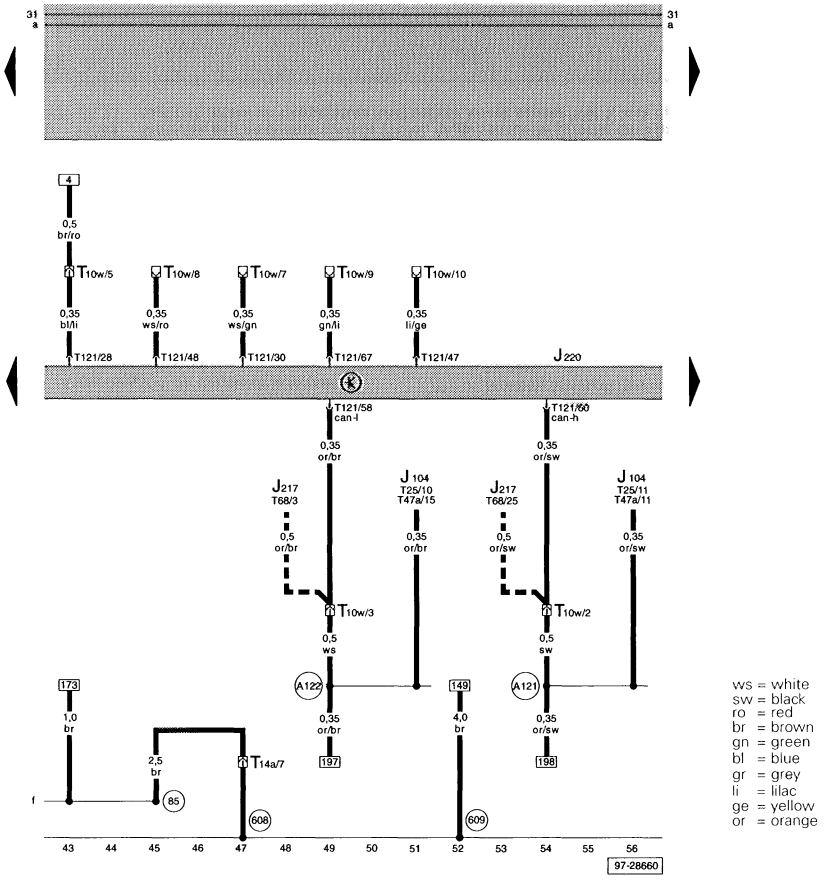


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

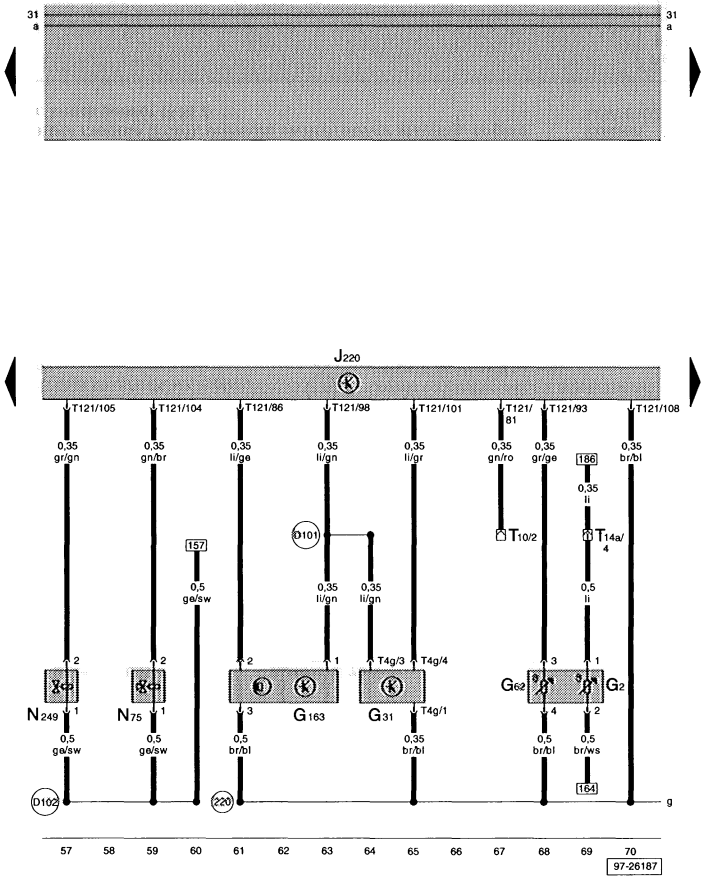
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N70 - Ignition Coil 1 with Power Output Stage
N127 - Ignition Coil 2 with Power Output Stage
N291 - Ignition Coil 3 with Power Output Stage
N292 - Ignition Coil 4 with Power Output Stage
P - Spark Plug Connectors
Q - Spark Plugs
T4a - 4-Pin Connector
T4b - 4-Pin Connector
T4c - 4-Pin Connector
T4d - 4-Pin Connector
T121 - Connector, 121 point

(15) - Ground connection, on cylinder head

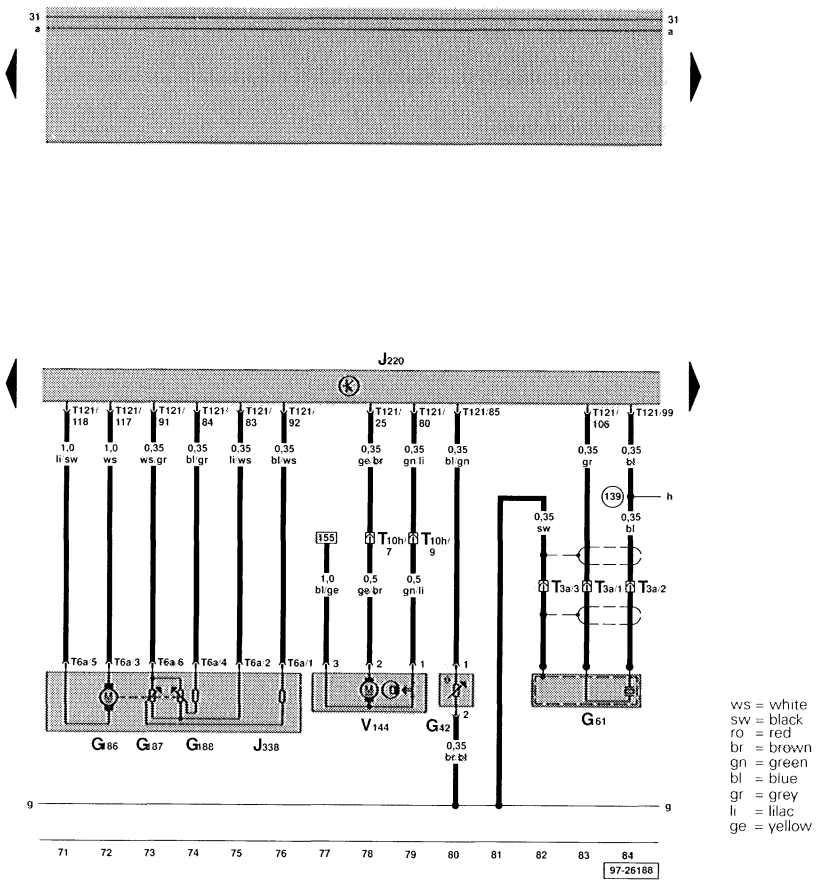
(85) - Ground connection -1-, in engine compartment wiring harness
(281) - Ground connector -1-, in wiring harness engine pre-wiring
(D52) - Plus connector (15a), in engine compartment wiring harness
(D78) - Plus connector -1- (30a), in engine compartment wiring harness



J104 - ABS Control Module (w/EDL), in engine compartment, left
J217 - Transmission Control Module (TCM), in plenum chamber, center
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, in engine compartment, in wiring duct, left
T25 - 25-Pin Connector, on ABS Control Module (through July 2000)
T47a - 47-Pin Connector, on ABS Control Module (beginning August 2000)
T68 - 68-Pin Connector, on Transmission Control Module (TCM)
T121 - Connector, 121 point
(85) - Ground connection -1-, in engine compartment wiring harness
(608) - Ground Connection (in center plenum chamber)
(609) - Ground Connection (in right plenum chamber)
(A121) - Connection (high bus), in instrument panel wiring harness
(A122) - Connection (low bus), in instrument panel wiring harness
--- Automatic transmission only



G2 - Engine Coolant Temperature (ECT) Sensor
G31 - Charge Air Pressure Sensor
G62 - Engine Coolant Temperature (ECT) Sensor
G163 - Camshaft Position (CMP) Sensor 2
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N75 - Wastegate Bypass Regulator Valve
N249 - Recirculating valve for turbocharger
T4g - 4-Pin Connector
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, in engine compartment, in wiring duct, left
T121 - Connector, 121 point
(220) - Ground connection (sensor ground), in engine compartment wiring harness
(D101) - Wire connection -1-, in engine compartment wiring harness
(D102) - Wire connection -2-, in engine compartment wiring harness

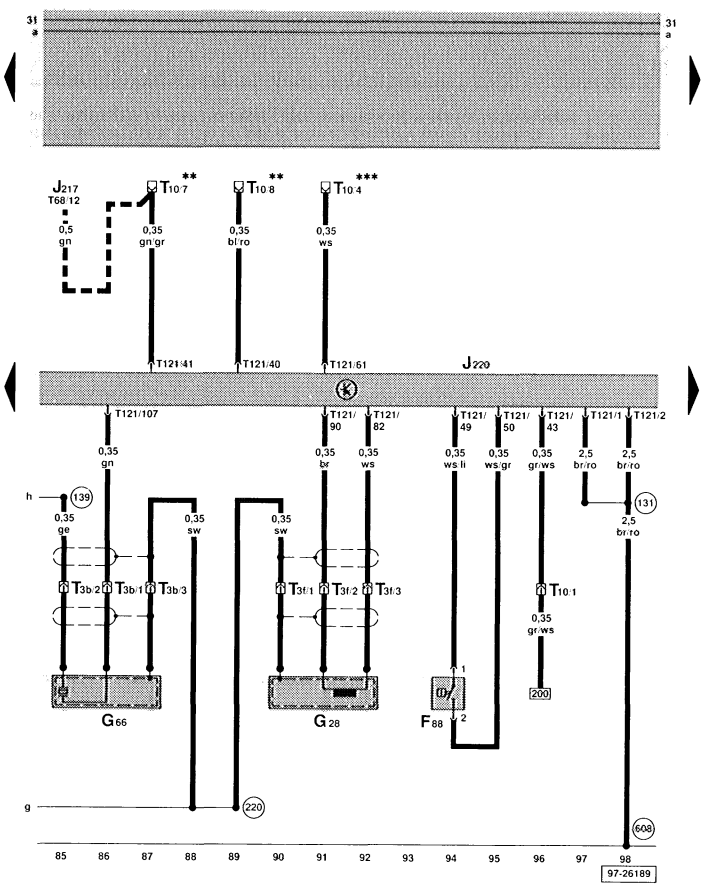


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

G42 - Intake Air Temperature (IAT) Sensor
G61 - Knock Sensor (KS) 1
G186 - Throttle drive (power accelerator actuation)
G187 - Angle sensor -1- for throttle drive (power accelerator actuation)
G188 - Angle sensor -2- for throttle drive (power accelerator actuation)
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J338 - Throttle Valve Control Module
T3a - 3-Pin Connector, in engine compartment, front
T6a - 6-Pin Connector
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T121 - Connector, 121 point
V144 - Leak detection pump (LDP)
(139) - Ground connection (sensor Ground), in Motronic Multiport Fuel Injection (MFI) wiring harness

Edition 11/99 USA.5102.05.21

Motronic engine control module (ECM), angle sensor for throttle drive (power accelerator actuation), intake air temperature (IAT) sensor, knock sensor (KS) 1, leak detection pump (LDP)

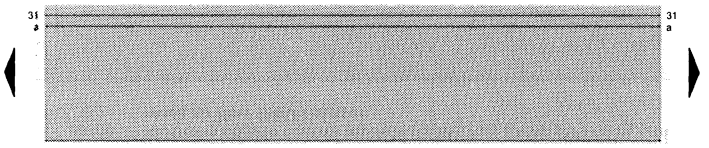


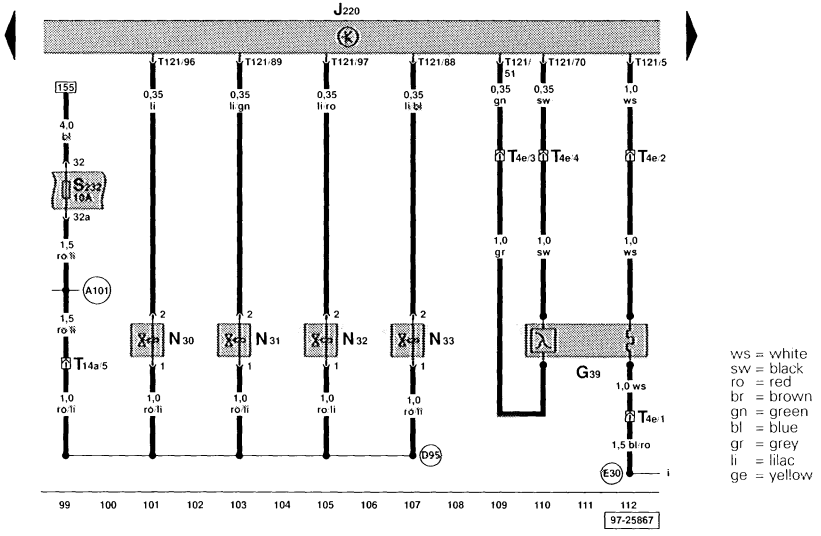
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

F88 - Pressure switch/power steering
G28 - Engine Speed (RPM) Sensor
G66 - Knock Sensor (KS) 2
J217 - Transmission Control Module (TCM), in plenum chamber, center
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
T3b - 3-Pin Connector, in engine compartment, front
T3f - 3-Pin Connector, in engine compartment, front
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T68 - Connector, 68 point
T121 - Connector, 121 point
(131) - Ground connection -2-, in engine compartment wiring harness
(139) - Ground connection (sensor Ground), in Motronic Multiport Fuel Injection (MFI) wiring harness
(220) - Ground connection (sensor ground), in engine compartment wiring harness
(608) - Ground Connection (in center plenum chamber)
** - A/C connection
*** - Coolant Fan Control Module connection
--- - Automatic transmission only

Motronic engine control module (ECM), pressure switch/power steering, engine speed (RPM) sensor, knock sensor (KS) 2

Edition 11/99 USA.5102.05.21

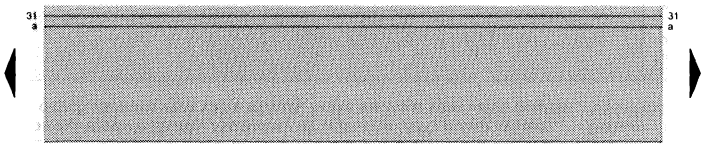


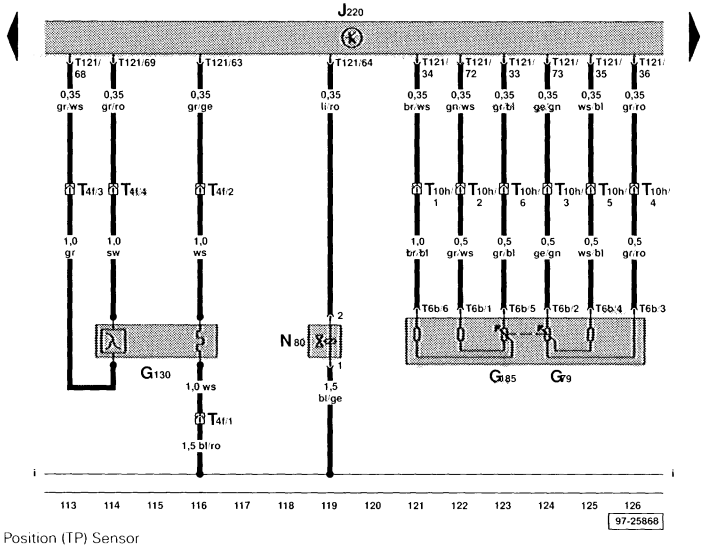


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

G39 - Heated Oxygen Sensor (HO2S)
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N30 - Cylinder 1 Fuel Injector
N31 - Cylinder 2 Fuel Injector
N32 - Cylinder 3 Fuel Injector
N33 - Cylinder 4 Fuel Injector
S232 - Fuse 32 in fuse holder
T4e - 4-Pin Connector, in protective housing for connectors under right floor
T14a - 14-Pin Connector, in engine compartment, in wiring duct, left
T121 - Connector, 121 point

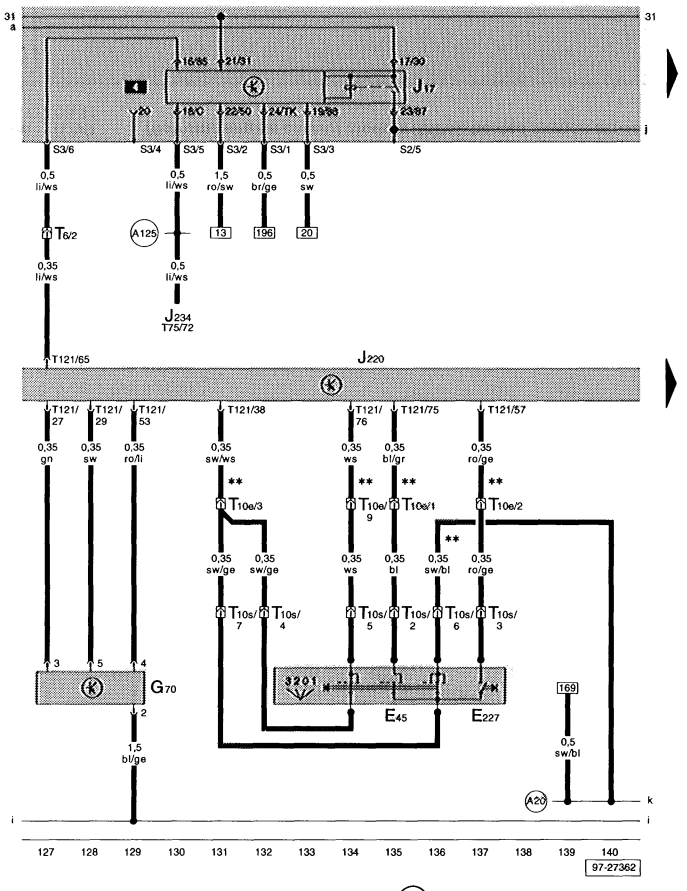
(A101) - Connector -3- (87a), in instrument panel wiring harness
(D95) - Wire connection (injectors), in engine compartment wiring harness
(E30) - Connector (87a), in wiring harness engine





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

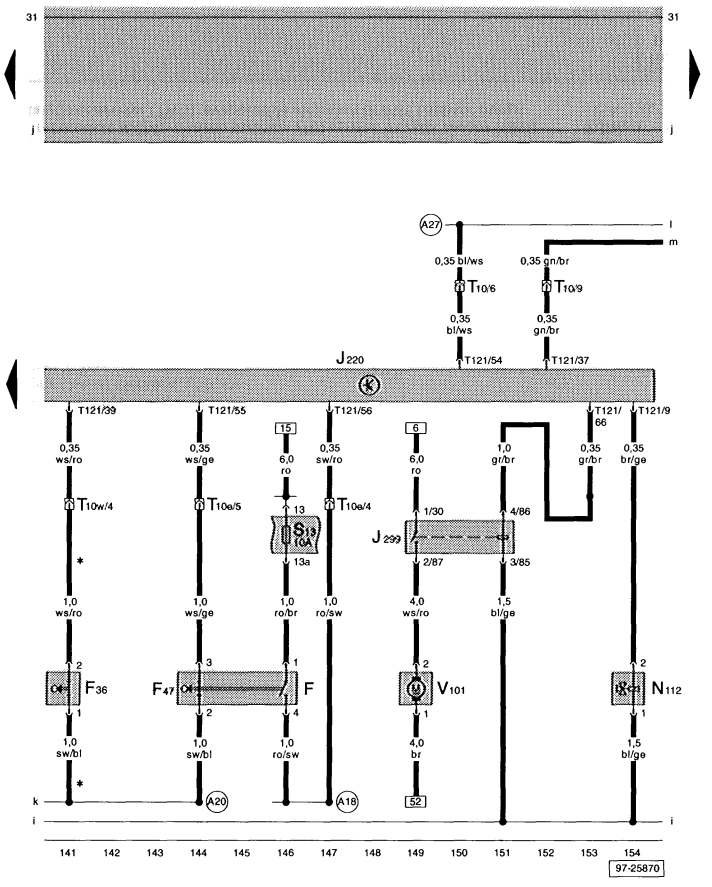
G79 - Throttle Position (TP) Sensor
G130 - Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC)
G185 - Sender -2- for accelerator pedal position
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N80 - Evaporative Emission (EVAP) Canister Purge Regulator Valve
T4f - 4-Pin Connector, in protective housing for connectors under right floor
T6b - 6-Pin Connector
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T121 - Connector, 121 point



E45 - Cruise Control Switch**
E227 - Cruise Control Push Button (SET)**
G70 - Mass Air Flow (MAF) Sensor
J17 - Fuel Pump (FP) Relay
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J234 - Airbag Control Module
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
T10s - 10-Pin Connector, near steering column
T75 - 75-Pin Connector
T121 - Connector, 121 point

(A20) - Wire connection (15a), in instrument panel wiring harness
(A125) - Connection (crash signal) in instrument panel wiring harness

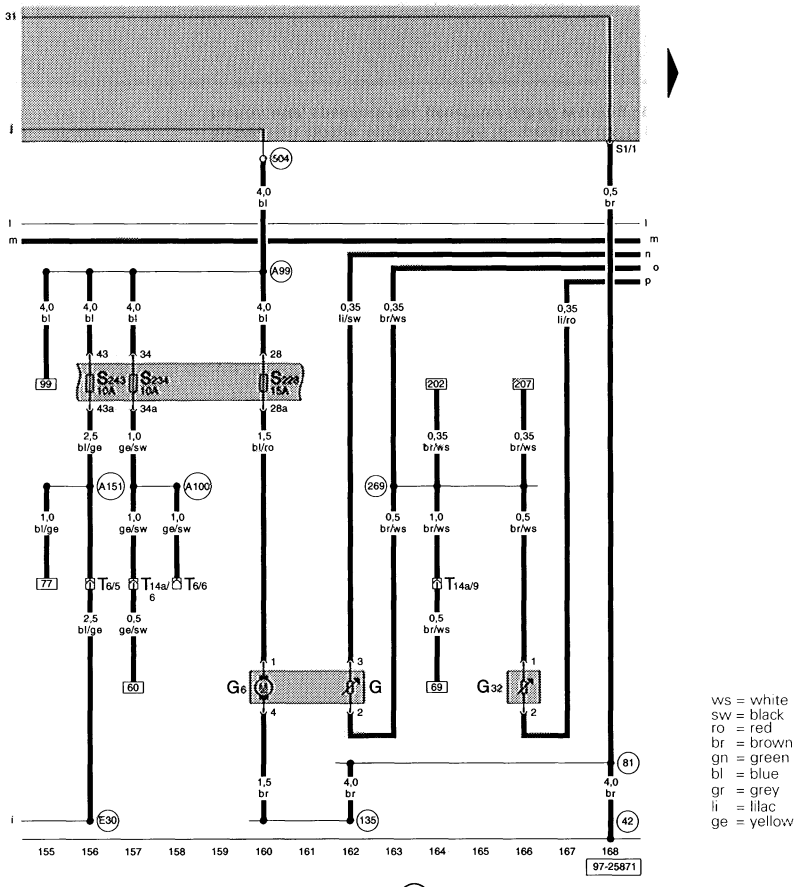
** - Vehicles with cruise control only



F - Brake Light Switch
F36 - Clutch Vacuum Vent Valve Switch
F47 - Brake Vacuum Vent Valve Switch for cruise control
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J299 - Secondary Air Injection (AIR) Pump Relay, in protective housing, in engine compartment, left, production control number (100)
N112 - Secondary Air Injection (AIR) Solenoid Valve
S13 - Fuse 13 in fuse holder
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
T121 - Connector, 121 point
V101 - Secondary Air Injection (AIR) Pump Motor

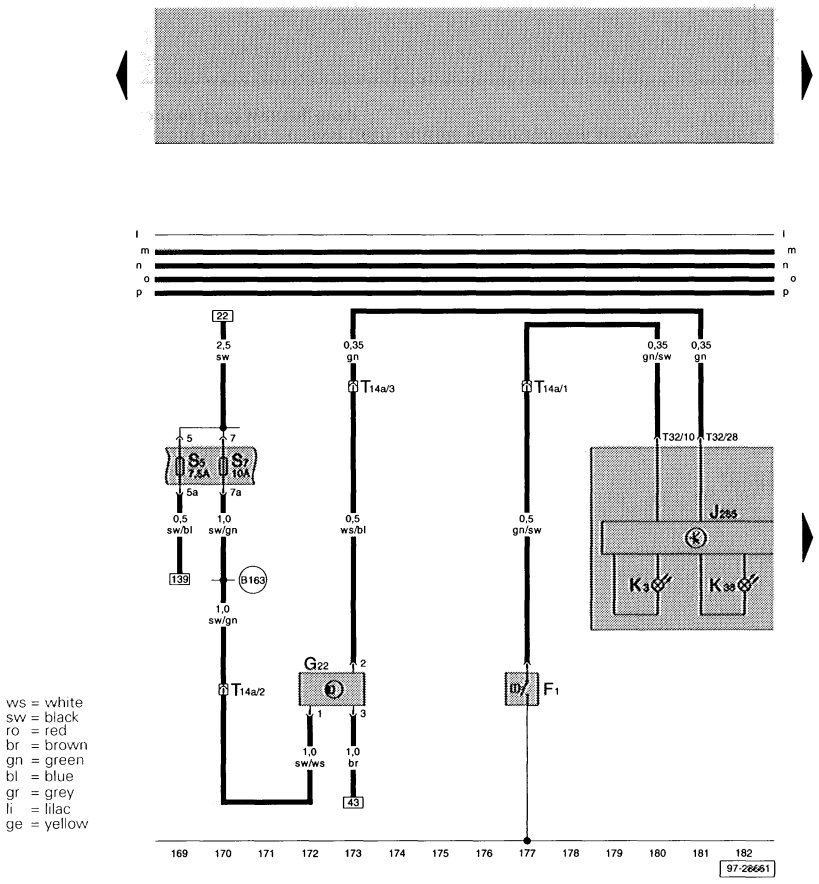
(A18) - Wire connection (54), in instrument panel
(A20) - Wire connection (15a), in instrument panel wiring harness
(A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness

* - Manual transmission only



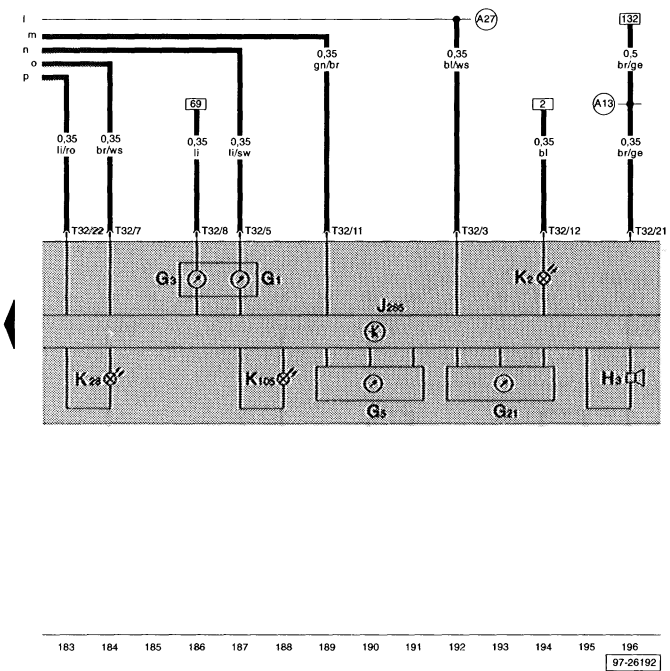
G - Fuel Level Sensor
G6 - Fuel Pump (FP)
G32 - Engine Coolant Level (ECL) Sensor
S228 - Fuse 28 in fuse holder
S234 - Fuse 34 in fuse holder
S243 - Fuse 43 in fuse holder
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, in engine compartment, in wiring duct, left

(42) - Ground connection, beside steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harnes
(269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
(504) - Threaded connection -1- (87) on the relay plate
(A99) - Connector -1- (87), in instrument panel wiring harness
(A100) - Connector -2- (87), in instrument panel wiring harness
(A151) - Connector -4- (87), in instrument panel wiring harness
(E30) - Connector (87a), in wiring harness engine



F1 - Oil Pressure Switch
G22 - Speedometer Vehicle Speed Sensor (VSS)
J285 - Control module with indicator unit in instrument panel insert
K3 - Oil Pressure Warning Light
K38 - Engine Oil Level Indicator Light
S5 - Fuse 5 in fuse holder
S7 - Fuse 7 in fuse holder
T14a - 14-Pin Connector, in engine compartment, in wiring duct, left
T32 - 32-Pin Connector, blue

(B163) - Plus connector -1- (15) in wiring harness interior

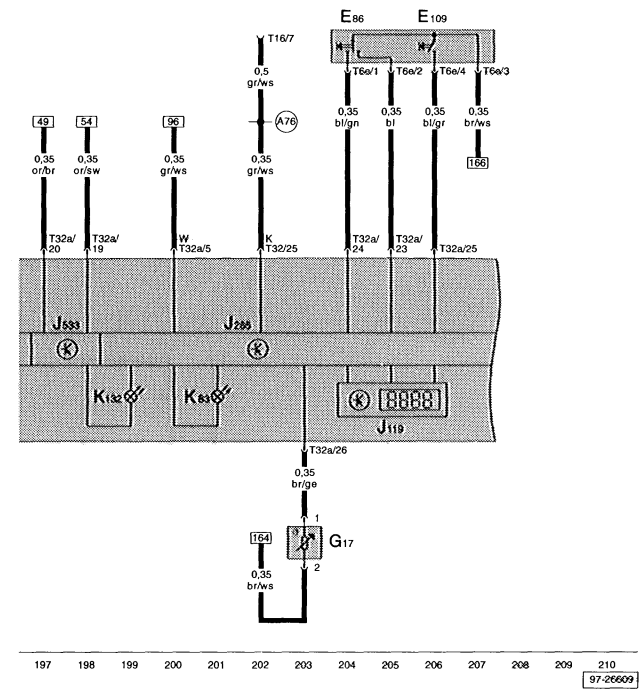


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

G1 - Fuel gauge
G3 - Engine Coolant Temperature (ECT) Gauge
G5 - Tachometer
G21 - Speedometer
H3 - Warning Buzzer
J285 - Control module with indicator unit in instrument panel insert
K2 - Generator (GEN) Warning Light
K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
K105 - Low Fuel Level Warning Light
T32 - 32-Pin Connector, blue

(A13) - Wire connection (door contact switch), in instrument panel wiring harness
(A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness

Instrument cluster, engine coolant temperature (ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E86 - Multi-Function Indicator Mode Select Switch
E109 - Multi-Function Indicator Memory Switch
G17 - Outside Air Temperature Sensor
J119 - Multi-function Indicator (MFI)
J285 - Control module with indicator unit in instrument panel insert
J533 - Data Bus On Board Diagnostic Interface
K83 - Malfunction Indicator Lamp (MIL)
K132 - Electronic Power Control (EPC) Warning Lamp
T6e - 6-Pin Connector
T16 - Data Link Connector (DLC), below instrument panel, center
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(A76) - Connector (K-diagnosis wire), in instrument panel wiring harness

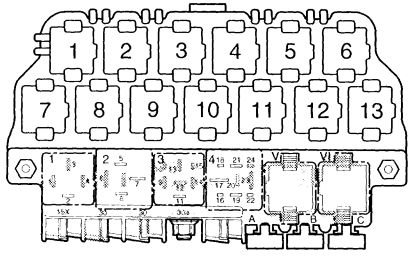
Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp

Comfort system (vehicles without power windows),

from May 1999

- Anti-theft warning system
- Central locking system with remote control
- Fuel tank lid unlock system
- Heated outside mirrors
- Interior lights
- Luggage compartment light
- Power sunroof
- Rear lid unlock system

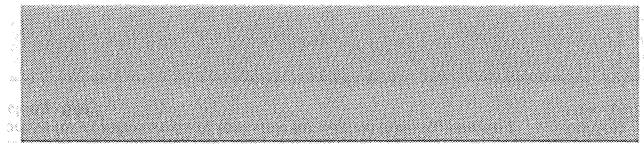
Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".

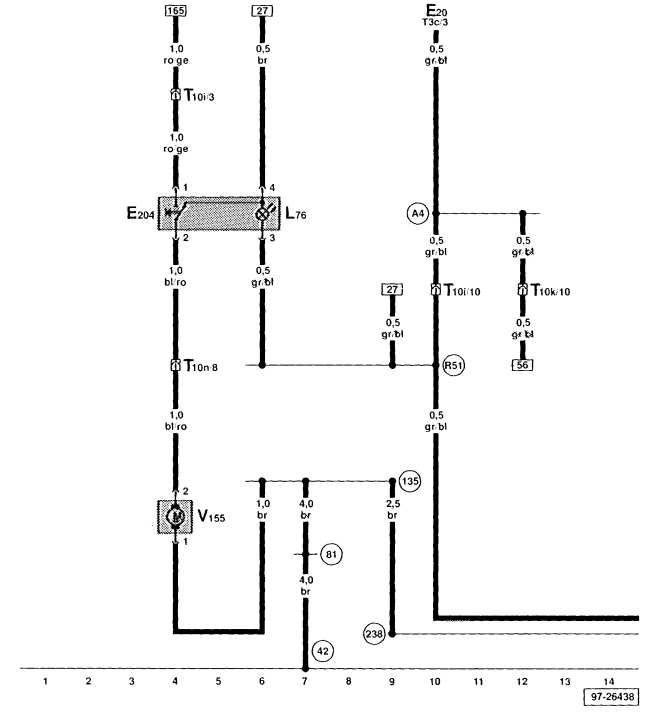


97-14163

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



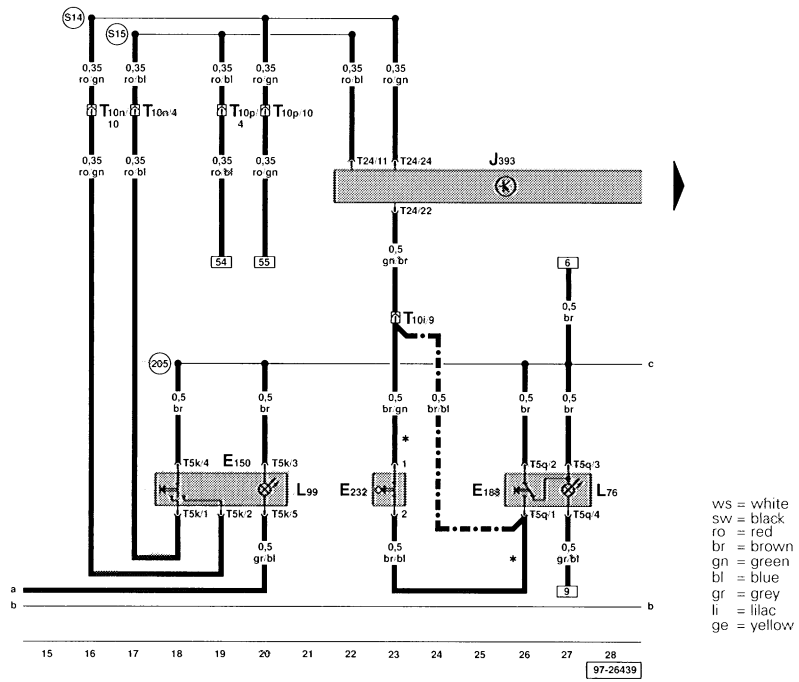


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E20 - Instrument Panel Light Dimmer Switch
E204 - Switch for remote/fuel tank door
L76 - Push Button Light
T3c - 3-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10k - 10-Pin Connector, black, connector station A-pillar, right
T10n - 10-Pin Connector, brown, connector station A-pillar, left
V155 - Motor for fuel tank lid unlock

(42) - Ground connection, beside steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(238) - Ground connection -1-, in wiring harness interior
(A4) - Plus connection (58b), in instrument panel wiring harness
(R51) - Connection (58b) in door wiring harness, driver side

Switch for remote/fuel tank door, motor for fuel tank lid unlock



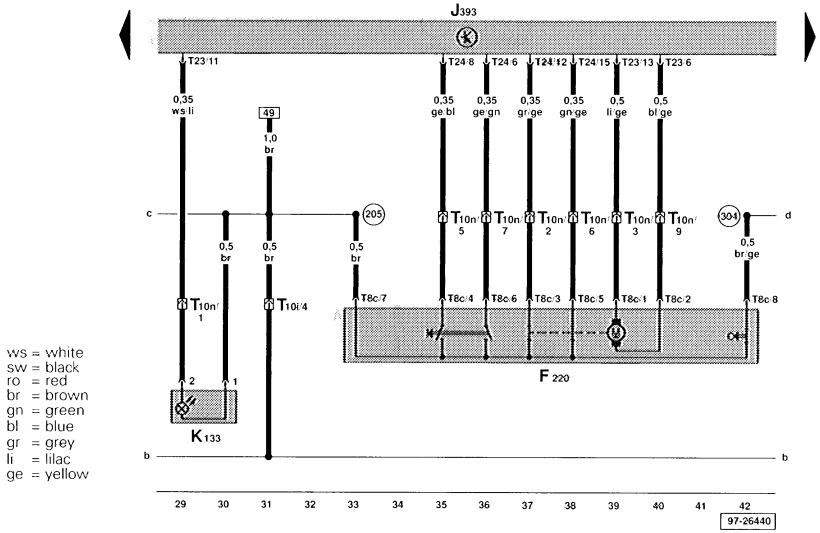
E150 - Switch for interior lock, driver side
E188 - Switch for remote unlock, rear lid, driver side
E232 - Key switch for switching off remote unlock rear lid
J393 - Central control module for comfort system, behind instrument panel, left
L76 - Push Button Light
L99 - Lighting for switch interior lock
T5k - 5-Pin Connector
T5q - 5-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10n - 10-Pin Connector, brown, connector station A-pillar, left
T10p - 10-Pin Connector, brown, connector station A-pillar, right
T24 - 24-Pin Connector

(205) - Ground connection, in driver's door wiring harness
(S14) - Wire connection (open), in central locking system wiring harness
(S15) - Wire connection (closed), in central locking system wiring harness

* - Jetta only
-•-•- Golf only

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Central control module for comfort system, switch for interior lock (driver side), switch for remote unlock rear lid

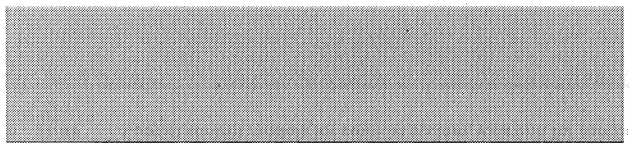


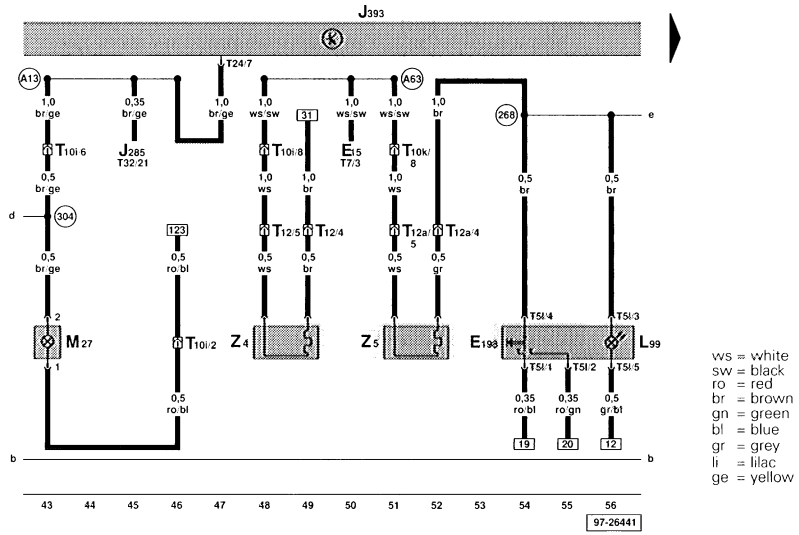
F220 - Lock unit for central locking, driver side
J393 - Central control module for comfort system, behind instrument panel, left
K133 - Warning light for central locking -SAFE-
T8c - 8-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10n - 10-Pin Connector, brown, connector station A-pillar, left
T23 - 23-Pin Connector
T24 - 24-Pin Connector

(205) - Ground connection, in driver's door wiring harness
(304) - Ground connector -3-, in wiring harness door cable - driver side

Central control module for comfort system, lock unit for central locking, warning light for central locking -SAFE-

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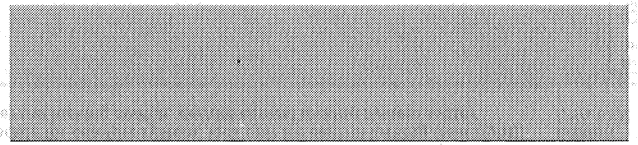


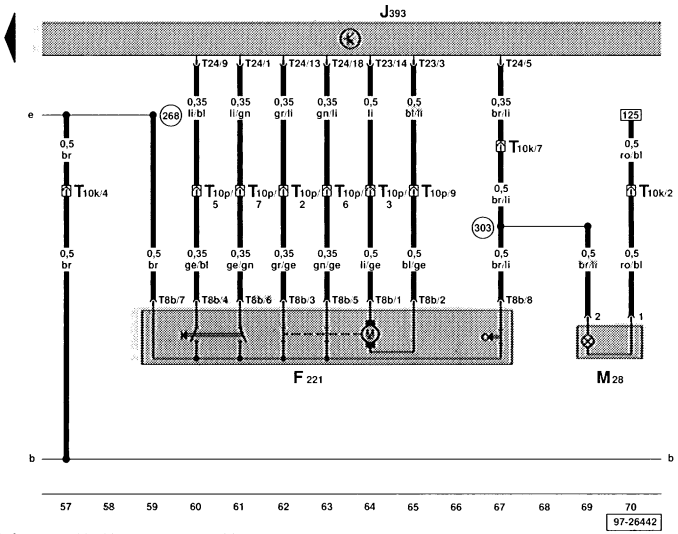
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E15 - Rear window defogger switch
E198 - Switch for interior lock, passenger side
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
L99 - Lighting for switch interior lock
M27 - Left Door Warning Light
T5l - 5-Pin Connector
T7 - 7-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10k - 10-Pin Connector, black, connector station A-pillar, right
T12 - 12-Pin Connector
T12a - 12-Pin Connector
T24 - 24-Pin Connector
T32 - 32-Pin Connector, blue
Z4 - Heated outside mirror, driver side
Z5 - Heated outside mirror, passenger side

(268) - Ground connector -2-, in wiring harness door cable - passenger side
(304) - Ground connector -3-, in wiring harness door cable - driver side
(A13) - Wire connection (door contact switch) in instrument panel wiring harness
(A63) - Connector (mirror adjustment/-heated) in instrument panel wiring harness

Central control module for comfort system, switch for interior lock (passenger side), left door warning light, heated outside mirrors



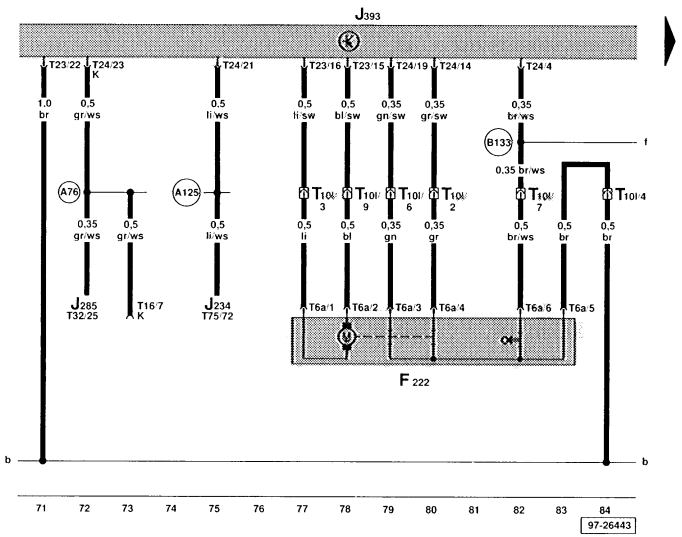


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

F221 - Lock unit for central locking, passenger side
J393 - Central control module for comfort system, behind instrument panel, left
M28 - Right Door Warning Light
T8b - 8-Pin Connector
T10k - 10-Pin Connector, black, connector station A-pillar, right
T10p - 10-Pin Connector, brown, connector station A-pillar, right
T23 - 23-Pin Connector
T24 - 24-Pin Connector

(268) - Ground connector -2-, in wiring harness door cable - passenger side
(303) - Ground connector -3-, in wiring harness door cable - passenger side

Central control module for comfort system, lock unit for central locking (passenger side), right door warning light

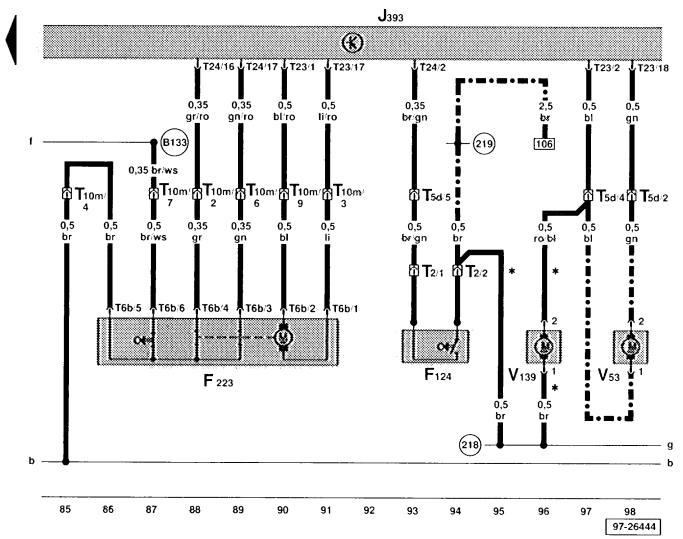


F222 - Lock unit for central locking, rear, left
J234 - Airbag Control Module, behind console, lower part
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
T6a - 6-Pin Connector
T10l - 10-Pin Connector, black, connector station B-pillar, left
T16 - Data Link Connector (DLC), below instrument panel, left
T23 - 23-Pin Connector
T24 - 24-Pin Connector
T32 - 32-Pin Connector, blue
T75 - 75-Pin Connector

(A76) - Connector (K-diagnosis wire) in instrument panel wiring harness
(A125) - Connection (crash signal) in instrument panel wiring harness
(B133) - Connector (central locking open), in wiring harness interior

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Central control module for comfort system, lock unit for central locking (rear left)



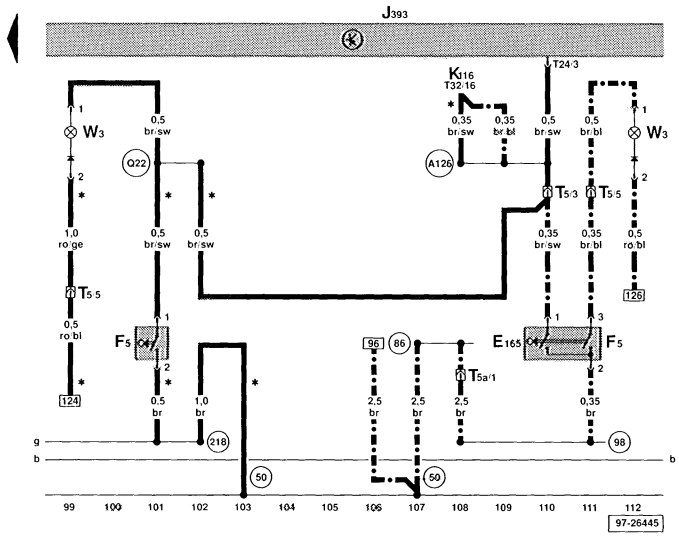
F124 - Trunk Lock Alarm/Central Locking Switch
F223 - Lock unit for central locking, rear, right
J393 - Central control module for comfort system, behind instrument panel, left
T2 - Double Connector, in rear lid
T5d - 5-Pin Connector, brown, connector station C-pillar, left
T6b - 6-Pin Connector
T10m - 10-Pin Connector, black, connector station B-pillar, right
T23 - 23-Pin Connector
T24 - 24-Pin Connector
V53 - Decklid Central Locking System Motor (Golf only)
V139 - Motor to unlock rear lid*

(218) - Ground connection -1-, in rear lid wiring harness
(219) - Ground connection -2-, in rear lid wiring harness
(B133) - Connector (central locking open), in wiring harness interior

* - Jetta only
-•-•- Golf only

Central control module for comfort system, lock unit for central locking (rear right), trunk lock alarm/central locking switch, decklid central locking system motor

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ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E165 - Trunk Lid Release Switch
F5 - Luggage Compartment Light Switch
J393 - Central control module for comfort system, behind instrument panel, left
K116 - Warning light for rear lid unlocked, in Instrument cluster
T5 - 5-Pin Connector, black, connector station C-pillar, left
T5a - 5-Pin Connector, pink, connector station C-pillar, left (Golf only)
T24 - 24-Pin Connector
T32 - 32-Pin Connector, blue, on Instrument cluster
W3 - Luggage compartment Light

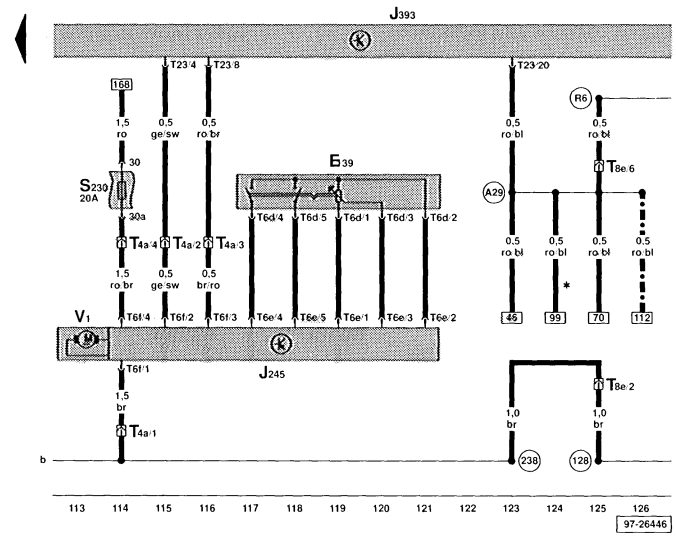
(50) - Ground connection, in luggage compartment, left
(86) - Ground connection -1-, in rear wiring harness
(98) - Ground connection, in rear lid wiring harness
(218) - Ground connection -1-, in rear lid wiring harness
(A126) - Connection (contact switch in rear lid) in instrument panel wiring harness
(Q22) - Wire connection -1-, in rear lid wiring harness

* - Jetta only
-•-•- Golf only

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Central control module for comfort system, trunk lid release switch, luggage compartment light switch

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ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E139 - Sunroof Regulator
J245 - Power Sunroof Control Module
J393 - Central control module for comfort system, behind instrument panel, left
S230 - Fuse 30 in fuse holder
T4a - 4-Pin Connector, behind instrument panel, left
T6d - 6-Pin Connector
T6e - 6-Pin Connector
T6f - 6-Pin Connector
T8e - 8-Pin Connector, behind instrument panel, left
T23 - 23-Pin Connector
V1 - Sunroof Motor

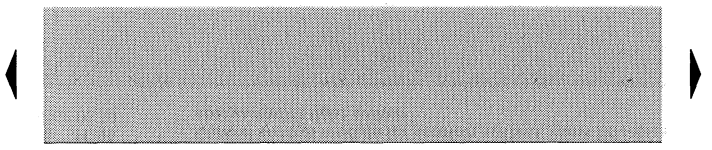
(128) - Ground connection -1-, in interior light wiring harness
(238) - Ground connection -1-, in wiring harness interior
(A29) - Wire connection (interior light), in instrument panel wiring harness
(R6) - Plus connection -1-, in interior light wiring harness

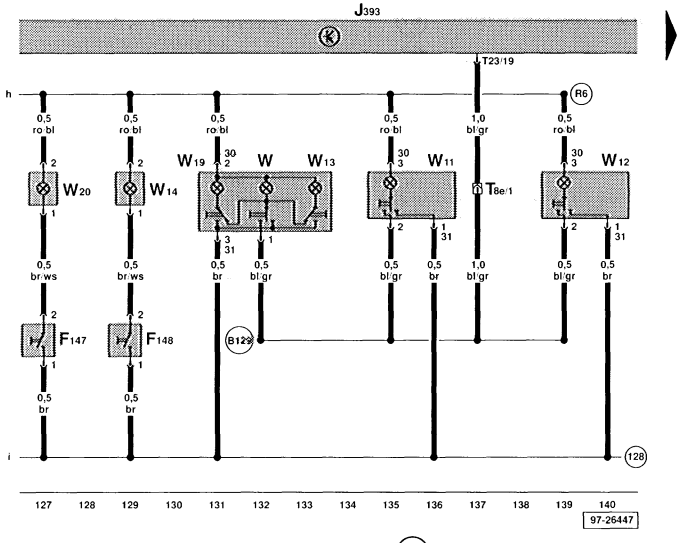
* - Jetta only
-•-•- Golf only

Central control module for comfort system, power sunroof control module, sunroof regulator, sunroof motor

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Repair Manual page number **97-393**



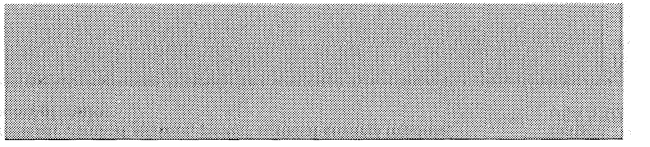


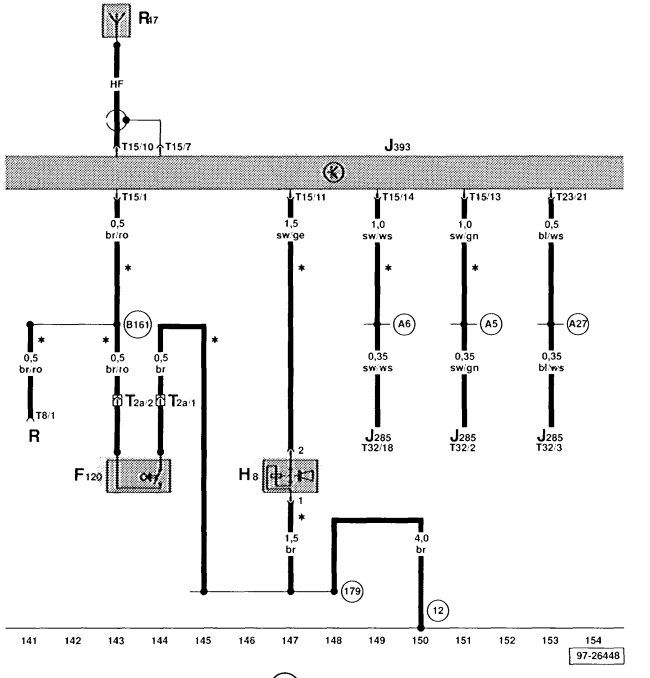
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

F147 - Left Make-Up Mirror Light Switch
F148 - Right Make-Up Mirror Light Switch
J393 - Central control module for comfort system, behind instrument panel, left
W - Front Interior Light
W11 - Left Rear Reading Light
W12 - Right Rear Reading Light
W13 - Right Front Map/Reading Light
W14 - Right Make-up Mirror Light
W19 - Left Front Reading Light
W20 - Left Make-up Mirror Light
T8e - 8-Pin Connector, behind instrument panel, left
T23 - 23-Pin Connector

(128) - Ground connection -1-, in interior light wiring harness
(B129) - Connector (interior light 3/L) in wiring harness interior
(R6) - Plus connection -1-, in interior light wiring harness

Edition 11/99 **Central control module for comfort system, Interior lights, make-up mirror lights**
USA.5102.05.21





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

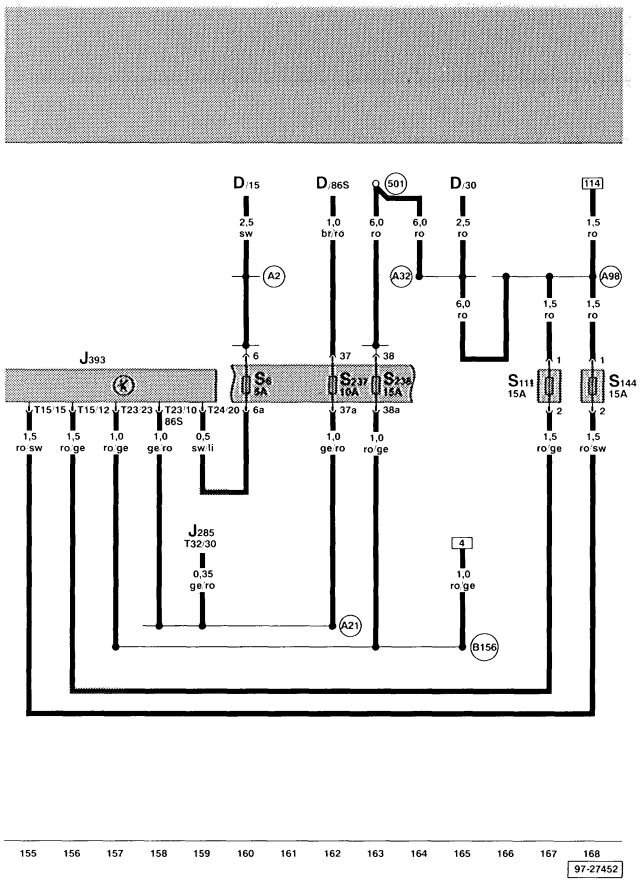
F120 - Hood Alarm Switch*
H8 - Alarm Horn*
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
R - Radio
R47 - Antenna wire for central locking and antitheft warning system
T2a - Double Connector, near headlight, right
T8 - 8-Pin Connector, on radio
T15 - 15-Pin Connector
T23 - 23-Pin Connector
T32 - 32-Pin Connector, blue, on Instrument cluster

(12) - Ground connection, in engine compartment, left
(179) - Ground connection, in left headlight wiring harness
(A5) - Plus connection (right turn signal), in instrument panel wiring harness
(A6) - Plus connection (left turn signal), in instrument panel wiring harness
(A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness
(B161) - Connector (anti-theft warning system), in wiring harness interior

* - Vehicles with anti-theft warning system only

Central control module for comfort system, antitheft warning system, antenna wire for central locking and antitheft warning system

Edition 11/99
USA.5102.05.21



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

D - Ignition/Starter Switch
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
S6 - Fuse 6 in fuse holder
S111 - Alarm System and Anti-Theft Fuse, above the thirteenfold auxiliary relay panel
S144 - Fuse for central locking/anti-theft warning system, above the thirteenfold auxiliary relay panel
S237 - Fuse 37 in fuse holder
S238 - Fuse 38 in fuse holder
T15 - 15-Pin Connector
T23 - 23-Pin Connector
T24 - 24-Pin Connector
T32 - 32-Pin Connector, blue
(501) - Threaded connection -2- (30) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A21) - Wire connection (86s), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness
(B156) - Plus connector (30a), in wiring harness interior

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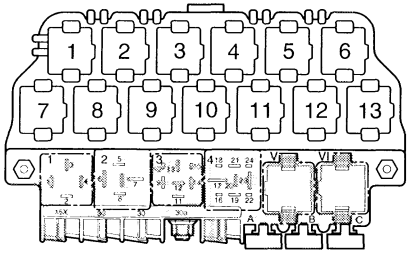
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Comfort System (vehicles with power windows),

from May 1999

- Anti-theft warning system
- Central locking system with remote control
- Fuel tank lid unlock system
- Heated power mirrors
- Interior lights
- Luggage compartment light
- Power sunroof
- Power windows
- Rear lid unlock system

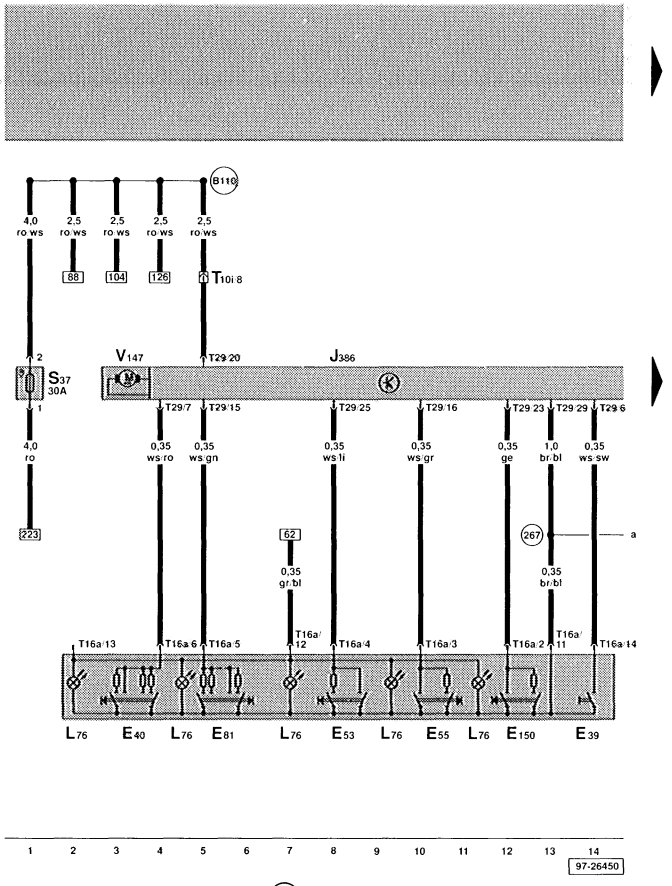
Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97-14163

Fuse colors

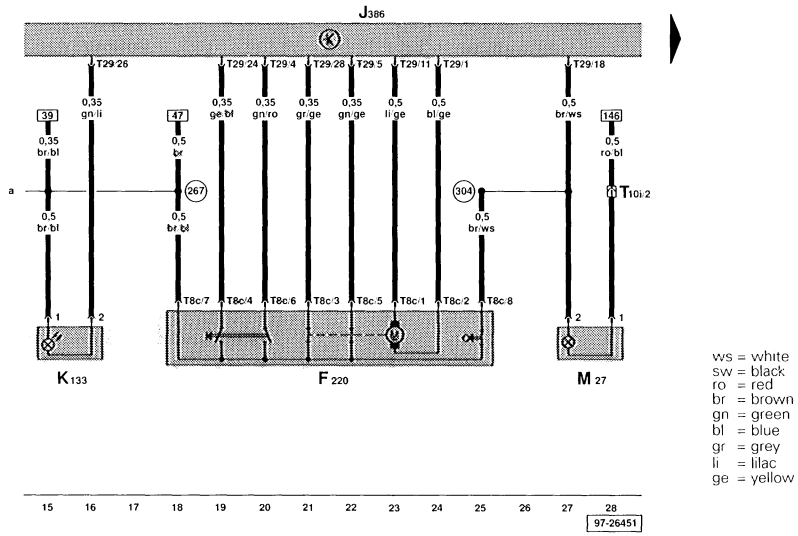
30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E39 - Safety switch for window regulator rear
E40 - Switch for window regulator front left
E53 - Switch for window regulator rear left, driver
E55 - Switch for window regulator rear right, driver
E81 - Switch for window regulator front right, driver
E150 - Switch for interior lock, driver side
J386 - Door control module, driver side
L76 - Push Button Light
S37 - Fuse for window regulator (circuit breaker), on thirteen position auxiliary relay panel
T10i - 10-Pin Connector, black, connector station A-pillar, left
T16a - 16-Pin Connector
T29 - 29-Pin Connector
V147 - Motor for window regulator, driver side
(267) - Ground connector -2-, in wiring harness door cable - driver side
(B110) - Connection (30), window regulator) in wiring harness interior

Door control module (driver side), switch for window regulator, safety switch for window regulator rear, switch for interior lock (driver side)

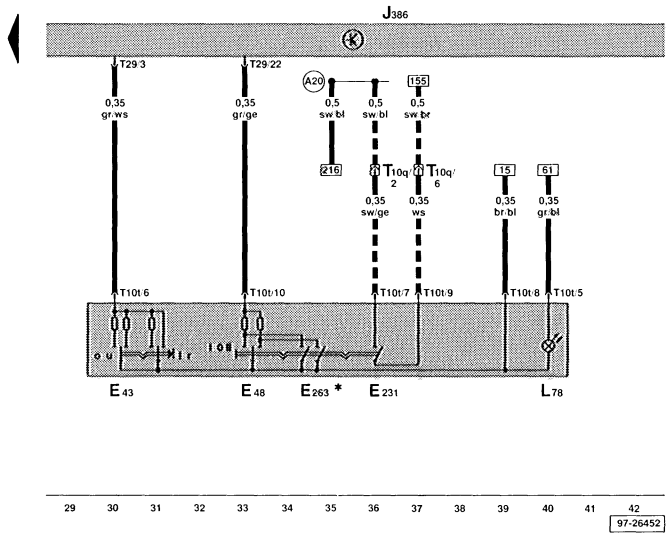


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

F220 - Lock unit for central locking, driver side
J386 - Door control module, driver side
K133 - Warning light for central locking -SAFE-
M27 - Left Door Warning Light
T8c - 8-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T29 - 29-Pin Connector

(267) - Ground connector -2-, in wiring harness door cable - driver side
(304) - Ground connector -3-, in wiring harness door cable - driver side

Door control module (driver side), lock unit for central locking (driver side), warning light for central locking -SAFE-, left door warning light



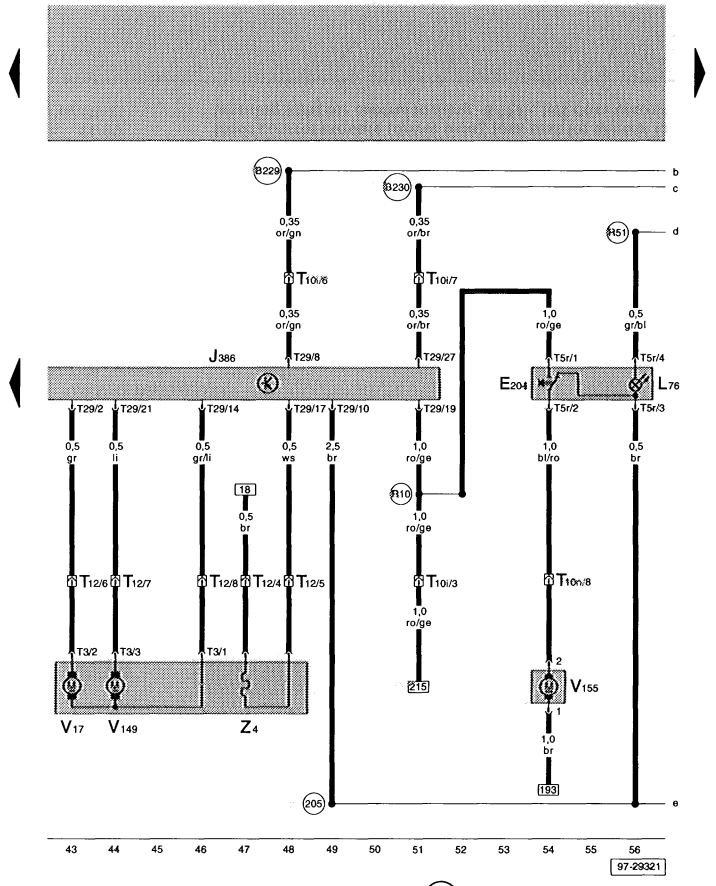
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E43 - Mirror Adjustment Switch
E48 - Mirror Selector Switch
E231 - Switch for outside mirror heating
E263 - Mirror fold-away Switch*
J386 - Door control module, driver side
L78 - Mirror Adjusting Switch Light
T10q - 10-Pin Connector, blue, connector station A-pillar, left
T10t - 10-Pin Connector
T29 - 29-Pin Connector

(A20) - Wire connection (15a), in instrument panel wiring harness

* - If equipped
--- - Vehicles with seperate heated outside mirrors only

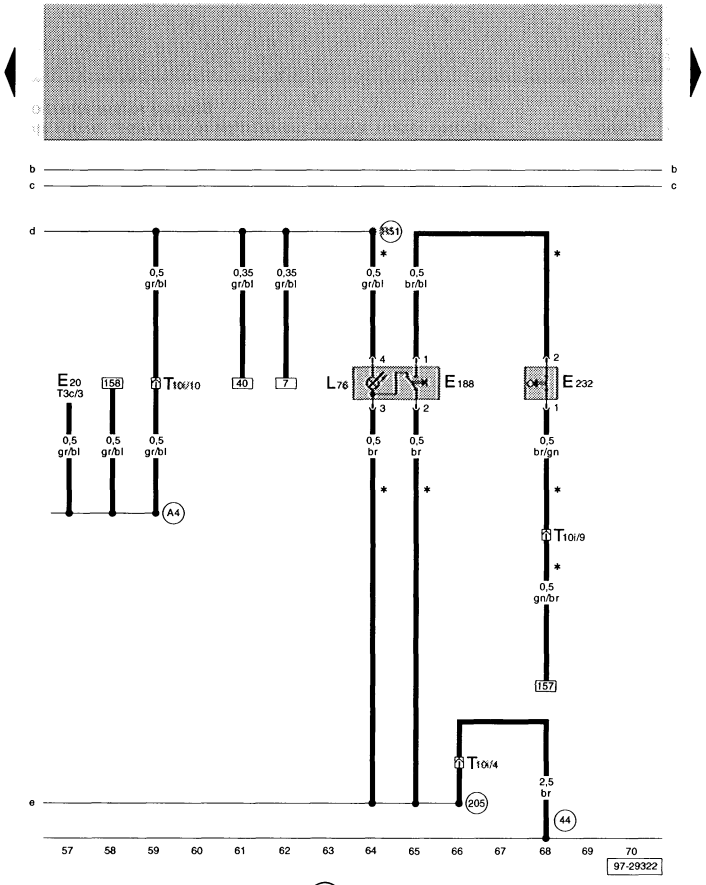
Door control module (driver side), mirror adjustment switch, mirror selector switch, switch for outside mirror heating



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E204 - Switch for remote/fuel tank door
J386 - Door control module, driver side
L76 - Push Button Light
T3 - 3-Pin Connector
T5r - 5-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10n - 10-Pin Connector, brown, connector station A-pillar, left
T12 - 12-Pin Connector
T29 - 29-Pin Connector
V17 - Driver's Side Mirror Adjustment Motor
V149 - Motor for mirror adjustment, driver side
V155 - Motor for fuel tank lid unlock
Z4 - Heated outside mirror, driver side

(205) - Ground connection, in driver's door wiring harness
(B229) - Connection (high bus), in instrument panel wiring harness
(B230) - Connection (low bus), in instrument panel wiring harness
(R10) - Plus connection -1- (30a), in driver's door wiring harness
(R51) - Connection (58b), in driver's door wiring harness

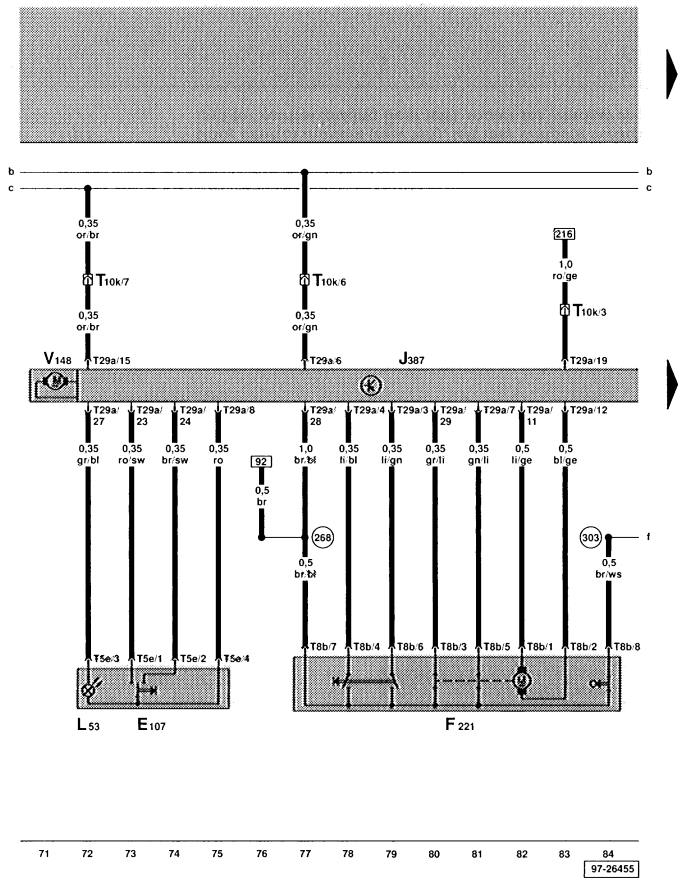


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E20 - Instrument Panel Light Dimmer Switch
E188 - Switch for remote unlock, rear lid, driver side
E232 - Key switch for switching off remote unlock rear lid
L76 - Push Button Light
T3c - 3-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left

(44) - Ground connection, on left A-pillar, lower part
(205) - Ground connection, in driver's door wiring harness
(A4) - Plus connection (58b), in instrument panel wiring harness
(R51) - Connection (58b), in driver's door wiring harness

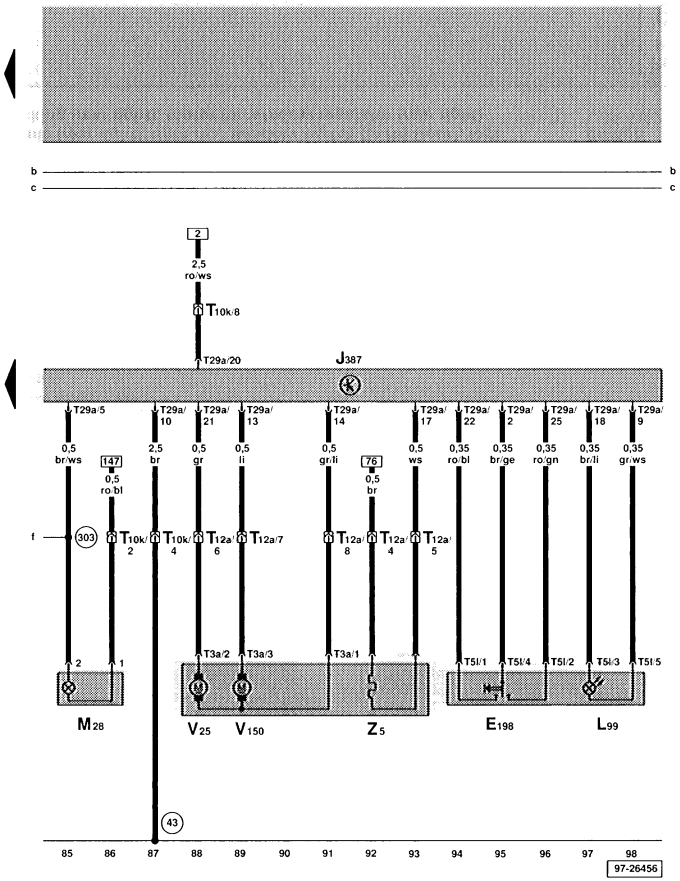
* - Jetta only



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E107 - Switch for window regulator, in passenger door
F221 - Lock unit for central locking, passenger side
J387 - Door control module, passenger side
L53 - Power Window Switch Light
T5e - 5-Pin Connector
T8b - 8-Pin Connector
T10k - 10-Pin Connector, black, connector station A-pillar, right
T29a - 29-Pin Connector
V148 - Motor for window regulator, passenger side

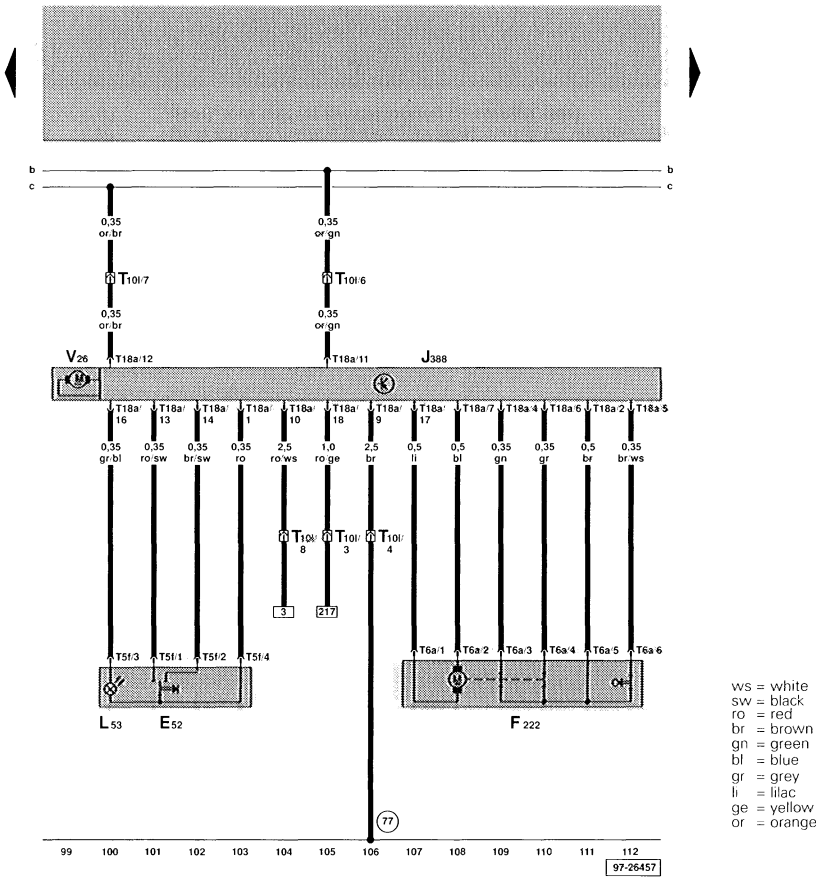
(268) - Ground connector -2-, in wiring harness door cable - passenger side
(303) - Ground connector -3-, in wiring harness door cable - passenger side



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E198 - Switch for interior lock, passenger side
J387 - Door control module, passenger side
L99 - Lighting for switch interior lock
M28 - Right Door Warning Light
T3a - 3-Pin Connector
T5l - 5-Pin Connector
T10k - 10-Pin Connector, black, connector station A-pillar, right
T12a - 12-Pin Connector
T29a - 29-Pin Connector
V25 - Passenger's Side Mirror Adjustment Motor
V150 - Motor for mirror adjustment, passenger side
Z5 - Heated outside mirror, passenger side

(43) - Ground connection, on right A-pillar, lower part
(303) - Ground connector -3-, in wiring harness door cable - passenger side



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

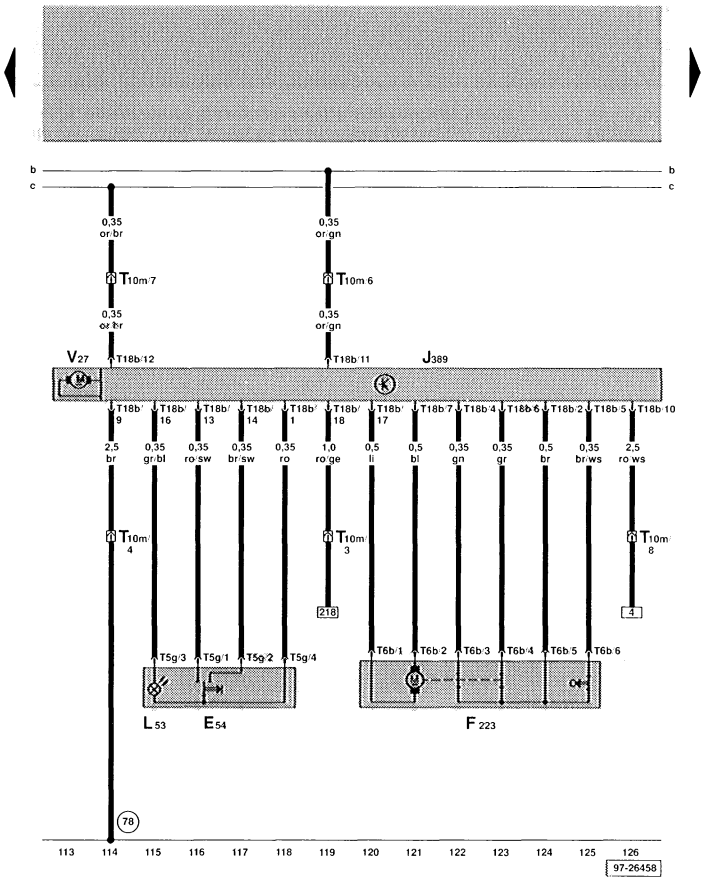
E52 - Left Rear Window Switch, (In LR Door)
F222 - Lock unit for central locking, rear, left
J388 - Door control module, rear, left
L53 - Power Window Switch Light
T5f - 5-Pin Connector
T6a - 6-Pin Connector
T10l - 10-Pin Connector, black, connector station B-pillar, left
T18a - 18-Pin Connector
V26 - Motor for window regulator, rear, left

(77) - Ground connection, on left B-pillar, lower part

Edition 11/99
USA.5102.05.21

Door control module (rear left), left rear window switch (In LR Door), lock unit for central locking (rear left), motor for window regulator (rear left)

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ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

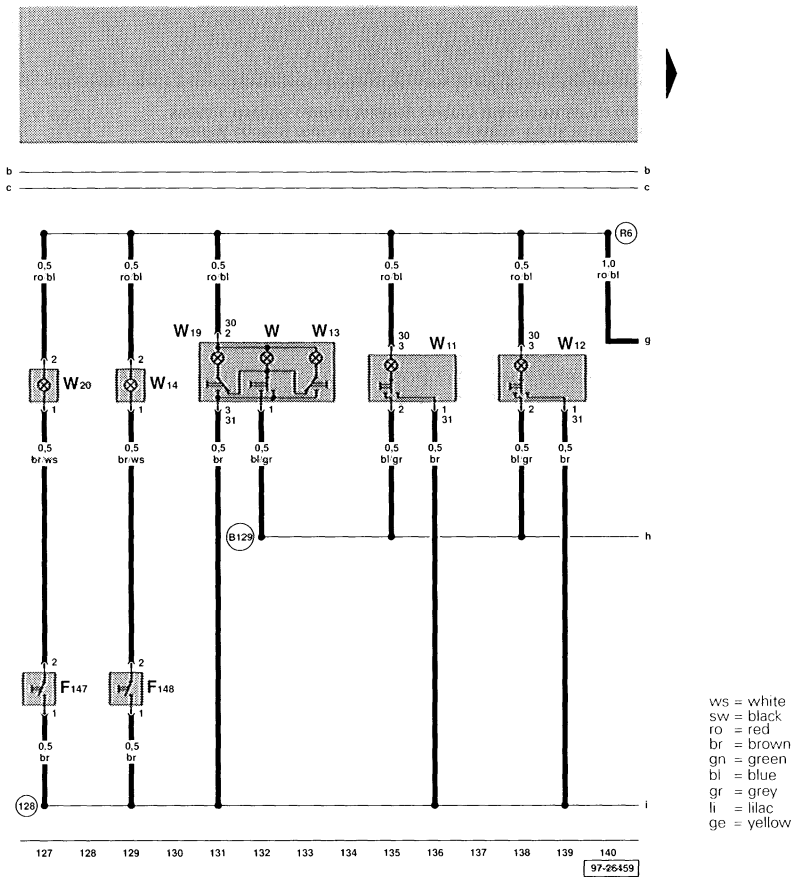
E54 - Right Rear Window Switch, (In RR Door)
F223 - Lock unit for central locking, rear, right
J389 - Door control module, rear, right
L53 - Power Window Switch Light
T5g - 5-Pin Connector
T6b - 6-Pin Connector
T10m - 10-Pin Connector, black, connector station B-pillar, right
T18b - 18-Pin Connector
V27 - Motor for window regulator, rear, right

(78) - Ground connection, on right B-pillar, lower part

Door control module (rear right), right rear window switch (In RR Door), lock unit for central locking (rear right), motor for window regulator (rear right)

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USA.5102.05.21

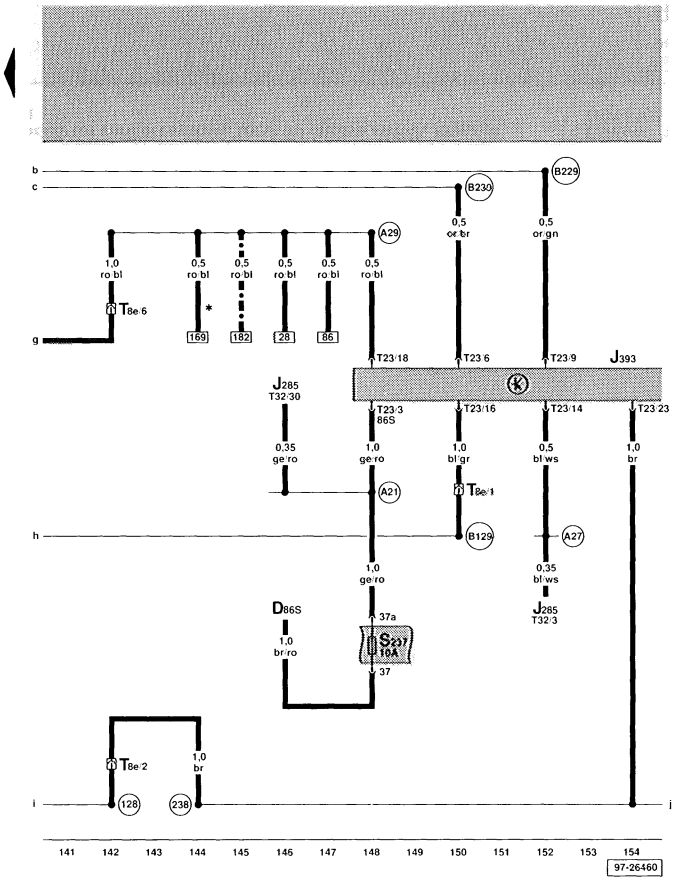
Repair Manual page number **97-407**



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = violet
li = lilac
ge = yellow

F147 - Left Make-Up Mirror Light Switch
F148 - Right Make-Up Mirror Light Switch
W - Front Interior Light
W11 - Left Rear Reading Light
W12 - Right Rear Reading Light
W13 - Right Front Map/Reading Light
W14 - Right Make-up Mirror Light
W19 - Left Front Reading Light
W20 - Left Make-up Mirror Light

(128) - Ground connection -1-, in interior light wiring harness
(B129) - Connector (interior light 3/L) in wiring harness interior
(R6) - Plus connection -1-, in interior light wiring harness



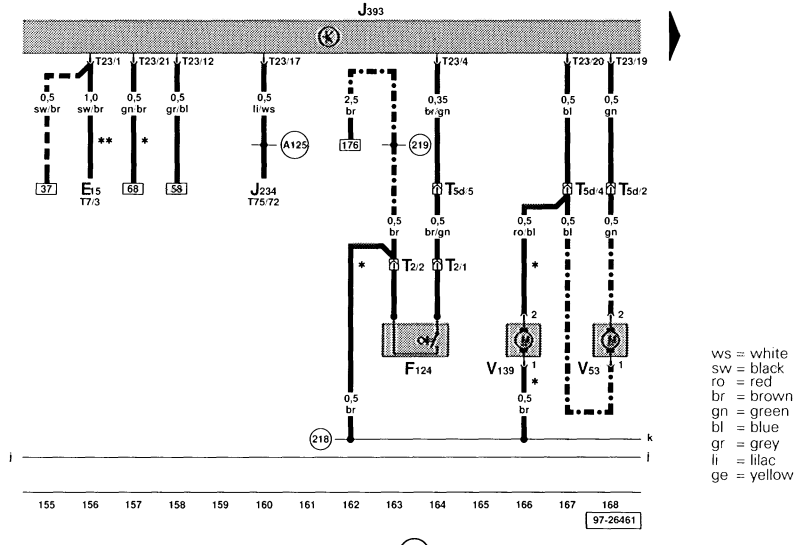
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = violet
li = lilac
or = orange

D - Ignition/Starter Switch
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
S237 - Fuse 37 in fuse holder
T8e - 8-Pin Connector, behind instrument panel, left
T23 - 23-Pin Connector
T32 - 32-Pin Connector, blue

(128) - Ground connection -1-, in interior light wiring harness
(238) - Ground connection -1-, in wiring harness interior
(A21) - Wire connection (86s), in instrument panel wiring harness
(A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness
(A29) - Wire connection (interior light), in instrument panel wiring harness
(B129) - Connector (interior light 3/L) in wiring harness interior
(B229) - Connection (high bus), in instrument panel wiring harness
(B230) - Connection (low bus), in instrument panel wiring harness

* - Jetta only
-•-•- Golf only

Repair Manual page number 97-408
Repair Manual page number 97-409

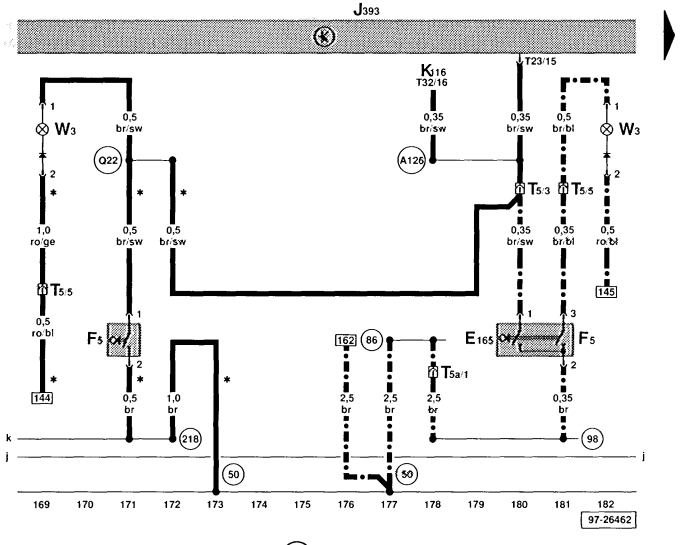


E15 - Rear window defogger switch
F124 - Trunk Lock Alarm/Central Locking Switch
J234 - Airbag Control Module
J393 - Central control module for comfort system, behind instrument panel, left
T2 - Double Connector, in rear lid
T5d - 5-Pin Connector, brown, connector station C-pillar, left
T7 - 7-Pin Connector
T23 - 23-Pin Connector
T75 - 75-Pin Connector
V53 - Decklid Central Locking System Motor (Golf only)
V139 - Motor to unlock rear lid*

(218) - Ground connection -1-, in rear lid wiring harness
(219) - Ground connection -2-, in rear lid wiring harness
(A125) - Connection (crash signal) in instrument panel wiring harness

* - Jetta only
--- - Vehicles with seperate heated outside mirrors only
** - Vehicles without seperate heated outside mirrors only
-•-•- Golf only

Central control module for comfort system, trunk lock alarm/central locking switch, decklid central locking system motor, motor to unlock rear lid

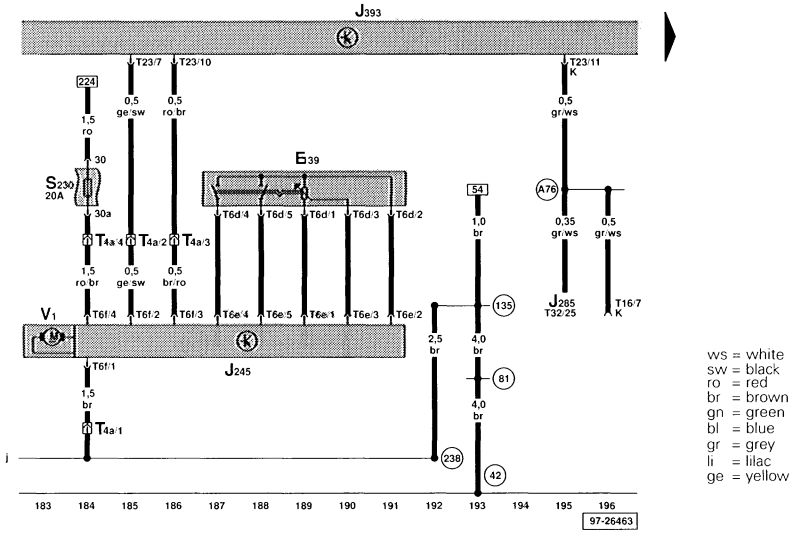


E165 - Trunk Lid Release Switch
F5 - Luggage Compartment Light Switch
J393 - Central control module for comfort system, behind instrument panel, left
K116 - Warning light for rear lid unlocked, in Instrument cluster
T5 - 5-Pin Connector, black, connector station C-pillar, left
T5a - 5-Pin Connector, pink, connector station C-pillar, left (Golf only)
T23 - 23-Pin Connector
T32 - 32-Pin Connector, blue, on Instrument cluster
W3 - Luggage compartment Light

(50) - Ground connection, in luggage compartment, left
(86) - Ground connection -1-, in rear wiring harness
(98) - Ground connection, in rear lid wiring harness
(218) - Ground connection -1-, in rear lid wiring harness
(A126) - Connection (contact switch in rear lid) in instrument panel wiring harness
(Q22) - Wire connection -1-, in rear lid wiring harness

* - Jetta only
-•-•- Golf only

Central control module for comfort system, trunk lid release switch, luggage compartment light

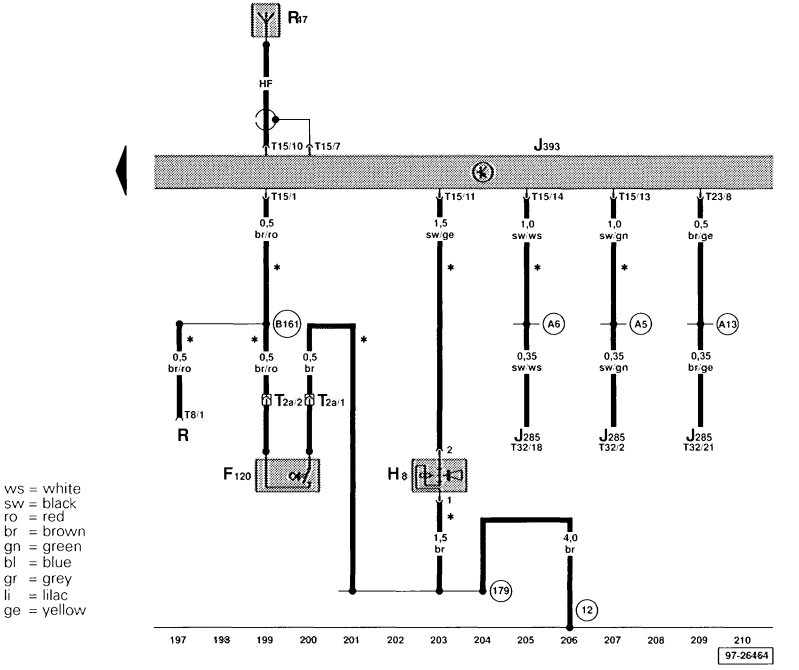


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E139 - Sunroof Regulator
J245 - Power Sunroof Control Module
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
S230 - Fuse 30 in fuse holder
T4a - 4-Pin Connector, behind instrument panel, left
T6d - 6-Pin Connector
T6e - 6-Pin Connector
T6f - 6-Pin Connector
T16 - Data Link Connector (DLC), below instrument panel, left
T23 - 23-Pin Connector
T32 - 32-Pin Connector, blue, on Instrument cluster
V1 - Sunroof Motor

(42) - Ground connection, beside steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(238) - Ground connection -1-, in wiring harness interior
(A76) - Connector (K-diagnosis wire) in instrument panel wiring harness

Central control module for comfort system, power sunroof control module, sunroof regulator, sunroof motor

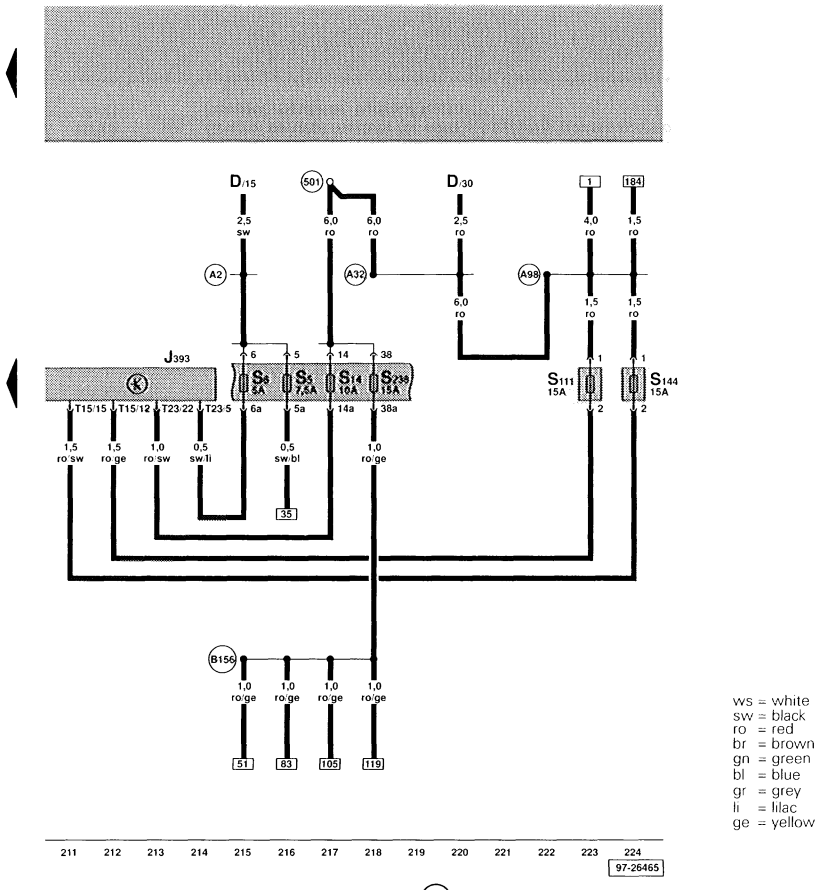


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

F120 - Hood Alarm Switch*
H8 - Alarm Horn*
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
R - Radio
R47 - Antenna wire for central locking and antitheft warning system
T2a - Double Connector, near headlight, right
T8 - 8-Pin Connector, on radio
T15 - 15-Pin Connector
T23 - 23-Pin Connector
T32 - 32-Pin Connector, blue, on Instrument cluster

(12) - Ground connection, in engine compartment, left
(179) - Ground connection, in left headlight wiring harness
(A5) - Plus connection (right turn signal), in instrument panel wiring harness
(A6) - Plus connection (left turn signal), in instrument panel wiring harness
(A13) - Wire connection (door contact switch) in instrument panel wiring harness
(B161) - Connector (anti-theft warning system), in wiring harness interior
* - Vehicles with anti-theft warning system only

Central control module for comfort system, antitheft warning system, antenna wire for central locking and antitheft warning system



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

D - Ignition/Starter Switch
J393 - Central control module for comfort system, behind instrument panel, left
S5 - Fuse 5 in fuse holder
S6 - Fuse 6 in fuse holder
S14 - Fuse 14 in fuse holder
S111 - Alarm System and Anti-Theft Fuse, above the thirteenfold auxiliary relay panel*
S144 - Fuse for central locking/anti-theft warning system, above the thirteenfold auxiliary relay panel*
S238 - Fuse 38 in fuse holder
T15 - 15-Pin Connector
T23 - 23-Pin Connector

(501) - Threaded connection -2- (30) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness
(B156) - Plus connector (30a), in wiring harness interior

* - Vehicles with anti-theft warning system only

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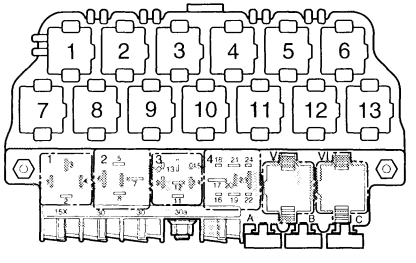
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Cruise control,

from May 1999

- **2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code AEG**

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

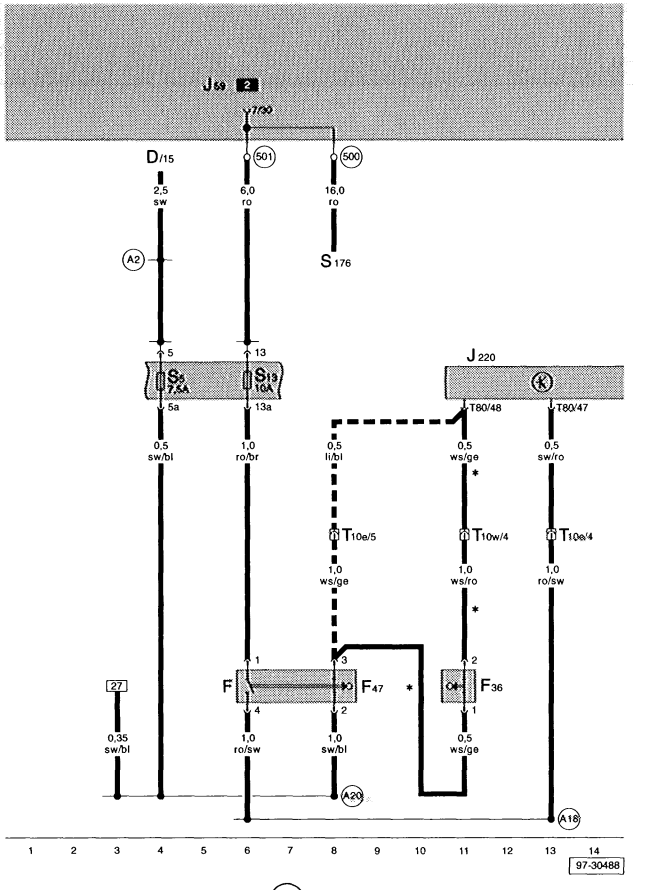
Relay panel:

2 Load Reduction Relay (100)

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



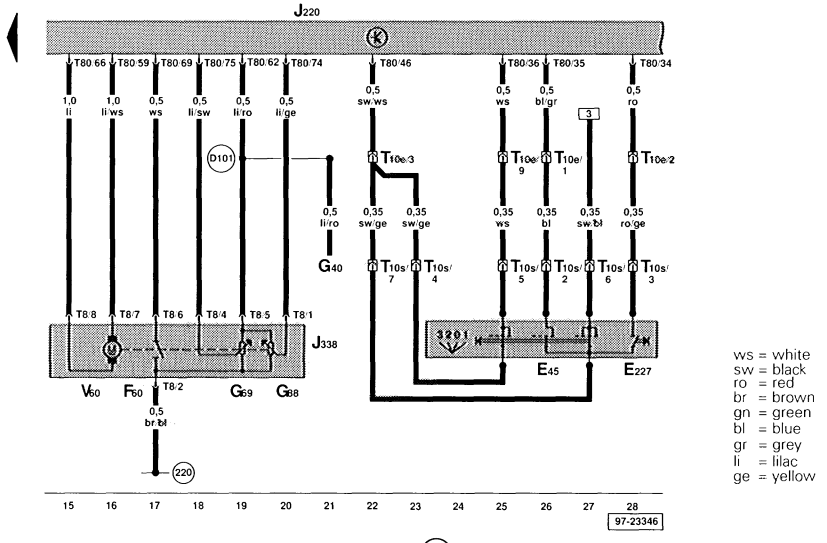
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

- D - Ignition/Starter Switch
- F - Brake Light Switch
- F36 - Clutch Vacuum Vent Valve Switch
- F47 - Brake Pedal Switch (cruise control/Diesel Direct Fuel Injection)
- J59 - Load Reduction Relay
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- S5 - Fuse 5 in fuse holder
- S13 - Fuse 13 in fuse holder
- S176 - Fuse -4- (30) in fuse bracket/battery
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T80 - 80-Pin Connector

- (500) - Threaded connection -1- (30) on the relay plate
- (501) - Threaded connection -2- (30) on the relay plate
- (A2) - Plus connection (15), in instrument panel wiring harness
- (A18) - Wire connection (54), in instrument panel wiring harness
- (A20) - Wire connection (15a), in instrument panel wiring harness

* - Manual transmission only
--- - Automatic transmission only

Motronic engine control module (ECM), brake light switch, clutch vacuum vent valve switch, brake pedal switch (cruise control/DFI)



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E45 - Cruise Control Switch
E227 - Cruise Control Push Button (SET)
F60 - Closed Throttle Position (CTP) Switch
G40 - Camshaft Position (CMP) Sensor
G69 - Throttle Position (TP) Sensor
G88 - Throttle Position (TP) Sensor
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J338 - Throttle Valve Control Module
T8 - 8-Pin Connector
T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
T10s - 10-Pin Connector, near steering column
T80 - 80-Pin Connector
V60 - Throttle Position (TP) Actuator

(220) - Ground connection (sensor ground), in engine compartment wiring harness
(D101) - Wire connection -1-, in engine compartment wiring harness

Edition 11/99
USA.5102.05.21

Motronic engine control module (ECM), cruise control switch, throttle valve control module

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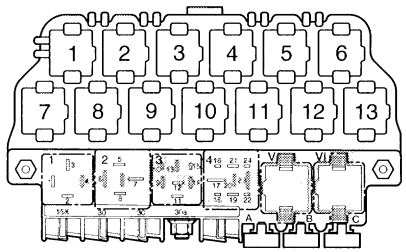
Airbag systems for vehicles with overlay wiring harness repair

from September 1998

applies to vehicles through model year 1999 only.

- **Driver- and front passsenger airbag**
- **Side airbag**
- **Seat belt tensioner**
- **Seat belt control**

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97-14163

Relay location on the thirteenfold auxiliary relay panel, above relay panel:

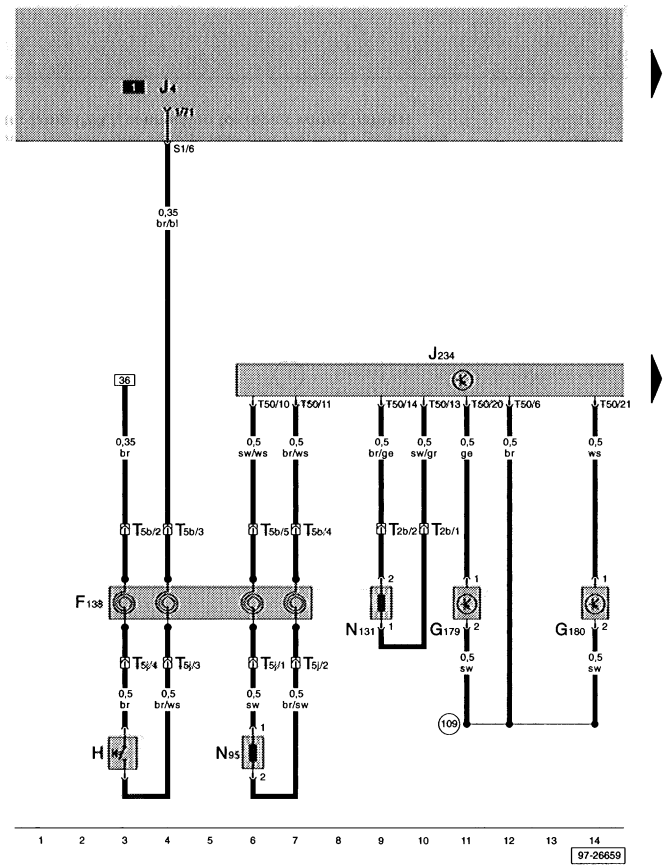
Relay panel:

1 Dual Horn Relay (53)

Note: Number in parentheses indicates production control number stamped on relay housing.

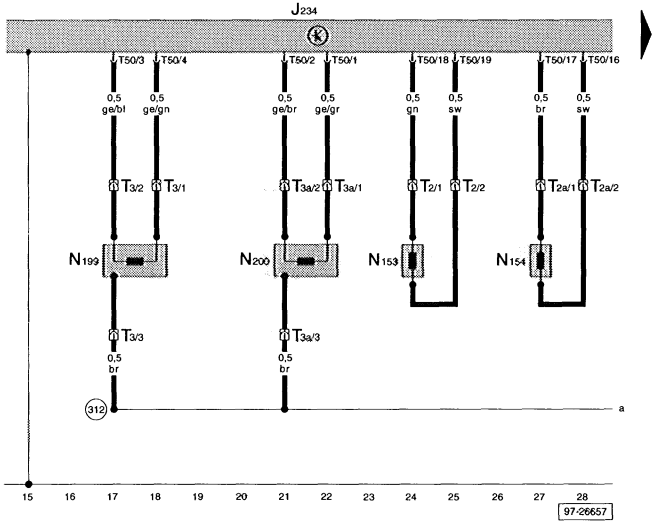
Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



- F138 - Airbag spiral spring/return spring with slip ring
- G179 - Crash sensor for side airbag, driver's side
- G180 - Crash sensor for side airbag, passenger side
- H - Signal horn activation
- J4 - Dual Horn Relay
- J234 - Airbag Control Module, behind console, lower part
- N95 - Driver's Side Airbag Igniter
- N131 - Passenger's Side Airbag Igniter 1
- T2b - 2-Pin Connector, on passenger's side airbag igniter 1
- T5b - 5-Pin Connector, beside steering column
- T5j - 5-Pin Connector, behind driver's airbag
- T50 - 50-Pin Connector
- (109) - Ground connection, in airbag wiring harness

Airbag control module, airbag spiral spring/return spring with slip ring, crash sensor for side airbag, airbag igniter

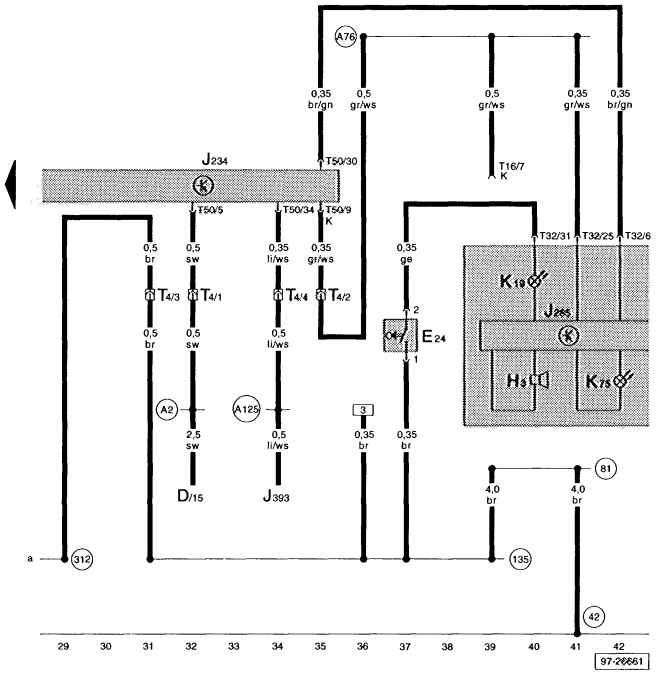


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

- J234 - Airbag Control Module, behind console, lower part
- N153 - Left Seat Belt Tensioner Igniter
- N154 - Right Seat Belt Tensioner Igniter
- N199 - Igniter for side airbag, driver's side
- N200 - Igniter for side airbag, passenger side
- T2 - Double Connector, below driver's seat
- T2a - Double Connector, below driver's seat
- T3 - 3-Pin Connector, below driver's seat
- T3a - 3-Pin Connector, below passenger's seat
- T50 - 50-Pin Connector

(312) - Ground connection, in airbag wiring harness

Airbag control module, seat belt tensioner igniter, igniter for side airbag



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

- D - Ignition/Starter Switch
- E24 - Left Seat Belt Switch
- H3 - Warning Buzzer
- J234 - Airbag Control Module, behind console, lower part
- J285 - Control module with indicator unit in instrument panel insert
- J393 - Central control module for comfort system
- K19 - Seat Belt Warning Light
- K75 - Airbag Malfunction Indicator Lamp (MIL)
- T4 - 4-Pin Connector, behind instrument panel right (connection for repair wiring harness)
- T16 - Data Link Connector (DLC), below instrument panel, left
- T32 - 32-Pin Connector, blue
- T50 - 50-Pin Connector

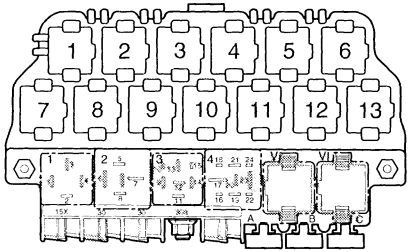
(42) - Ground connection, beside steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(312) - Ground connection, in airbag wiring harness
(A2) - Plus connection (15), in instrument panel wiring harness
(A76) - Connector (K-diagnosis wire) in instrument panel wiring harness
(A125) - Connection (crash signal) in instrument panel wiring harness

Airbag control module, left seat belt switch, seat belt warning light, airbag malfunction indicator lamp (MIL), connection for repair wiring harness

Multi-function steering wheel for cruise control and radio

from May 2000

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97-14163

Relay location on the thirteenfold auxiliary relay panel, above relay panel:

5 *Control module for multi-function steering wheel (450)*

6

Relay panel:

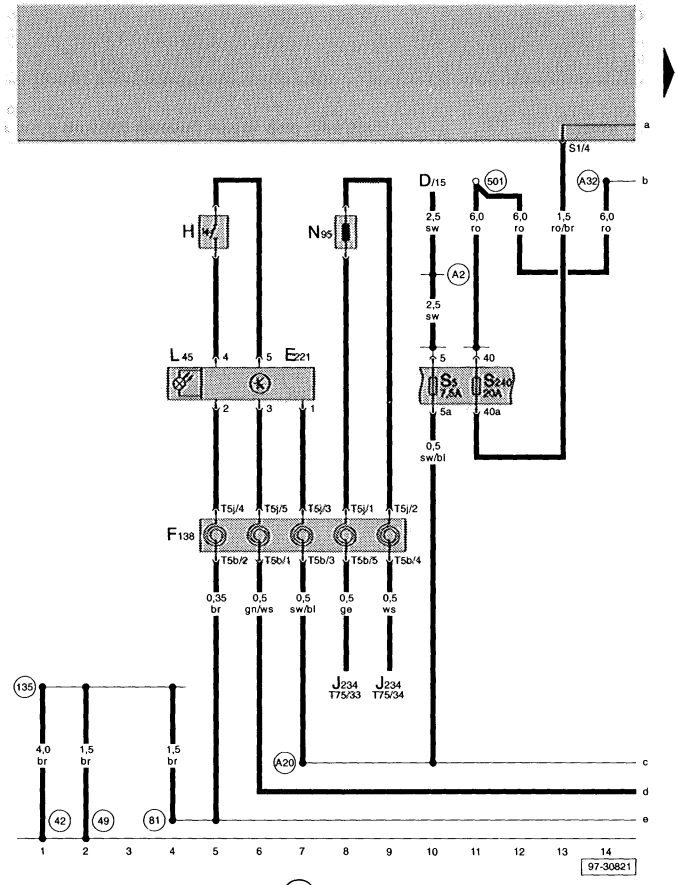
2 *Load Reduction Relay (100)*

4 *Fuel Pump (FP) Relay (409)*

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

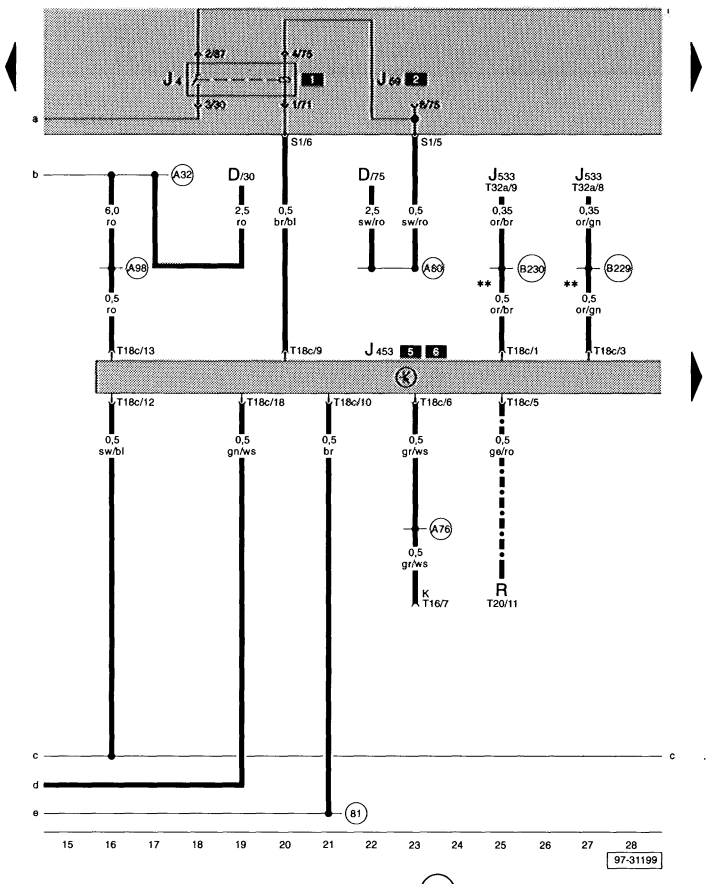


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

D - Ignition/Starter Switch
E221 - Control unit in steering wheel
F138 - Airbag Spiral Spring/Return Spring with Slip Ring
H - Signal horn activation
J234 - Airbag Control Module
L45 - Operating Unit Light
N95 - Driver's Side Airbag Igniter
S5 - Fuse 5 in fuse holder
S240 - Fuse 40 in fuse holder
T5b - 5-Pin Connector, on airbag spiral spring
T5j - 5-Pin Connector, behind driver's airbag
T75 - 75-Pin Connector

(42) - Ground connection, beside steering column
(49) - Ground connection, on steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(501) - Threaded connection -2- (30) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A20) - Wire connection (15a), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness

Control unit in steering wheel, signal horn activation, airbag spiral spring/return spring with slip ring, driver's side airbag igniter



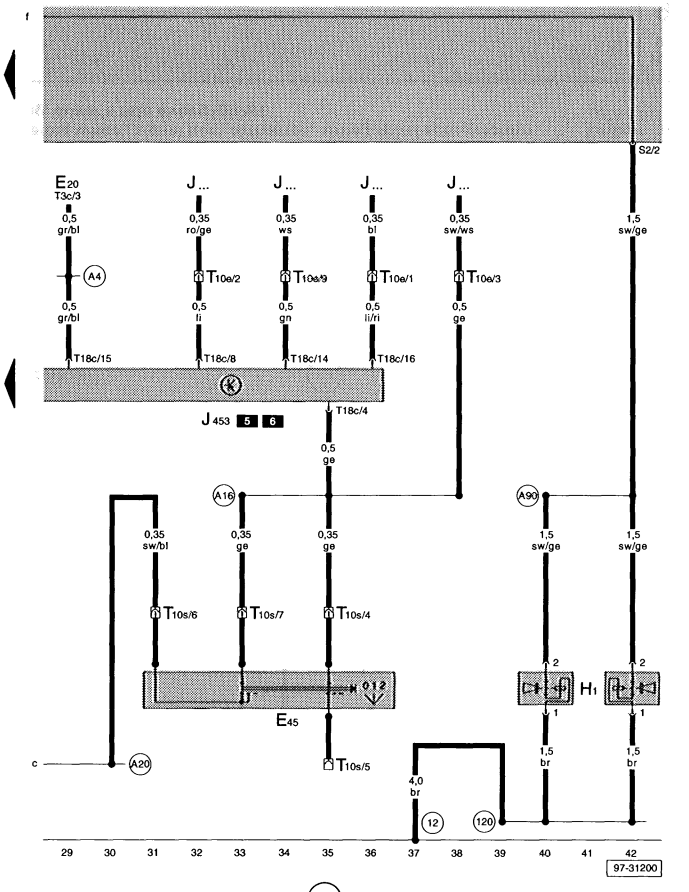
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

D - *Ignition/Starter Switch*
J4 - *Horn Relay*
J59 - *Load Reduction Relay*
J453 - *Control module for multi-function steering wheel*
J533 - *Data Bus On Board Diagnostic Interface*
R - *Radio*
T16 - *Data Link Connector (DLC), below instrument panel, left*
T18c - *18-Pin Connector*
T20 - *20-Pin Connector, on Radio*
T32a - *32-Pin Connector, green*

(81) - *Ground connection -1-, in instrument panel wiring harness*

(A32) - *Plus connection (30), in instrument panel wiring harness*
(A76) - *Connector (K-diagnosis wire) in instrument panel wiring harness*
(A80) - *Connector -1- (X) in instrument panel wiring harness*
(A98) - *Plus connector -4- (30), in instrument panel wiring harness*
(B229) - *Connection (High-Bus) (interior wiring harness)*
(B230) - *Connection (Low-Bus) (interior wiring harness)*

** - *Beginning August 2001*
-•-•- *Through July 2001*



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E20 - *Instrument Panel Light Dimmer Switch*
E45 - *Cruise Control Switch*
H1 - *Dual tone horn*
J453 - *Control module for multi-function steering wheel*
J... - *Engine Control Module (ECM)*
T3c - *3-Pin Connector*
T10e - *10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left**
T10s - *10-Pin Connector, near steering column*
T18c - *18-Pin Connector*

(12) - *Ground connection, in engine compartment, left*
(120) - *Ground connection -2-, in headlight wiring harness*

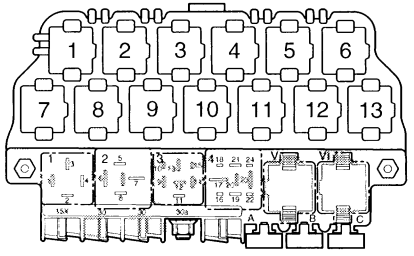
(A4) - *Plus connection (58b), in instrument panel wiring harness*
(A16) - *Wire connection (cruise control), in instrument panel wiring harness*
(A20) - *Wire connection (15a), in instrument panel wiring harness*
(A90) - *Connector (two-tone horn), in instrument panel wiring harness*

* - *See also wiring diagram cruise control/ motor*

1.8L - Engine - Motronic Multiport Fuel Injection (MFI)/110 kW, code AWW,

from June 2000

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97-14163

Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

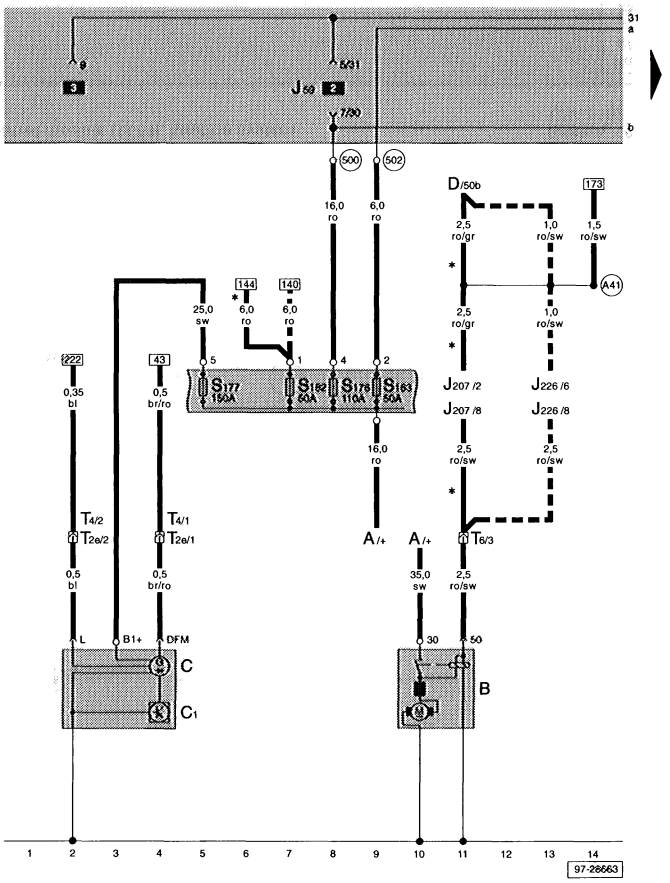
2 Load Reduction Relay (100)

4 Fuel Pump (FP) Relay (409)

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

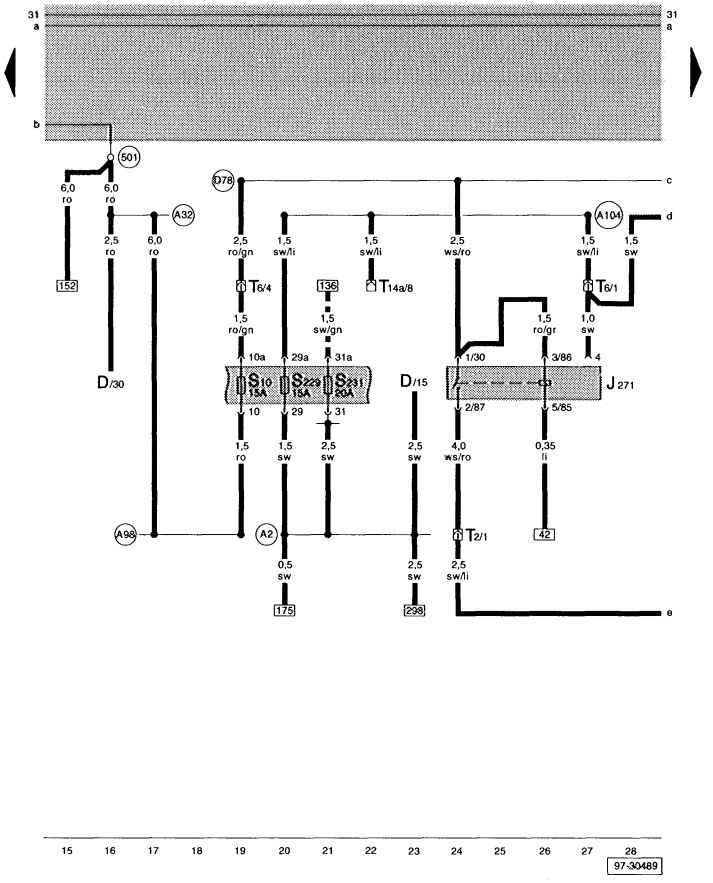


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

A - Battery
B - Starter
C - Generator (GEN)
C1 - Voltage Regulator (VR)
D - Ignition/Starter Switch
J59 - Load Reduction Relay
J207 - Starting Interlock Relay
J226 - Park/Neutral Position (PNP) Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
T2e - Double Connector, near starter (vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
(500) - Threaded connection -1- (30) on the relay plate
(502) - Threaded connection -1- (30a) on the relay plate
(A41) - Plus connection (50), in instrument panel wiring harness
* - Manual transmission only
--- Automatic transmission only

Repair Manual page number 97-428

Repair Manual page number 97-429

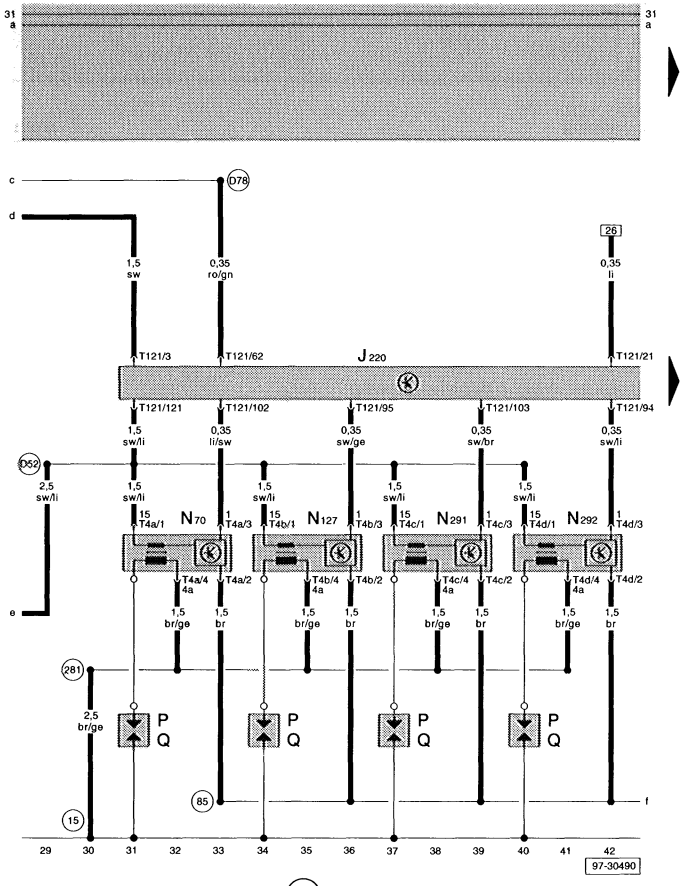


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

- D - Ignition/Starter Switch
- J271 - Motronic engine control module (ECM) power supply relay, in protective housing, in engine compartment, left, production control number (428)
- S10 - Fuse 10 in fuse holder
- S229 - Fuse 29 in fuse holder
- S231 - Fuse 31 in fuse holder
- T2 - 2-Pin Connector, in engine compartment, left
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- (501) - Threaded connection -2- (30) on the relay plate
- (A2) - Plus connection (15), in instrument panel wiring harness
- (A32) - Plus connection (30), in instrument panel wiring harness
- (A98) - Plus connector -4- (30), in instrument panel wiring harness
- (A104) - Plus connector -2- (15), in instrument panel wiring harness
- (D78) - Plus connector -1- (30a), in engine compartment wiring harness

--- Automatic transmission only

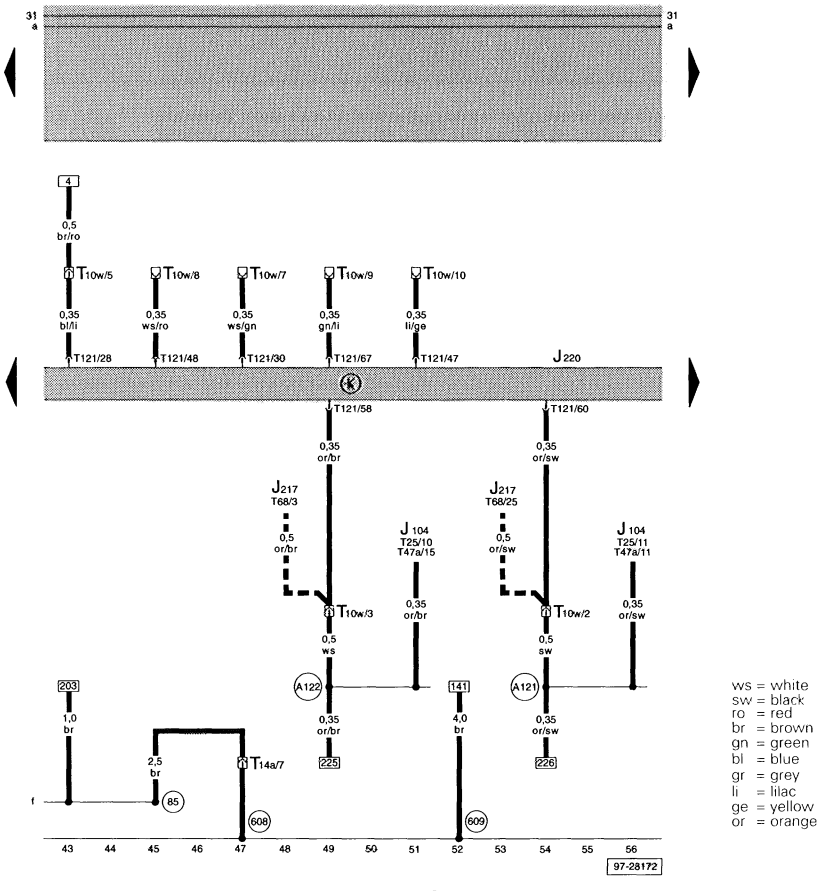
Repair Manual page number 97-430



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- N70 - Ignition Coil 1 with Power Output Stage
- N127 - Ignition Coil 2 with Power Output Stage
- N291 - Ignition Coil 3 with Power Output Stage
- N292 - Ignition Coil 4 with Power Output Stage
- P - Spark Plug Connectors
- Q - Spark Plugs
- T4a - 4-Pin Connector
- T4b - 4-Pin Connector
- T4c - 4-Pin Connector
- T4d - 4-Pin Connector
- T121 - Connector, 121 point
- (15) - Ground connection, on cylinder head
- (85) - Ground connection -1-, in engine compartment wiring harness
- (281) - Ground connector -1-, in wiring harness engine pre-wiring
- (D52) - Plus connector (15a), in engine compartment wiring harness
- (D78) - Plus connector -1- (30a), in engine compartment wiring harness

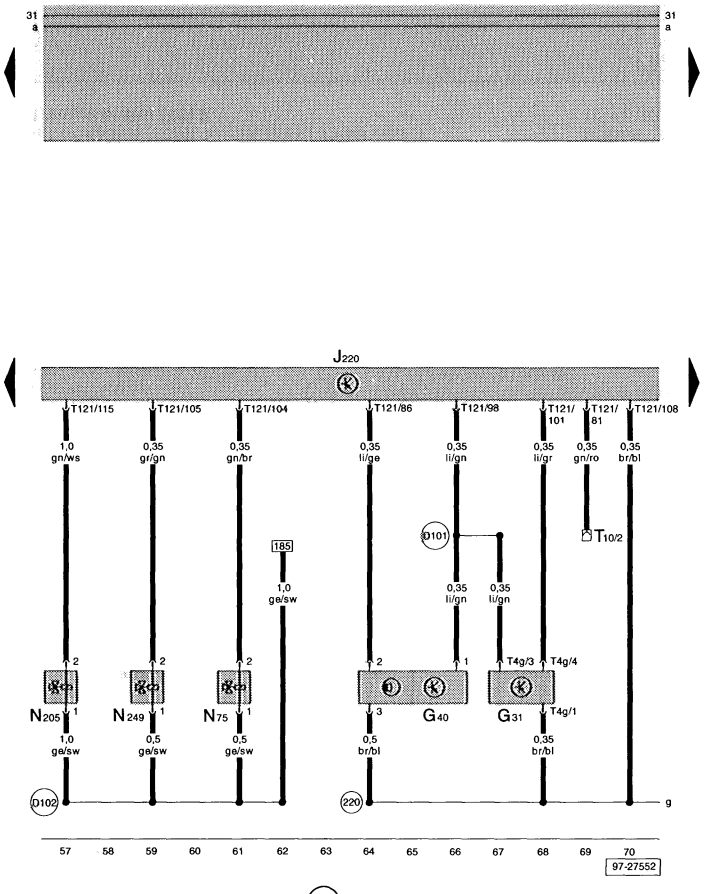
Repair Manual page number 97-431



J104 - ABS Control Module (w/EDL), in engine compartment, left
J217 - Transmission Control Module (TCM)
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, in engine compartment, in wiring duct, left
T25 - 25-Pin Connector, on ABS Control Module (through July 2000)
T47a - 47-Pin Connector, on ABS Control Module (beginning August 2000)
T68 - 68-Pin Connector, on Transmission Control Module (TCM)
T121 - Connector, 121 point

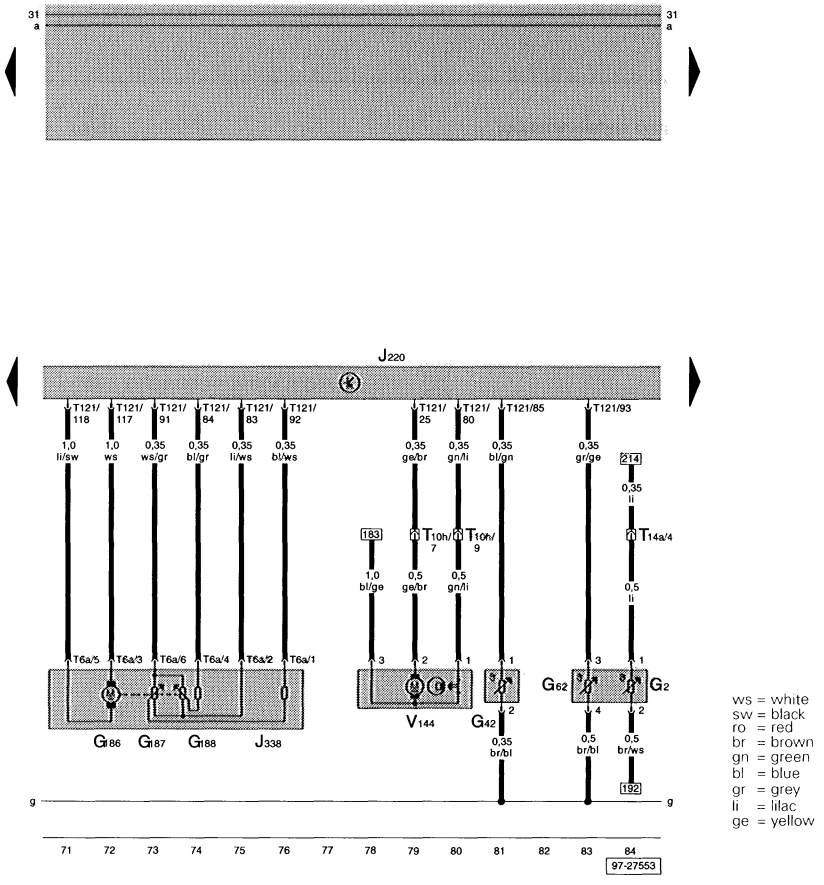
(85) - Ground connection -1-, in engine compartment wiring harness
(608) - Ground Connection (in center plenum chamber)
(609) - Ground Connection (in right plenum chamber)
(A121) - Connection (high bus), in instrument panel wiring harness
(A122) - Connection (low bus), in instrument panel wiring harness

--- Automatic transmission only



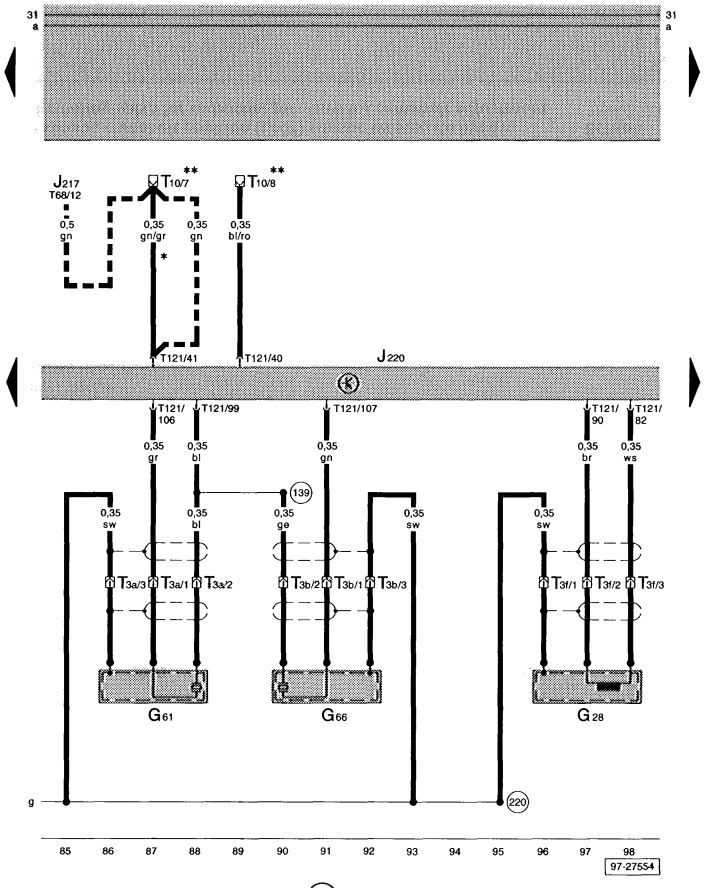
G31 - Charge Air Pressure Sensor
G40 - Camshaft Position (CMP) Sensor
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N75 - Wastegate Bypass Regulator Valve
N205 - Valve -1- for camshaft adjustment
N249 - Recirculating valve for turbocharger
T4g - 4-Pin Connector
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T121 - Connector, 121 point

(220) - Ground connection (sensor ground), in engine compartment wiring harness
(D101) - Wire connection -1-, in engine compartment wiring harness
(D102) - Wire connection -2-, in engine compartment wiring harness



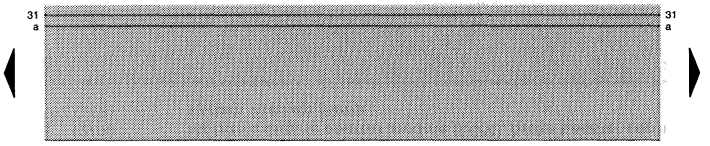
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

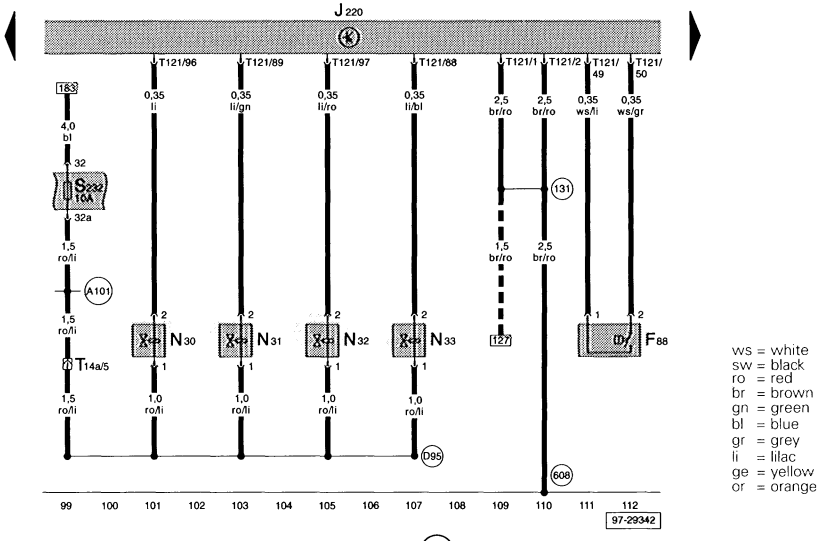
G2 - Engine Coolant Temperature (ECT) Sensor
G42 - Intake Air Temperature (IAT) Sensor
G62 - Engine Coolant Temperature (ECT) Sensor
G186 - Throttle drive (power accelerator actuation)
G187 - Angle sensor -1- for throttle drive (power accelerator actuation)
G188 - Angle sensor -2- for throttle drive (power accelerator actuation)
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J338 - Throttle Valve Control Module
T6a - 6-Pin Connector
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, in engine compartment, in wiring duct, left
T121 - Connector, 121 point
V144 - Leak detection pump (LDP)



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

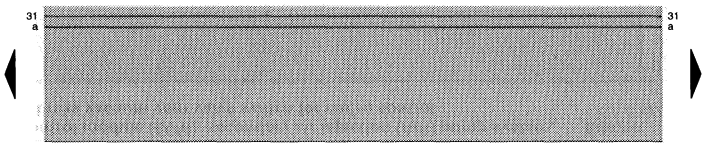
G28 - Engine Speed (RPM) Sensor
G61 - Knock Sensor (KS) 1
G66 - Knock Sensor (KS) 2
J217 - Transmission Control Module (TCM)
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
T3a - 3-Pin Connector, in engine compartment, front
T3b - 3-Pin Connector, in engine compartment, front
T3f - 3-Pin Connector, in engine compartment, front
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T68 - Connector, 68 point
T121 - Connector, 121 point
(139) - Ground connection (sensor Ground), in Motronic Multiport Fuel Injection (MFI) wiring harness
(220) - Ground connection (sensor ground), in engine compartment wiring harness
* - Manual transmission only
** - A/C connection
--- Automatic transmission only

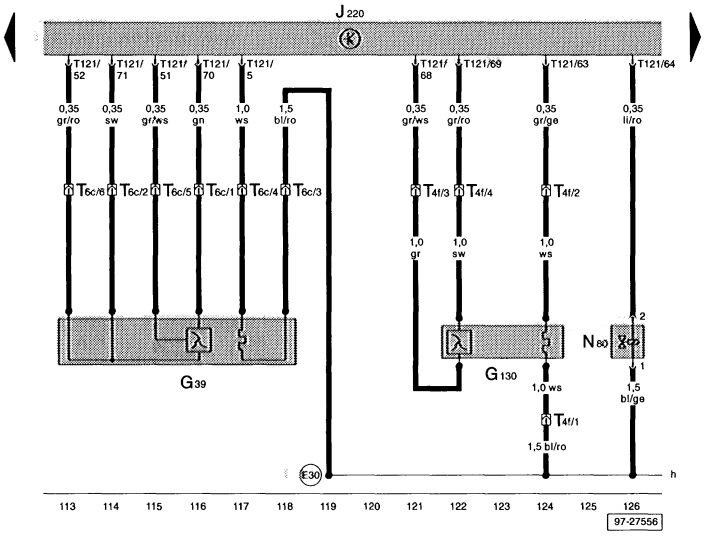




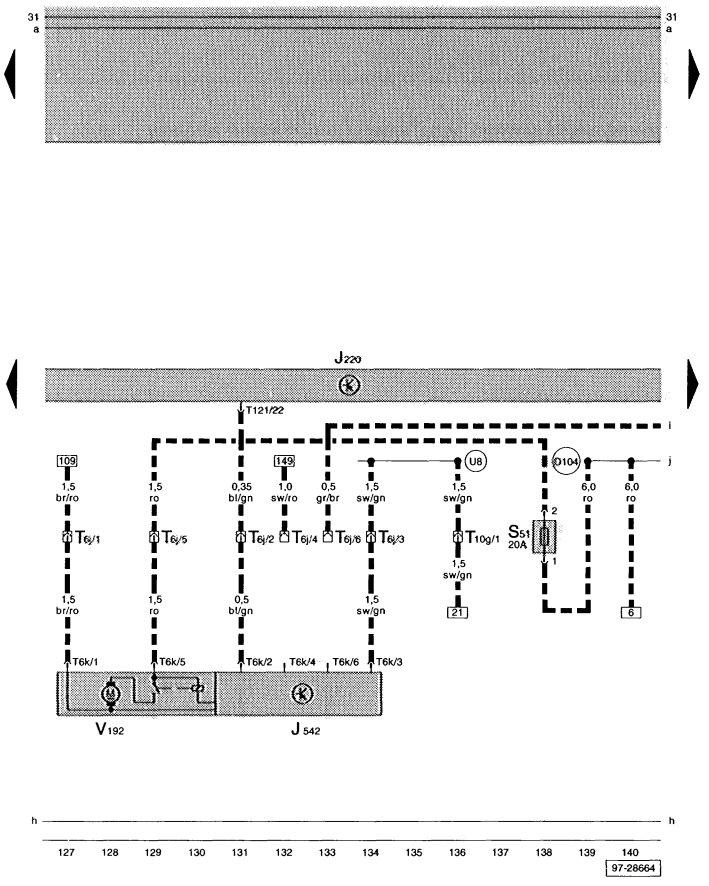
- F88 - Pressure switch/power steering
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- N30 - Cylinder 1 Fuel Injector
- N31 - Cylinder 2 Fuel Injector
- N32 - Cylinder 3 Fuel Injector
- N33 - Cylinder 4 Fuel Injector
- S232 - Fuse 32 in fuse holder
- T14a - 14-Pin Connector, near battery
- T121 - Connector, 121 point
- (131) - Ground connection -2-, in engine compartment wiring harness
- (608) - Ground Connection (in center plenum chamber)
- (A101) - Connector -3- (87a), in instrument panel wiring harness
- (D95) - Wire connection (injectors), in engine compartment wiring harness

--- Automatic transmission only





- G39 - Heated Oxygen Sensor (HO2S)
- G130 - Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- N80 - Evaporative Emission (EVAP) Canister Purge Regulator Valve
- T4f - 4-Pin Connector, in protective housing for connectors under right floor
- T6c - 6-Pin Connector, in protective housing for connectors under right floor
- T121 - Connector, 121 point
- (E30) - Connector (87a), in wiring harness engine

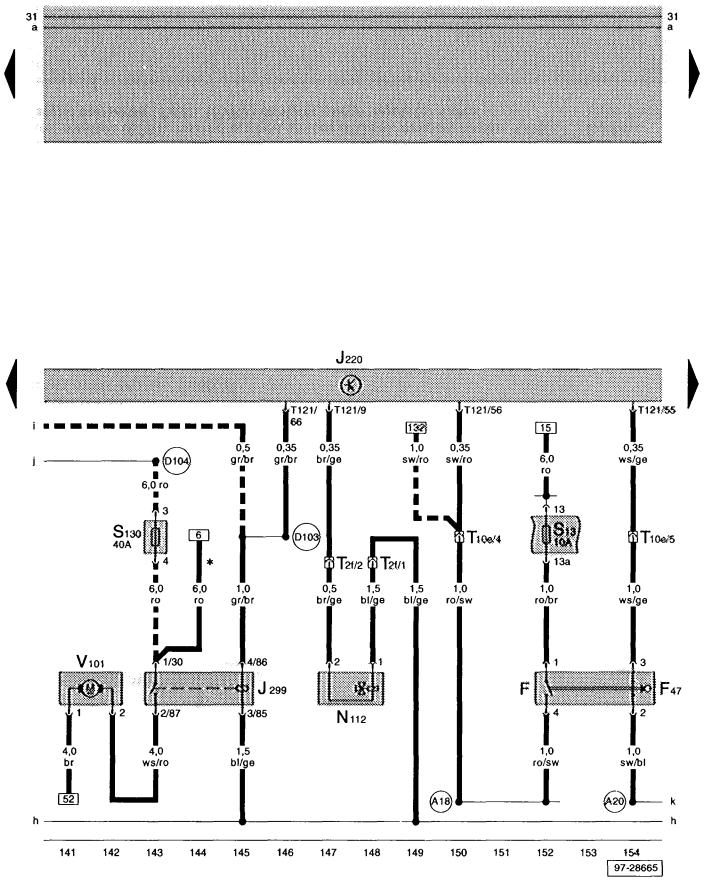


J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J542 - Brake Booster Control Module
S51 - Fuse, in protective housing, in engine compartment, left
T6j - 6-Pin Connector, in engine compartment left
T6k - 6-Pin Connector
T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
T121 - Connector, 121 point
V192 - Brake System Vacuum Pump

(D104) - Plus connection -2- (30a), in engine compartment wiring harness
(U8) - Plus Connection (15a) in automatic transmission wiring harness

--- Automatic transmission only

Motronic engine control module (ECM), brake booster control module, brake system vacuum pump

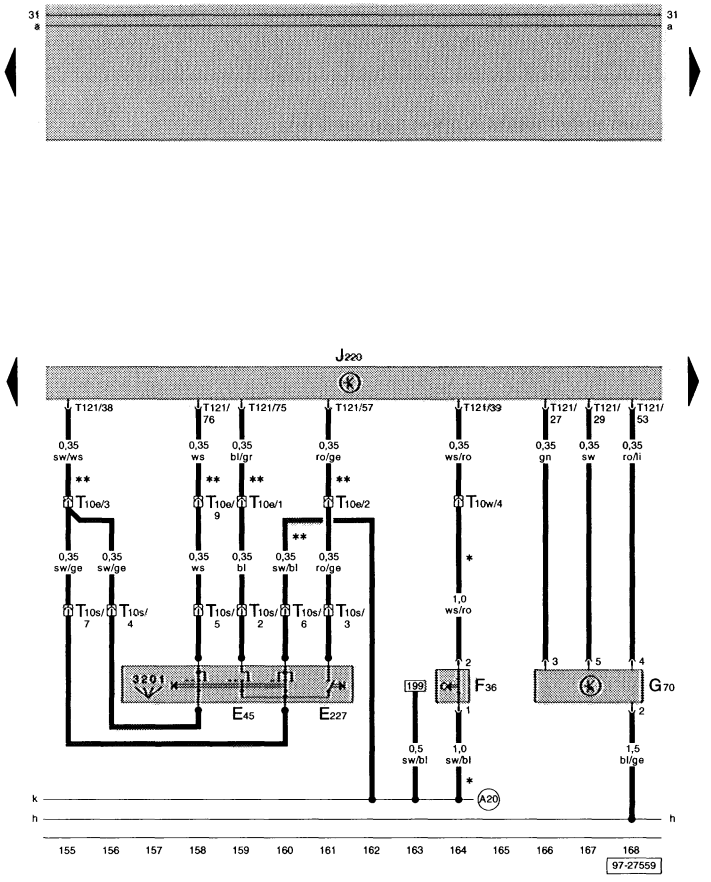


F - Brake Light Switch
F47 - Brake Vacuum Vent Valve Switch for cruise control
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J299 - Secondary Air Injection (AIR) Pump Relay, in protective housing, in engine compartment, left, production control number (100)
N112 - Secondary Air Injection (AIR) Solenoid Vaive
S13 - Fuse 13 in fuse holder
S130 - Fuse for secondary air pump, in protective housing, in engine compartment, left
T2f - Double Connector, in engine compartment left
T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
T121 - Connector, 121 point
V101 - Secondary Air Injection (AIR) Pump Motor

(A18) - Wire connection (54), in instrument panel
(A20) - Wire connection (15a), in instrument panel wiring harness
(D103) - Wire connection -3-, in engine compartment wiring harness
(D104) - Plus connection -2- (30a), in engine compartment wiring harness

* - Manual transmission only
--- Automatic transmission only

Motronic engine control module (ECM), secondary air injection (AIR) pump system, brake light switch, brake vacuum vent valve switch for cruise control



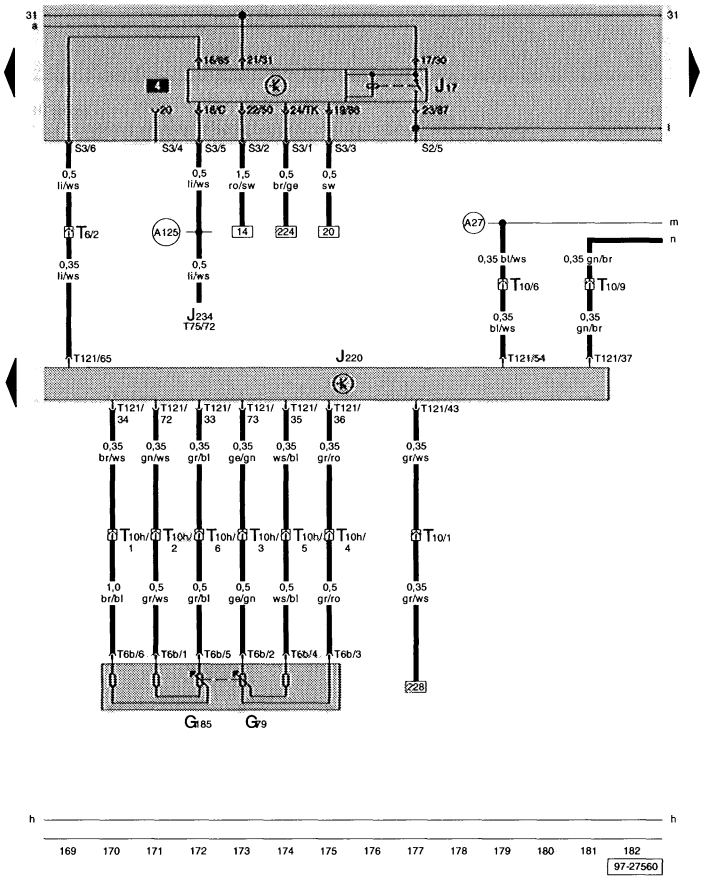
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

E45 - Cruise Control Switch**
E227 - Cruise Control Push Button (SET)**
F36 - Clutch Vacuum Vent Valve Switch
G70 - Mass Air Flow (MAF) Sensor
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
T10s - 10-Pin Connector, near steering column
T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
T121 - Connector, 121 point

(A20) - Wire connection (15a), in instrument panel wiring harness

* - Manual transmission only
** - Vehicles with cruise control only

Motronic engine control module (ECM), cruise control switch, mass air flow (MAF) sensor, clutch vacuum vent valve switch

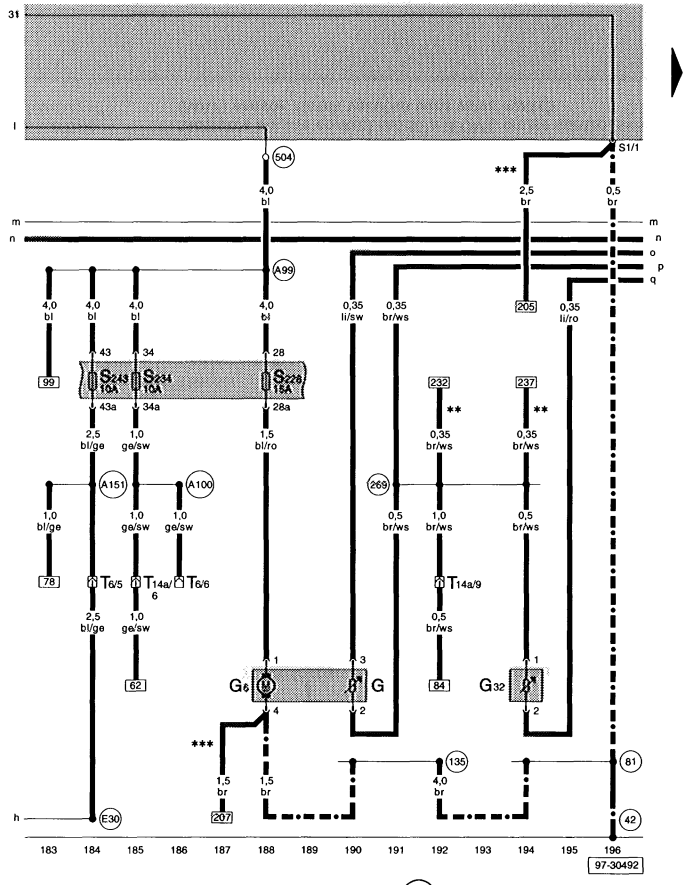


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

G79 - Throttle Position (TP) Sensor
G185 - Sender -2- for accelerator pedal position
J17 - Fuel Pump (FP) Relay
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J234 - Airbag Control Module
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T6b - 6-Pin Connector
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T75 - 75-Pin Connector
T121 - Connector, 121 point

(A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness
(A125) - Connection (crash signal) in instrument panel wiring harness

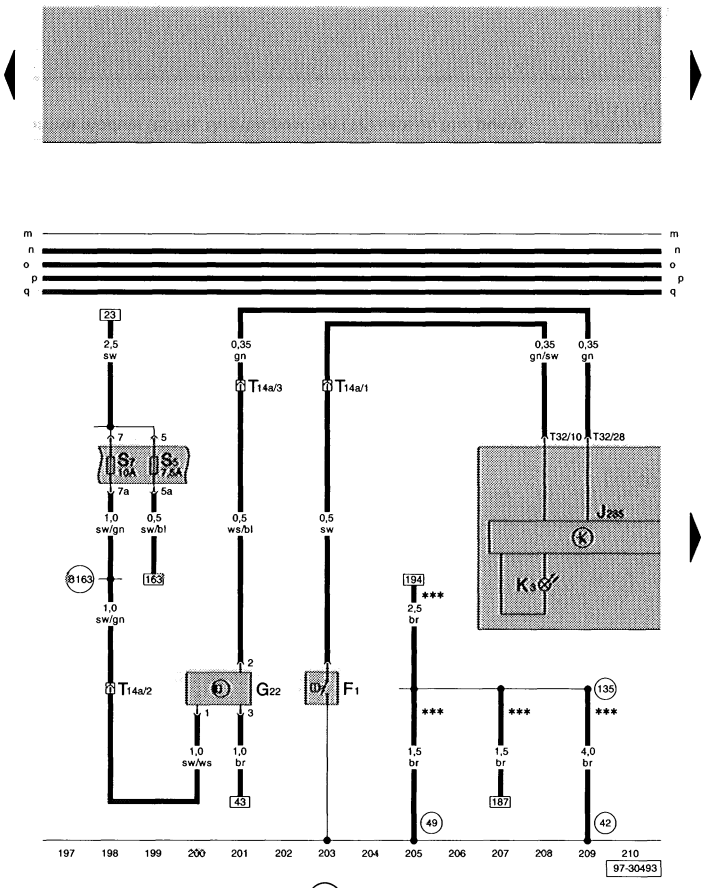
Motronic engine control module (ECM), throttle position (TP) sensor, fuel pump (FP) relay



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

- G - Fuel Level Sensor
- G6 - Fuel Pump (FP)
- G32 - Engine Coolant Level (ECL) Sensor
- S228 - Fuse 28 in fuse holder
- S234 - Fuse 34 in fuse holder
- S243 - Fuse 43 in fuse holder
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- (42) - Ground connection, beside steering column
- (81) - Ground connection -1-, in instrument panel wiring harness
- (135) - Ground connection -2-, in instrument panel wiring harnes
- (269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
- (504) - Threaded connection -1- (87) on the relay plate
- (A99) - Connector -1- (87), in instrument panel wiring harness
- (A100) - Connector -2- (87), in instrument panel wiring harness
- (A151) - Connector -4- (87), in instrument panel wiring harness
- (E30) - Connector (87a), in wiring harness engine
- ** - Vehicles with Multi-Function Indicator (MFI) only
- -•-- - Through April 2000
- *** - Beginning May 2000

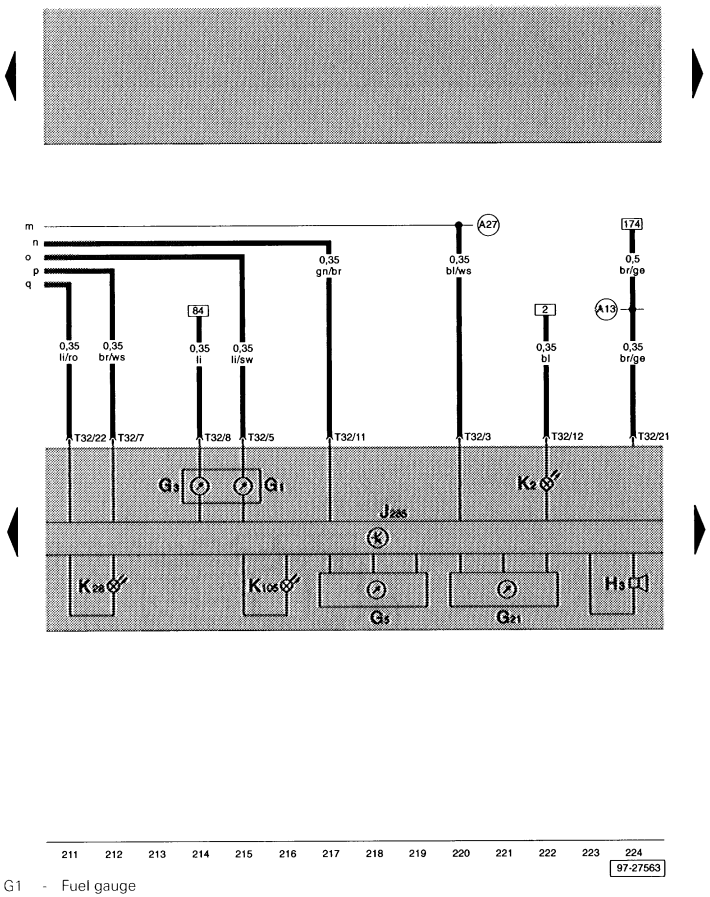
Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

- F1 - Oil Pressure Switch
- G22 - Speedometer Vehicle Speed Sensor (VSS)
- J285 - Control module with indicator unit in instrument panel insert
- K3 - Oil Pressure Warning Light
- S5 - Fuse 5 in fuse holder
- S7 - Fuse 7 in fuse holder
- T14a - 14-Pin Connector, near battery
- T32 - 32-Pin Connector, blue
- (42) - Ground connection, beside steering column
- (49) - Ground connection, on steering column
- (135) - Ground connection -2-, in instrument panel wiring harnes
- (B163) - Plus connector -1- (15) in wiring harness interior
- *** - Beginning May 2000

Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light



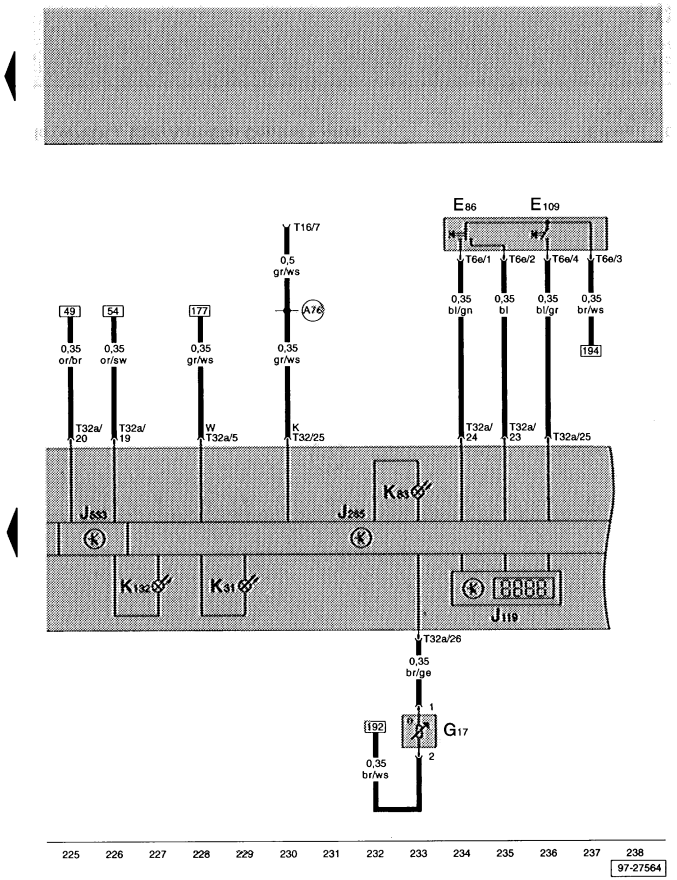
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

G1 - Fuel gauge
G3 - Engine Coolant Temperature (ECT) Gauge
G5 - Tachometer
G21 - Speedometer
H3 - Warning Buzzer
J285 - Control module with indicator unit in instrument panel insert
K2 - Generator (GEN) Warning Light
K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
K105 - Low Fuel Level Warning Light
T32 - 32-Pin Connector, blue

(A13) - Wire connection (door contact switch), in instrument panel wiring harness
(A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness

Edition 07/00 USA.5102.07.21

Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E86 - Multi-Function Indicator Mode Select Switch
E109 - Multi-Function Indicator Memory Switch
G17 - Outside Air Temperature Sensor
J119 - Multi-function Indicator (MFI)
J285 - Control module with indicator unit in instrument panel insert
J533 - Data Bus On Board Diagnostic Interface
K31 - Cruise Control Indicator Light
K83 - Malfunction Indicator Lamp (MIL)
K132 - Electronic Power Control (EPC) Warning Lamp
T6e - 6-Pin Connector
T16 - Data Link Connector (DLC), below instrument panel, left
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(A76) - Connector (K-diagnosis wire), in instrument panel wiring harness

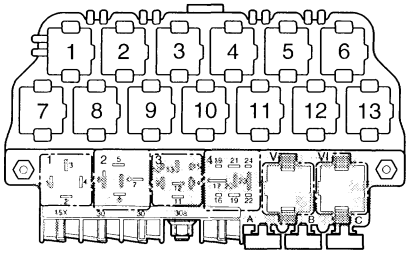
Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp

Edition 07/00 USA.5102.07.21

Anti-lock brake system (ABS), Anti-lock brake system (ABS) with electronic differential lock (EDL) and anti-slip control (ASC),

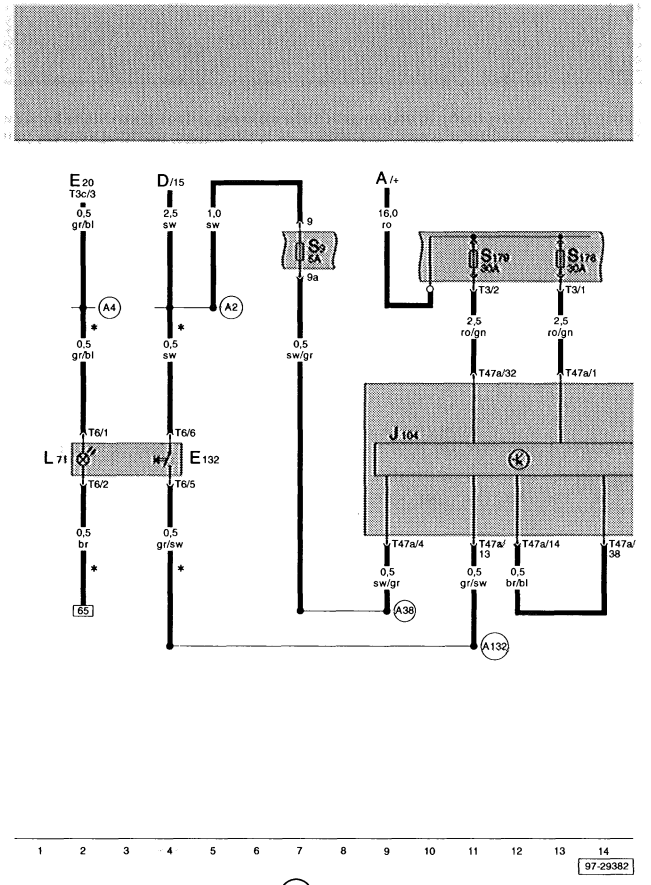
from August 2000

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

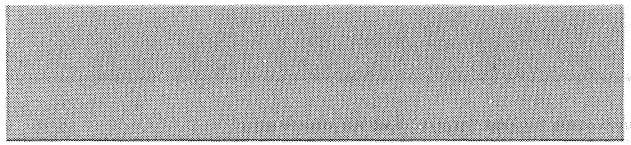


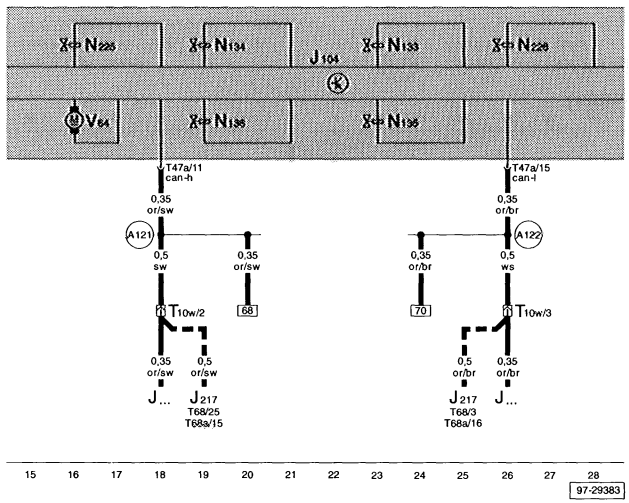
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

A - Battery
D - Ignition/Starter Switch
E20 - Instrument Panel Light Dimmer Switch
E132 - ESP/Anti-Slip Control Switch*
J104 - ABS Control Module (w/EDL), in engine compartment, left
L71 - Anti-Slip Control Switch Illumination*
S9 - Fuse 9 in fuse holder
S178 - Fuse -6- (30) in fuse bracket/battery
S179 - Fuse -7- (30) in fuse bracket/battery
T3 - 3-Pin Connector
T3c - 3-Pin Connector
T6 - 6-Pin Connector*
T47a - 47-Pin Connector

(A2) - Plus connection (15), in instrument panel wiring harness
(A4) - Plus connection (58b), in instrument panel wiring harness
(A38) - Plus connection -2- (15a), in instrument panel wiring harness
(A132) - Connection (ASC), in instrument panel wiring harness

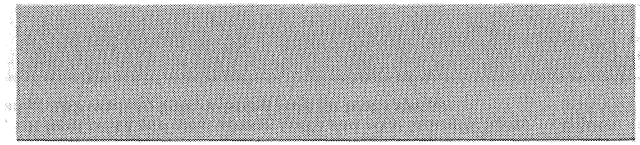
* - Vehicles with ESP/Anti-Slip Control (ASC) only

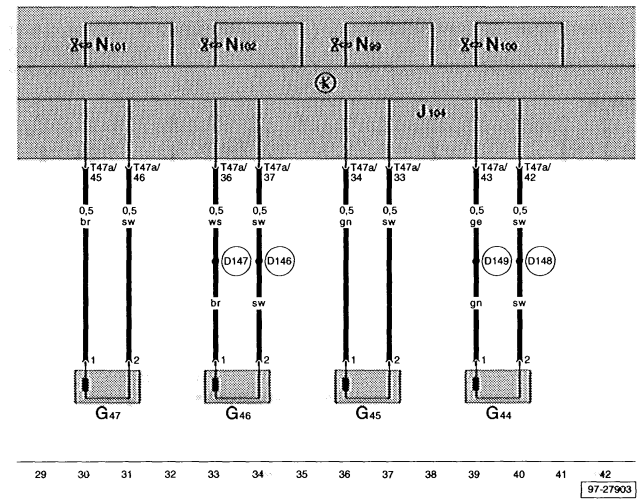




ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

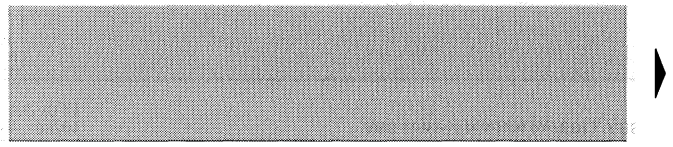
J104 - ABS Control Module (w/EDL), in engine compartment, left
J217 - Transmission Control Module (TCM), in plenum chamber, center
J... - Engine Control Module (ECM)
N133 - Right Rear ABS Inlet Valve
N134 - Left Rear ABS Inlet Valve
N135 - Right Rear ABS Outlet Valve
N136 - Left Rear ABS Outlet Valve
N225 - Pilot valve -1- traction control
N226 - Pilot valve -2- traction control
T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
T47a - 47-Pin Connector
T68 - 68-Pin Connector, on transmission control module (TCM) (4 speed automatic)
T68a - 68-Pin Connector, on Transmission Control Module (TCM) (5 speed automatic with Tiptronic)
V64 - ABS Hydraulic Pump
(A121) - Connection (high bus), in instrument panel wiring harness
(A122) - Connection (low bus), in instrument panel wiring harness
--- Automatic transmission only

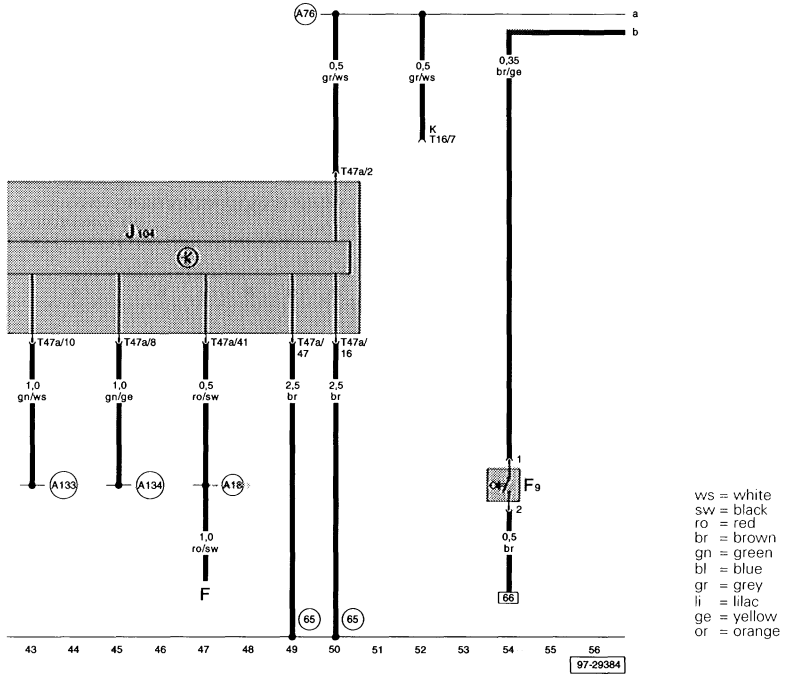




ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

G44 - Right Rear ABS Wheel Speed Sensor
G45 - Right Front ABS Wheel Speed Sensor
G46 - Left Rear ABS Wheel Speed Sensor
G47 - Left Front ABS Wheel Speed Sensor
J104 - ABS Control Module (w/EDL), in engine compartment, left
N99 - Right Front ABS Inlet Valve
N100 - Right Front ABS Outlet Valve
N101 - Left Front ABS Inlet Valve
N102 - Left Front ABS Outlet Valve
T47a - 47-Pin Connector
(D146) - Connector (speed sensor rear, left +), in wiring harness engine compartment
(D147) - Connector (speed sensor rear, left -), in wiring harness engine compartment
(D148) - Connector (speed sensor rear, right +), in wiring harness engine compartment
(D149) - Connector (speed sensor rear, right -), in wiring harness engine compartment

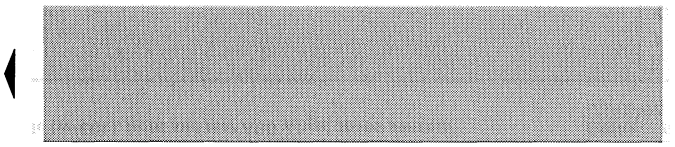


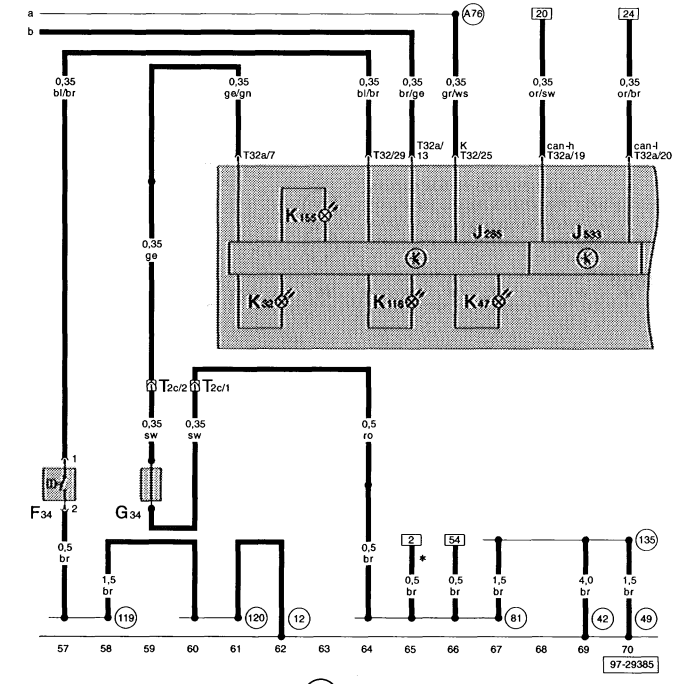


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F - Brake Light Switch
F9 - Parking Brake Warning Light Switch
J104 - ABS Control Module (w/EDL), in engine compartment, left
T16 - Data Link Connector (DLC), below instrument panel, left
T47a - 47-Pin Connector

(65) - Ground connection, on chassis side member, front left
(A18) - Wire connection (54), in instrument panel wiring harness
(A76) - Connector (K-diagnosis wire) in instrument panel wiring harness
(A133) - Connection (ABS-signal left) in instrument panel wiring harness
(A134) - Connection (ABS-signal right) in instrument panel wiring harness





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F34 - Brake Fluid Level Warning Switch
G34 - Left Front Brake Pad Wear Sensor
J285 - Control module with indicator unit in instrument panel insert
J533 - Data Bus On Board Diagnostic Interface
K32 - Brake Pad Wear Indicator Light
K47 - ABS Warning Light
K118 - Warning light for brake system
K155 - ESP/ASC Control Lamp
T2c - Double Connector, near left front brake pad wear sensor
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(12) - Ground connection, in engine compartment, left
(42) - Ground connection, beside steering column
(49) - Ground connection, on steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(119) - Ground connection -1-, in headlight wiring harness
(120) - Ground connection -2-, in headlight wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(A76) - Connector (K-diagnosis wire) in instrument panel wiring harness
* - Vehicles with ESP/Anti-Slip Control (ASC) only

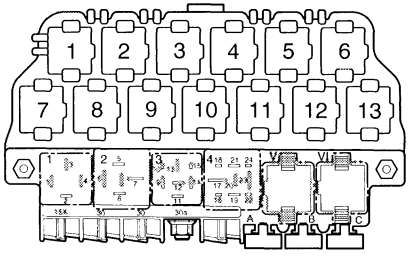
2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code AVH,

from August 2000

2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code AZG,

from October 2000

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97-14163

Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

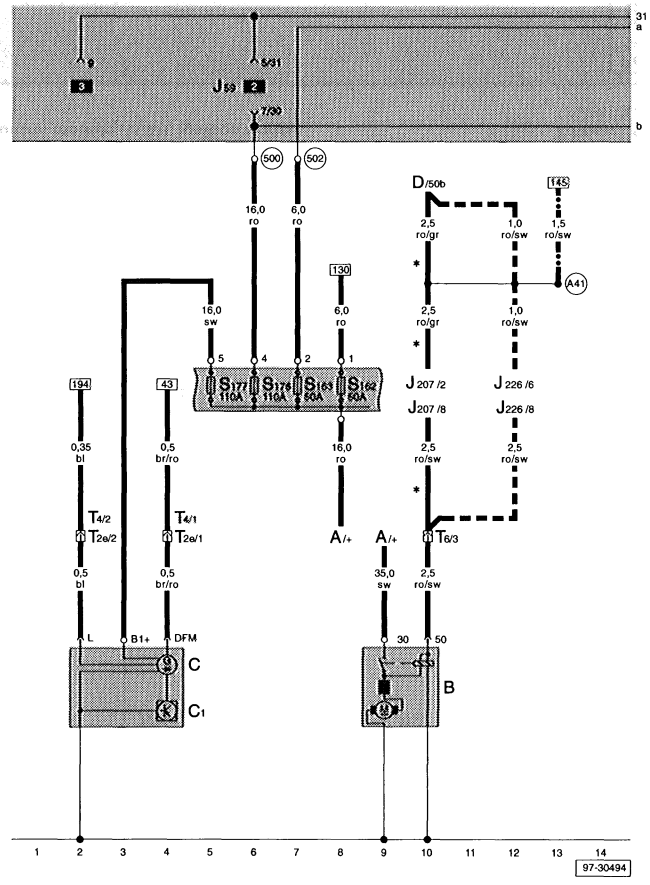
2 Load Reduction Relay (100)

4 Fuel Pump (FP) Relay (409)

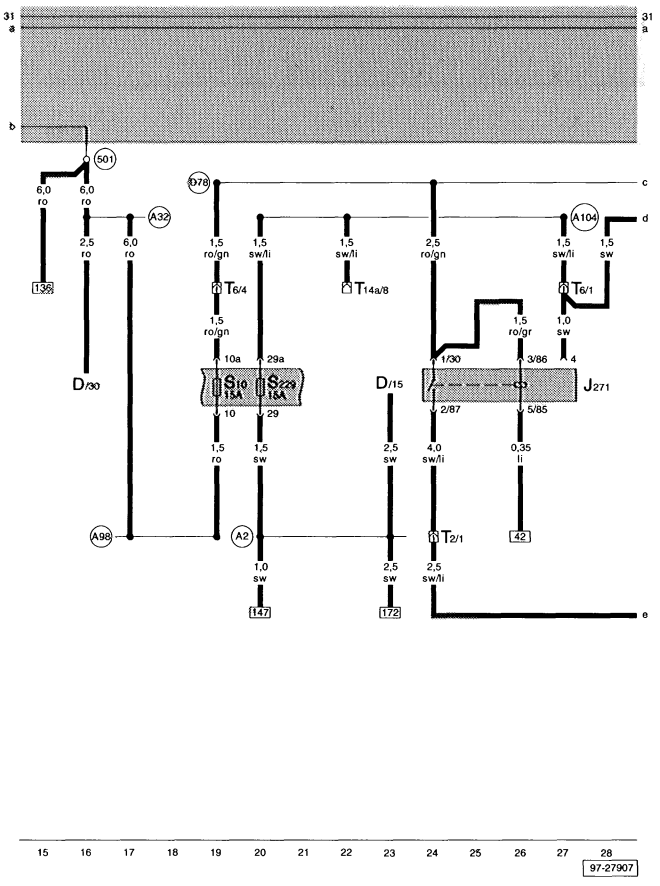
Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



A - Battery
B - Starter
C - Generator (GEN)
C1 - Voltage Regulator (VR)
D - Ignition/Starter Switch
J59 - Load Reduction Relay
J207 - Starting Interlock Relay
J226 - Park/Neutral Position (PNP) Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
T2e - Double Connector, near starter (vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
(500) - Threaded connection -1- (30) on the relay plate
(502) - Threaded connection -1- (30a) on the relay plate
(A41) - Plus connection (50), in instrument panel wiring harness (through April 2001)
* - Manual transmission only
--- - Automatic transmission only
-•-•- Through April 2001



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

D - Ignition/Starter Switch

J271 - Motronic engine control module (ECM) power supply relay, in protective housing, in engine compartment, left, production control number (428)

S10 - Fuse 10 in fuse holder

S229 - Fuse 29 in fuse holder

T2 - 2-Pin Connector, in engine compartment, left

T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left

T14a - 14-Pin Connector, near battery

(501) - Threaded connection -2- (30) on the relay plate

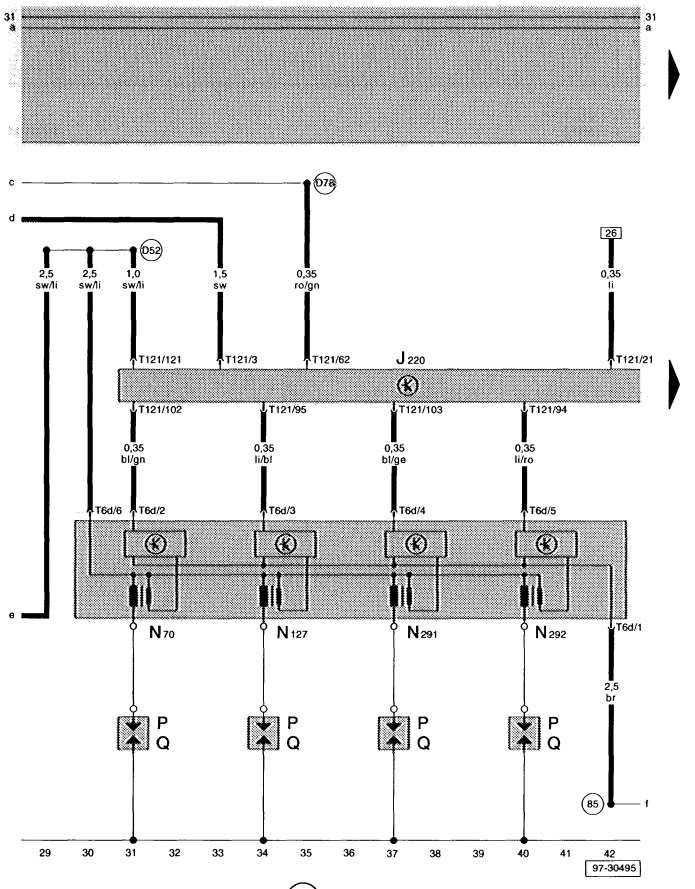
(A2) - Plus connection (15), in instrument panel wiring harness

(A32) - Plus connection (30), in instrument panel wiring harness

(A98) - Plus connector -4- (30), in instrument panel wiring harness

(A104) - Plus connector -2- (15), in instrument panel wiring harness

(D78) - Plus connector -1- (30a), in engine compartment wiring harness



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

J220 - Motronic Engine Control Module (ECM), in plenum chamber, center

N70 - Ignition Coil 1 with Power Output Stage

N127 - Ignition Coil 2 with Power Output Stage

N291 - Ignition Coil 3 with Power Output Stage

N292 - Ignition Coil 4 with Power Output Stage

P - Spark Plug Connectors

Q - Spark Plugs

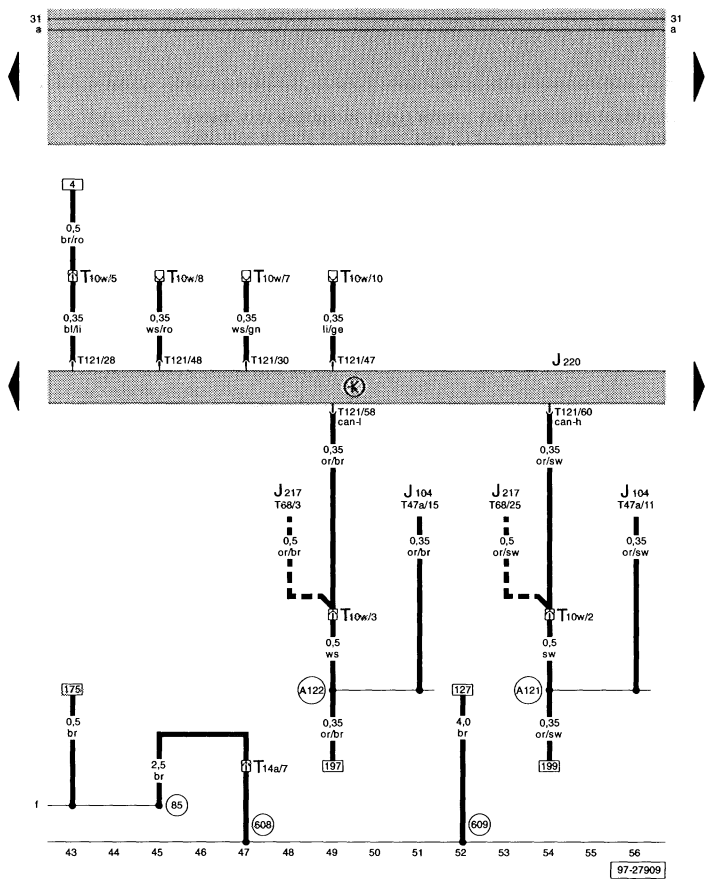
T6d - 6-Pin Connector

T121 - Connector, 121 point

(85) - Ground connection -1-, in engine compartment wiring harness

(D52) - Plus connector (15a), in engine compartment wiring harness

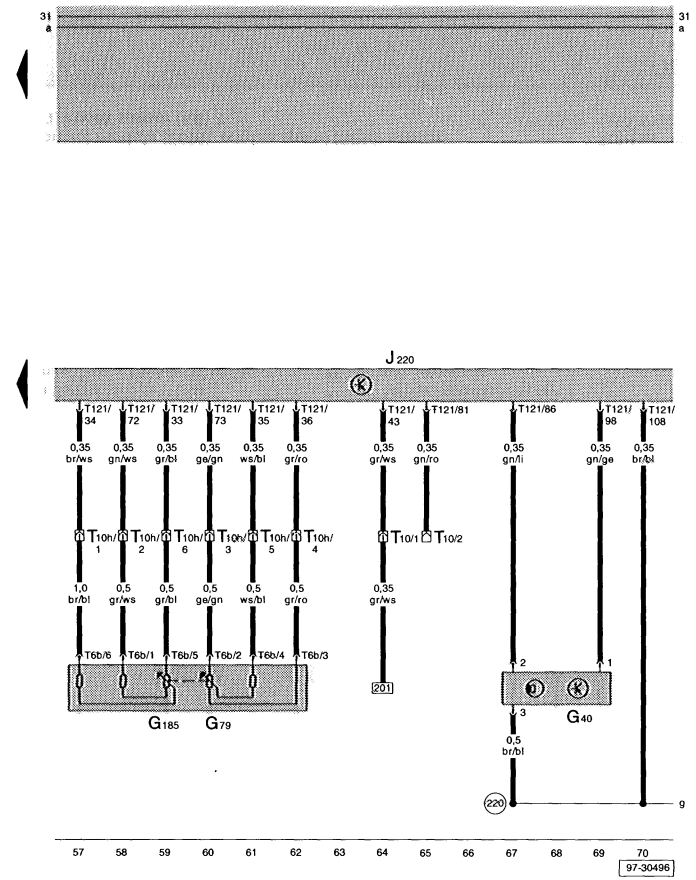
(D78) - Plus connector -1- (30a), in engine compartment wiring harness



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

- J104 - ABS Control Module (w/EDL), in engine compartment, left
- J217 - Transmission Control Module (TCM)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- T47a - 47-Pin Connector, on ABS Control Module
- T68 - 68-Pin Connector, on Transmission Control Module (TCM)
- T121 - Connector, 121 point
- (85) - Ground connection -1-, in engine compartment wiring harness
- (608) - Ground Connection (in center plenum chamber)
- (609) - Ground Connection (in right plenum chamber)
- (A121) - Connection (high bus), in instrument panel wiring harness
- (A122) - Connection (low bus), in instrument panel wiring harness

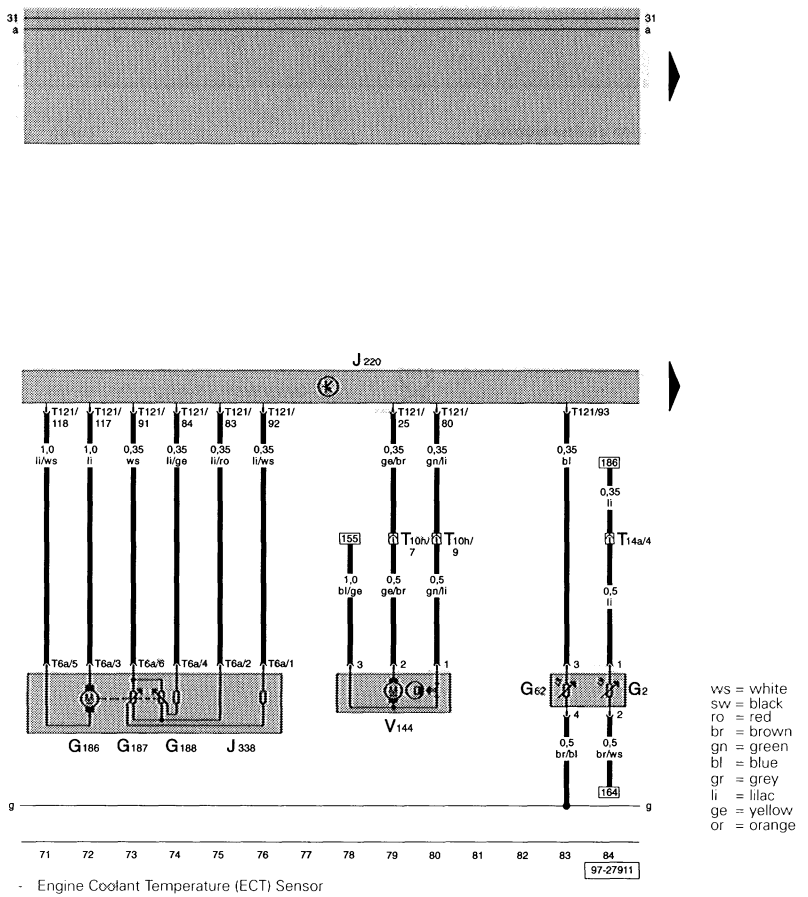
--- Automatic transmission only



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
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or = orange

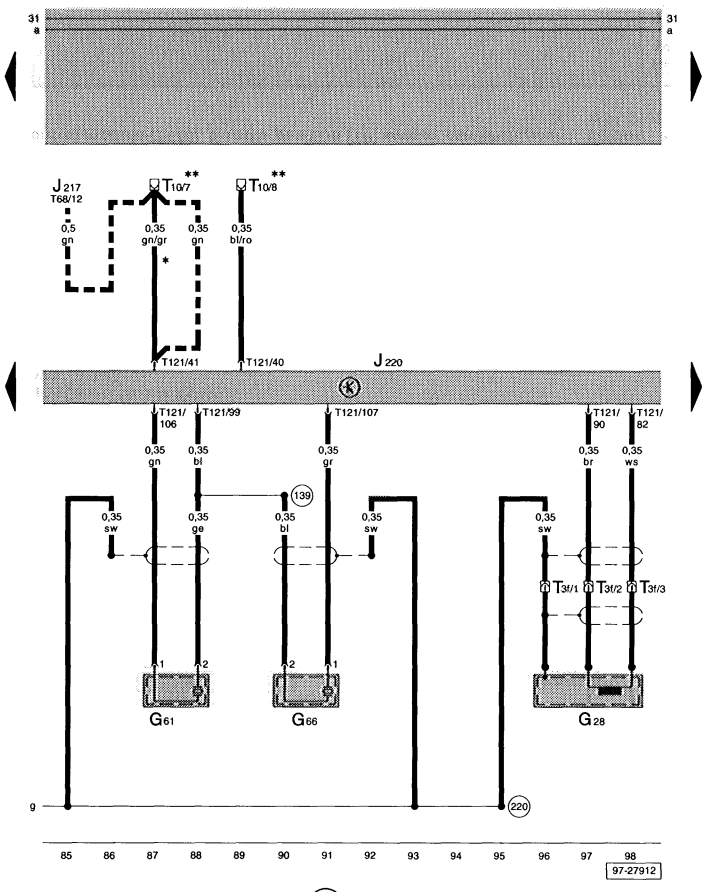
- G40 - Camshaft Position (CMP) Sensor
- G79 - Throttle Position (TP) Sensor
- G185 - Sender -2- for accelerator pedal position
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T6b - 6-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T121 - Connector, 121 point
- (220) - Ground connection (sensor ground), in engine compartment wiring harness

Repair Manual page number 97-456
Repair Manual page number 97-457



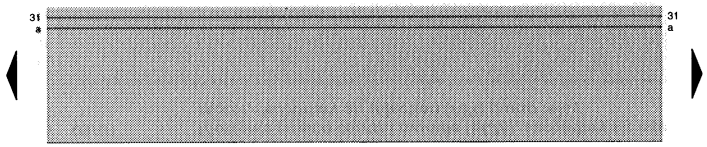
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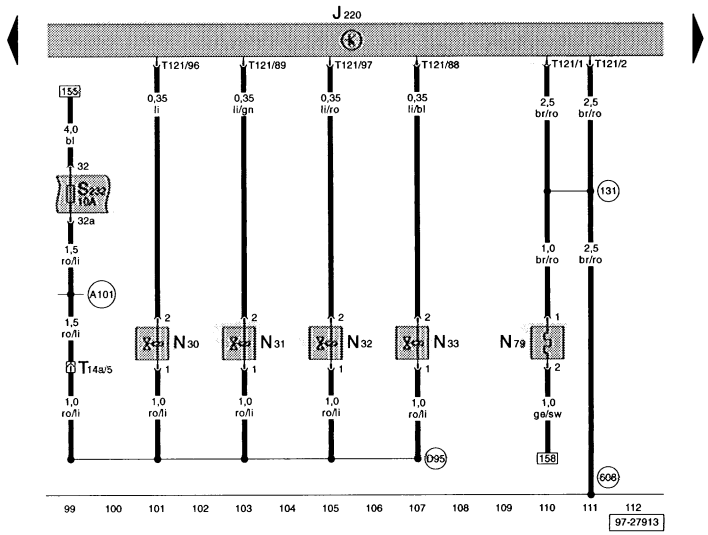
- G2 - Engine Coolant Temperature (ECT) Sensor
- G62 - Engine Coolant Temperature (ECT) Sensor
- G186 - Throttle drive (power accelerator actuation)
- G187 - Angle sensor -1- for throttle drive (power accelerator actuation)
- G188 - Angle sensor -2- for throttle drive (power accelerator actuation)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J338 - Throttle Valve Control Module
- T6a - 6-Pin Connector
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- T121 - Connector, 121 point
- V144 - Leak detection pump (LDP)



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sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

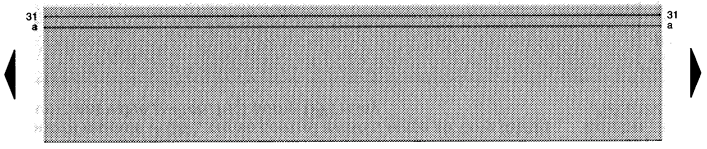
- G28 - Engine Speed (RPM) Sensor
- G61 - Knock Sensor (KS) 1
- G66 - Knock Sensor (KS) 2
- J217 - Transmission Control Module (TCM)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T3f - 3-Pin Connector, in engine compartment, front
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T68 - Connector, 68 point
- T121 - Connector, 121 point
- (139) - Ground connection (sensor Ground), in Motronic Multiport Fuel Injection (MFI) wiring harness
- (220) - Ground connection (sensor ground), in engine compartment wiring harness
- * - Manual transmission only
- ** - A/C connection
- - - - Automatic transmission only

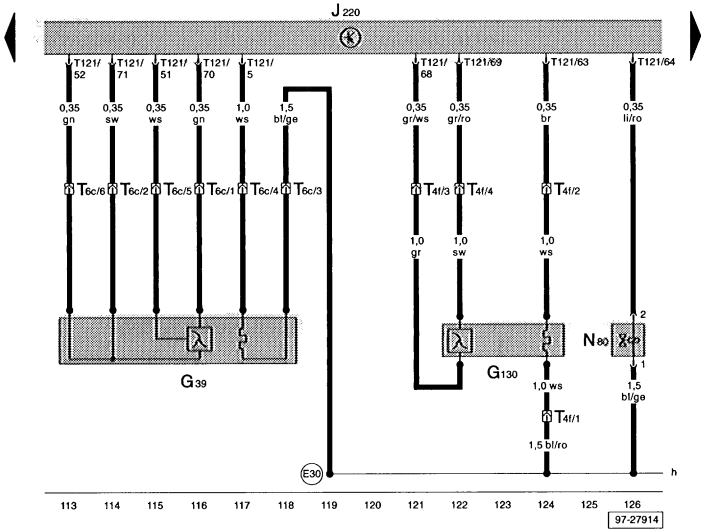




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or = orange

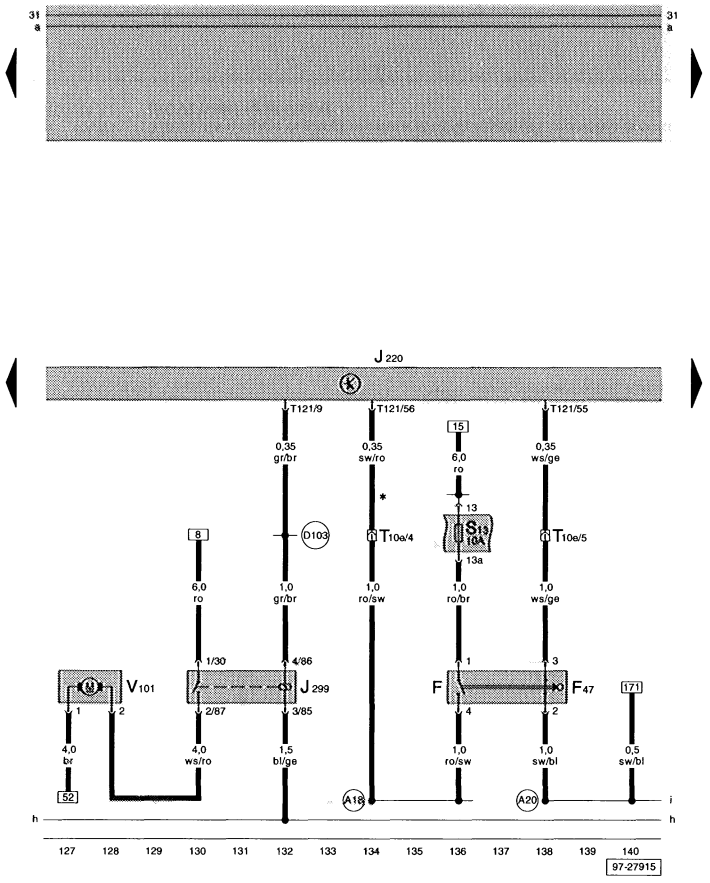
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- N30 - Cylinder 1 Fuel Injector
- N31 - Cylinder 2 Fuel Injector
- N32 - Cylinder 3 Fuel Injector
- N33 - Cylinder 4 Fuel Injector
- N79 - Positive Crankcase Ventilation (PCV) Heating Element
- S232 - Fuse 32 in fuse holder
- T14a - 14-Pin Connector, near battery
- T121 - Connector, 121 point
- (131) - Ground connection -2-, in engine compartment wiring harness
- (608) - Ground connection (in center plenum chamber)
- (A101) - Connector -3- (87a), in instrument panel wiring harness
- (D95) - Wire connection (injectors), in engine compartment wiring harness





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ro = red
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gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

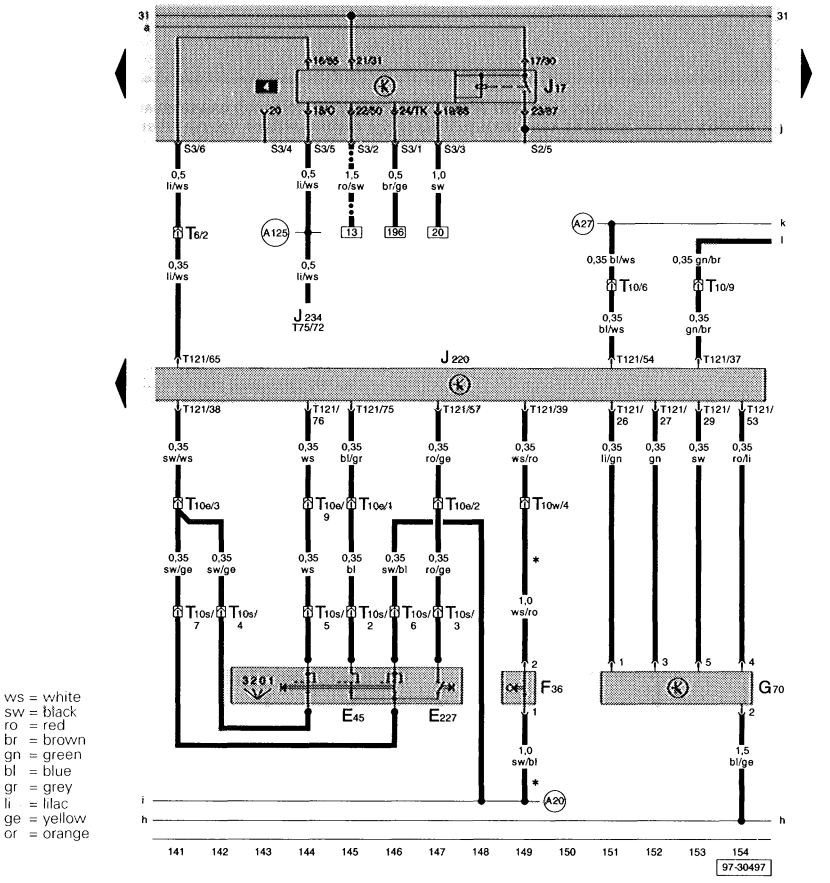
- G39 - Heated Oxygen Sensor (HO2S)
- G130 - Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- N80 - Evaporative Emission (EVAP) Canister Purge Regulator Valve
- T4f - 4-Pin Connector, in protective housing for connectors under right floor
- T6c - 6-Pin Connector, in protective housing for connectors under right floor
- T121 - Connector, 121 point
- (E30) - Connector (87a), in wiring harness engine



- F - Brake Light Switch
- F47 - Brake Pedal Switch (cruise control/Diesel Direct Fuel Injection)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J299 - Secondary Air Injection (AIR) Pump Relay, in protective housing, in engine compartment, left, production control number (100)
- S13 - Fuse 13 in fuse holder
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T121 - Connector, 121 point
- V101 - Secondary Air Injection (AIR) Pump Motor
- (A18) - Wire connection (54), in instrument panel
- (A20) - Wire connection (15a), in instrument panel wiring harness
- (D103) - Wire connection -3-, in engine compartment wiring harness
- * - Manual transmission only

Edition 09/01 USA.5102.11.21

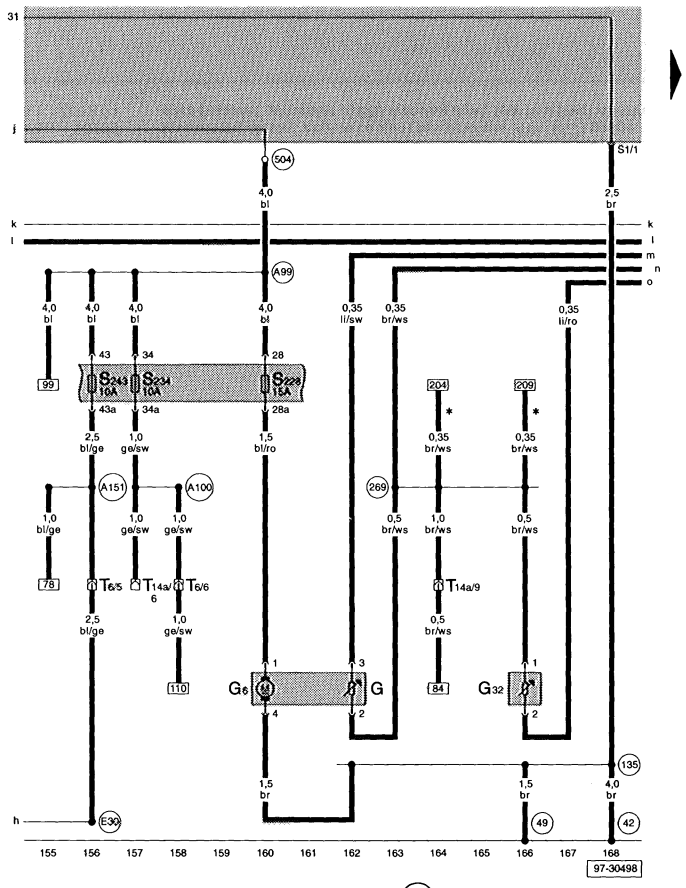
Motronic engine control module (ECM), secondary air injection (AIR) pump motor, secondary air injection (AIR) pump relay



- E45 - Cruise Control Switch
- E227 - Cruise Control Push Button (SET)
- F36 - Clutch Vacuum Vent Valve Switch*
- G70 - Mass Air Flow (MAF) Sensor
- J17 - Fuel Pump (FP) Relay
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J234 - Airbag Control Module
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T10s - 10-Pin Connector, near steering column
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T75 - 75-Pin Connector
- T121 - Connector, 121 point
- (A20) - Wire connection (15a), in instrument panel wiring harness
- (A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness
- (A125) - Connection (crash signal) in instrument panel wiring harness
- * - Manual transmission only
- -•-•- Through April 2001

Motronic engine control module (ECM), cruise control switch, mass air flow (MAF) sensor, clutch vacuum vent valve switch, fuel pump (FP) relay

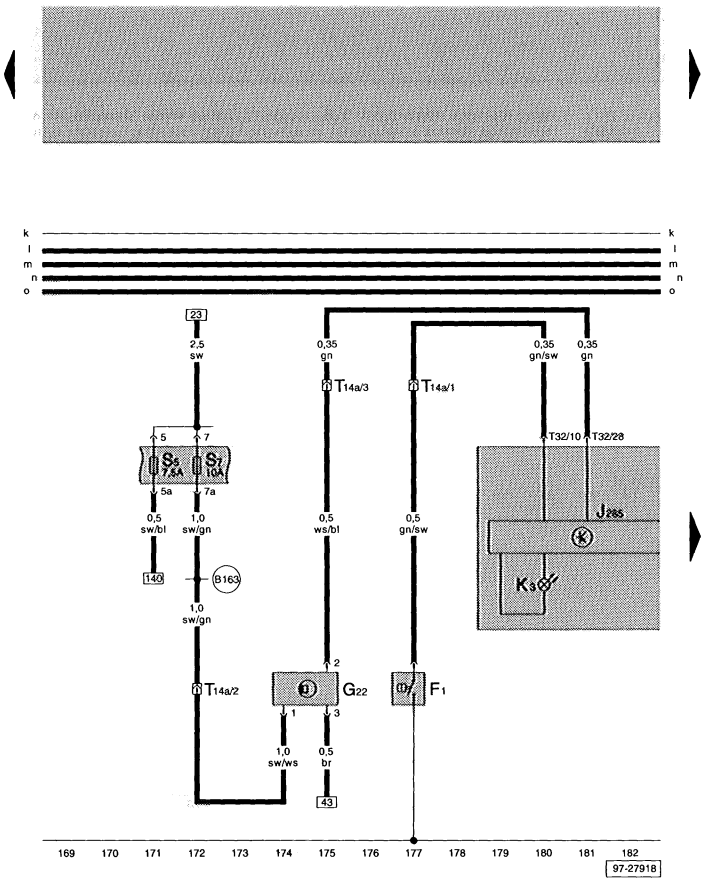
Edition 09/01 USA.5102.11.21



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

- G - Fuel Level Sensor
- G6 - Fuel Pump (FP)
- G32 - Engine Coolant Level (ECL) Sensor
- S228 - Fuse 28 in fuse holder
- S234 - Fuse 34 in fuse holder
- S243 - Fuse 43 in fuse holder
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- (42) - Ground connection, beside steering column
- (49) - Ground connection, on steering column
- (135) - Ground connection -2-, in instrument panel wiring harnes
- (269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
- (504) - Threaded connection -1- (87) on the relay plate
- (A99) - Connector -1- (87), in instrument panel wiring harness
- (A100) - Connector -2- (87), in instrument panel wiring harness
- (A151) - Connector -4- (87), in instrument panel wiring harness
- (E30) - Connector (87a), in wiring harness engine
- * - Vehicles with Multi-Function Indicator (MFI) only

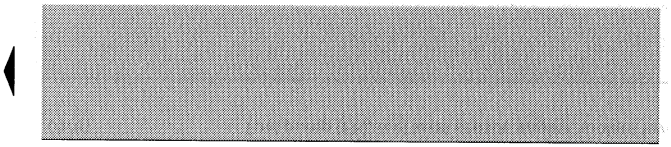
Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor

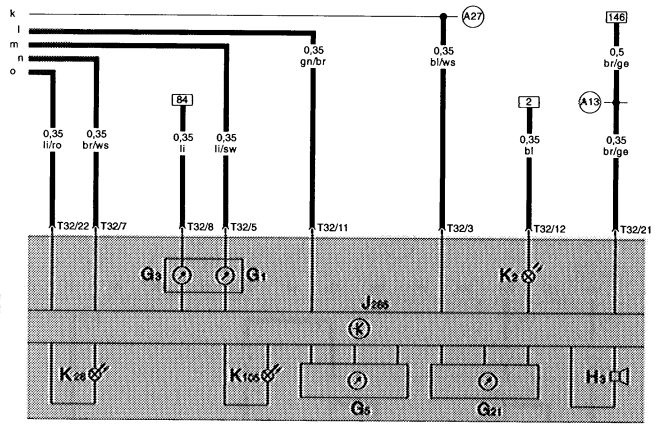


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

- F1 - Oil Pressure Switch
- G22 - Speedometer Vehicle Speed Sensor (VSS)
- J285 - Control module with indicator unit in instrument panel insert
- K3 - Oil Pressure Warning Light
- S5 - Fuse 5 in fuse holder
- S7 - Fuse 7 in fuse holder
- T14a - 14-Pin Connector, near battery
- T32 - 32-Pin Connector, blue
- (B163) - Plus connector -1- (15) in wiring harness interior

Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light





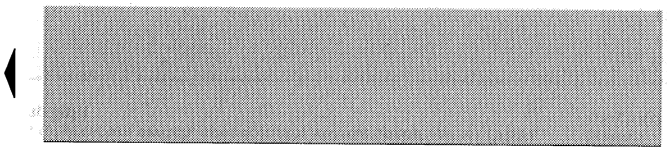
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br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow

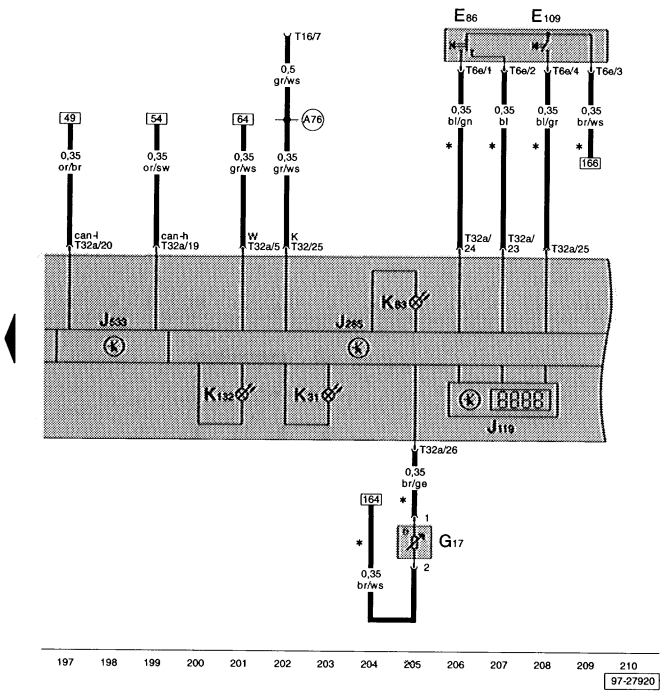
G1 - Fuel gauge
G3 - Engine Coolant Temperature (ECT) Gauge
G5 - Tachometer
G21 - Speedometer
H3 - Warning Buzzer
J285 - Control module with indicator unit in instrument panel insert
K2 - Generator (GEN) Warning Light
K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
K105 - Low Fuel Level Warning Light
T32 - 32-Pin Connector, blue

(A13) - Wire connection (door contact switch), in instrument panel wiring harness
(A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness

Edition 09/00 USA.5102.08.21

Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E86 - Multi-Function Indicator Mode Select Switch
E109 - Multi-Function Indicator Memory Switch
G17 - Outside Air Temperature Sensor
J119 - Multi-function Indicator (MFI)
J285 - Control module with indicator unit in instrument panel insert
J533 - Data Bus On Board Diagnostic Interface
K31 - Cruise Control Indicator Light
K83 - Malfunction Indicator Lamp (MIL)
K132 - Electronic Power Control (EPC) Warning Lamp
T6e - 6-Pin Connector
T16 - Data Link Connector (DLC), below instrument panel, left
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(A76) - Connector (K-diagnosis wire), in instrument panel wiring harness

* - Vehicles with Multi-Function Indicator (MFI) only

Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp

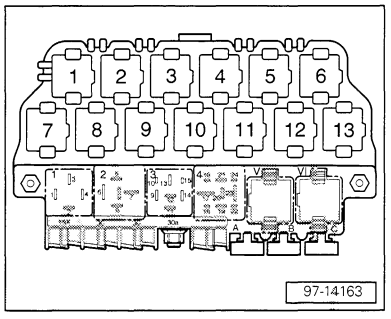
Edition 09/00 USA.5102.08.21

Airbag systems,

from October 2000

- Driver- and front passsenger airbag
- Head airbag
- Side airbag
- Seat belt tensioner
- Seat belt control

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations"

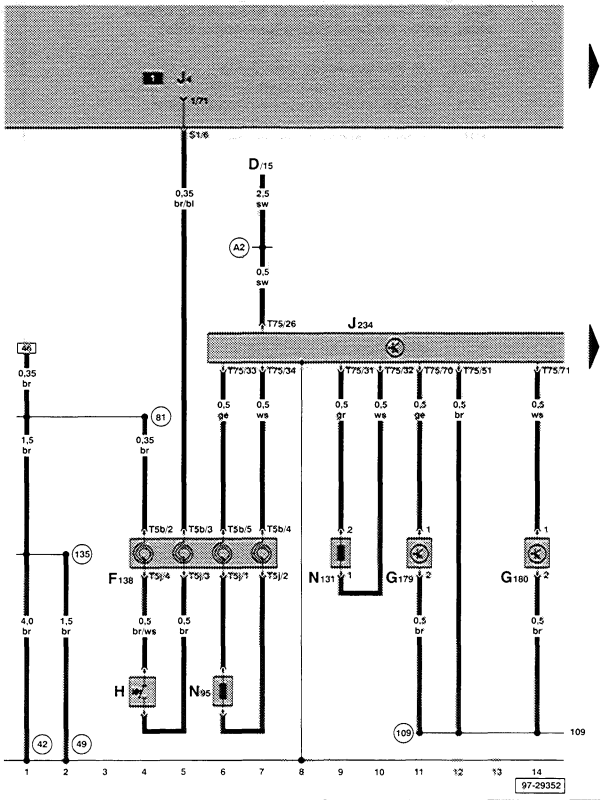


Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

1 J4 - Dual Horn Relay (53)

4 J17 - Fuel Pump (FP) Relay (409)

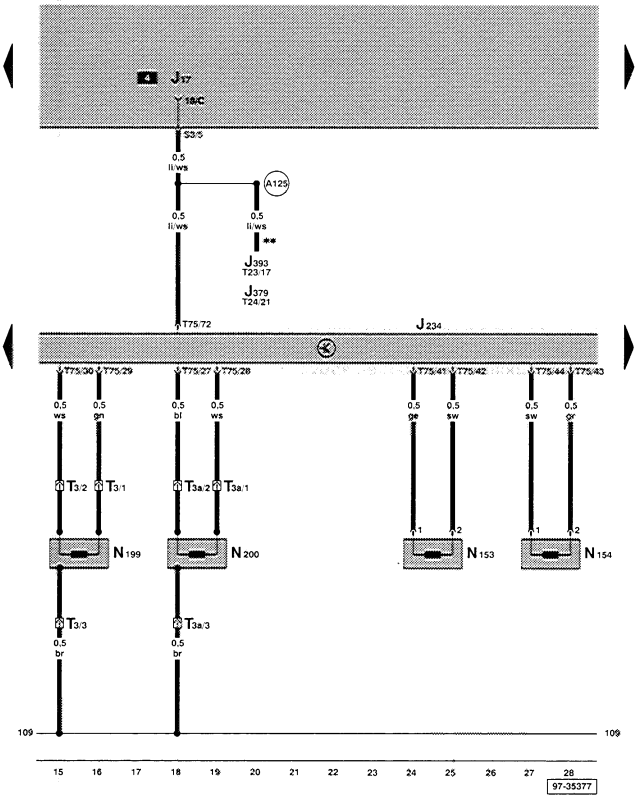


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Airbag control module, airbag spiral spring/return spring with slip ring, crash sensor for side airbag, airbag igniter, signal horn activation

D - Ignition/Starter Switch
F138 - Airbag Spiral Spring/Return Spring With Slip Ring
G179 - Crash sensor for side airbag, driver's side
G180 - Crash sensor for side airbag, passenger side
H - Signal horn activation
J4 - Dual Horn Relay
J234 - Airbag Control Module, behind console, lower part
N95 - Driver's Side Airbag Igniter
N131 - Passenger's Side Airbag Igniter 1
T5b - 5-Pin Connector
T5j - 5-Pin Connector
T75 - 75-Pin Connector

42 - Ground connection, beside steering column
49 - Ground connection, on steering column
81 - Ground connection -1-, in instrument panel wiring harness
109 - Ground connection, in airbag wiring harness
135 - Ground connection -2-, in instrument panel wiring harness
A2 - Plus connection (15), in instrument panel wiring harness



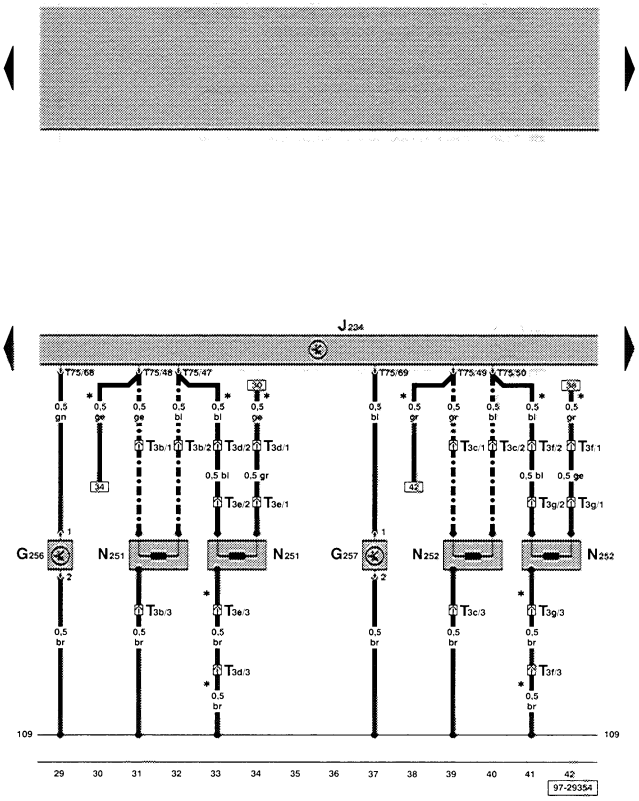
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sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Airbag control module, seat belt tensioner igniter, igniter for side airbags

J17 - Fuel Pump (FP) Relay (gasoline engine only)
J234 - Airbag Control Module, behind console, lower part
J379 - Control module for central locking and anti-theft-system
J393 - Central control module for comfort system
N153 - Left Seat Belt Tensioner Igniter
N154 - Right Seat Belt Tensioner Igniter
N199 - Igniter for side airbag, driver's side
N200 - Igniter for side airbag, passenger side
T3 - 3-Pin Connector, below driver's seat
T3a - 3-Pin Connector, below passenger's seat
T23 - 23-Pin Connector
T24 - 24-Pin Connector
T75 - 75-Pin Connector

A125 - Connection (crash signal) in instrument panel wiring harness

** - Through April 2001

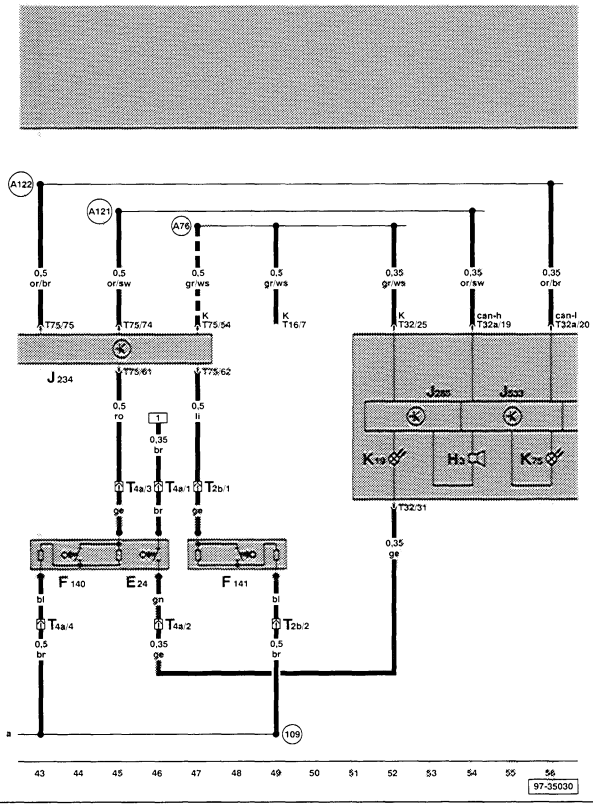


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Airbag control module, left and right rear side airbag crash sensors, igniter for head airbag (driver side), igniter for head airbag (passenger side)

G256 - Left Rear Side Airbag Crash Sensor
G257 - Right Rear Side Airbag Crash Sensor
J234 - Airbag Control Module, behind console, lower part
N251 - Igniter for head airbag, driver side
N252 - Igniter for head airbag, passenger side
T3b - 3-Pin Connector, behind C-pillar trim, left
T3c - 3-Pin Connector, behind C-pillar trim, right
T3d - 3-Pin Connector, near connector station D-pillar, left
T3e - 3-Pin Connector, behind D-pillar trim, left
T3f - 3-Pin Connector, near connector station D-pillar, right
T3g - 3-Pin Connector, behind D-pillar trim, right
T75 - 75-Pin Connector

* - Jetta Wagon only
-•-•- Golf/ Jetta Sedan only



Airbag control module, seat belt warning light, airbag malfunction indicator lamp (MIL), left seat belt switch, left and right front seat belt microswitches

- E24 - Left Seat Belt Switch
- F140 - Left Front Seat Belt Microswitch*
- F141 - Right Front Seat Belt Microswitch*
- H3 - Warning Buzzer
- J234 - Airbag Control Module, behind console, lower part
- J285 - Control module with indicator unit in instrument panel insert
- J533 - Data Bus On Board Diagnostic Interface
- K19 - Seat Belt Warning Light
- K75 - Airbag Malfunction Indicator Lamp (MIL)
- T2b - Double Connector, below passenger's seat
- T4a - 4-Pin Connector, below driver's seat
- T16 - Data Link Connector (DLC), below instrument panel, left
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green
- T75 - 75-Pin Connector

- (109) - Ground connection, in airbag wiring harness
- (A76) - Connection (K-diagnosis wire) in instrument panel wiring harness
- (A121) - Connection (high bus), in instrument panel wiring harness
- (A122) - Connection (low bus), in instrument panel wiring harness

- * - Scan Tool display text for these component codes may be different than indicated
- --- Through June 2001

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03

Repair Manual page number 97-473

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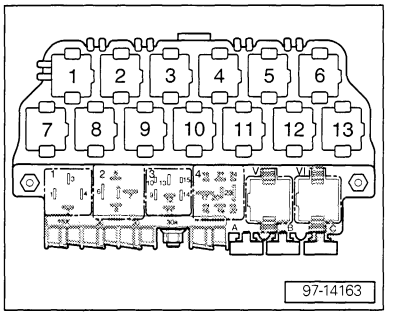
Repair Manual page number 97-472

Repair Manual page number 97-475

Jetta Wagon - Standard Equipment,

from January 2001

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations"



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

3 J207- Starting Interlock Relay (53)

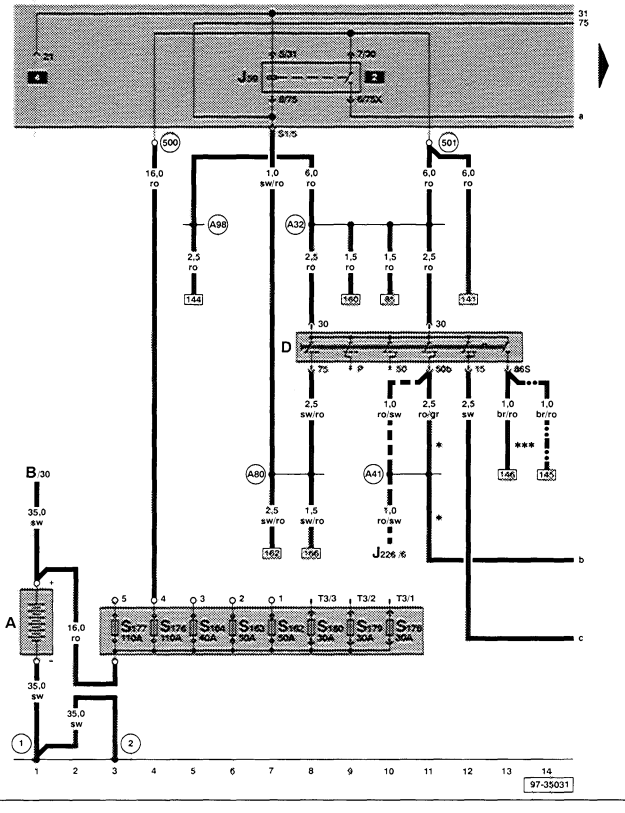
Relay panel:

1 J4 - Dual Horn Relay (53)

2 J52 - Load Reduction Relay (100)

V J31 - Wiper/Washer Intermittent Relay (377)

VI J31 - Wiper/Washer Intermittent Relay (377)



ws = white
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ro = red
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gn = green
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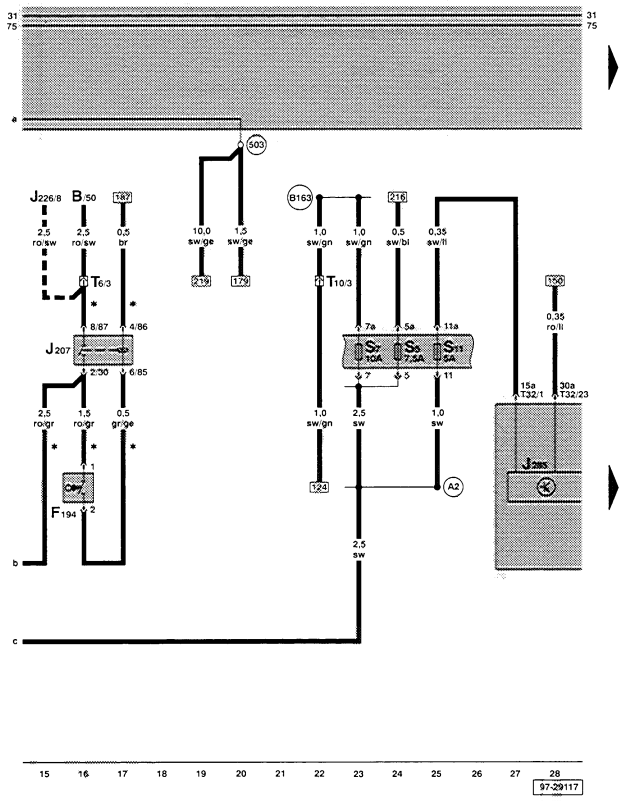
Battery, ignition/starter switch

A - Battery
B - Starter
D - Ignition/Starter Switch
J59 - Load Reduction Relay
J226 - Park/Neutral Position (PNP) Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S164 - Fuse -3- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
S178 - Fuse -6- (30) in fuse bracket/battery
S179 - Fuse -7- (30) in fuse bracket/battery
S180 - Fuse -8- (30) in fuse bracket/battery
T3 - 3-Pin Connector

(1) - Ground strap, battery to body
(2) - Ground strap, transmission to body
(500) - Threaded connection -1- (30) on the relay plate
(501) - Threaded connection -2- (30) on the relay plate
(A32) - Plus connection (30), in instrument panel wiring harness
(A41) - Plus connection (50), in instrument panel wiring harness (gasoline engine only), through April 2001
(A80) - Connection -1- (X), in instrument panel wiring harness
(A98) - Plus connection -4- (30), in instrument panel wiring harness

* - Manual transmission only, (not 2.0L-Engine - code BBW. Different wiring ⇒ wiring diagram Motor)
--- Automatic transmission only
*** - Beginning November 2001
-••- Through October 2001

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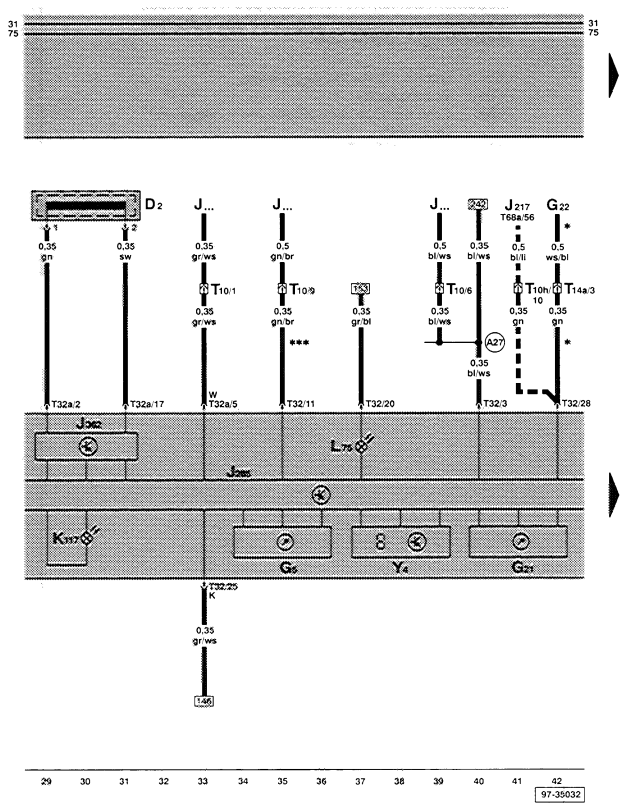
Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay

B - Starter
F194 - Clutch Pedal Position (CPP) Switch*
J207 - Starting Interlock Relay*
J226 - Park/Neutral Position (PNP) Relay
J285 - Control module with indicator unit in instrument panel insert
S5 - Fuse 5 in fuse holder
S7 - Fuse 7 in fuse holder
S11 - Fuse 11 in fuse holder
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T32 - 32-Pin Connector, blue

(503) - Threaded connection -2- (75x) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(B163) - Plus connection -1- (15) in wiring harness interior

* - Manual transmission only, (not 2.0L-Engine - code BBW. Different wiring ⇒ wiring diagram Motor)
--- - Automatic transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



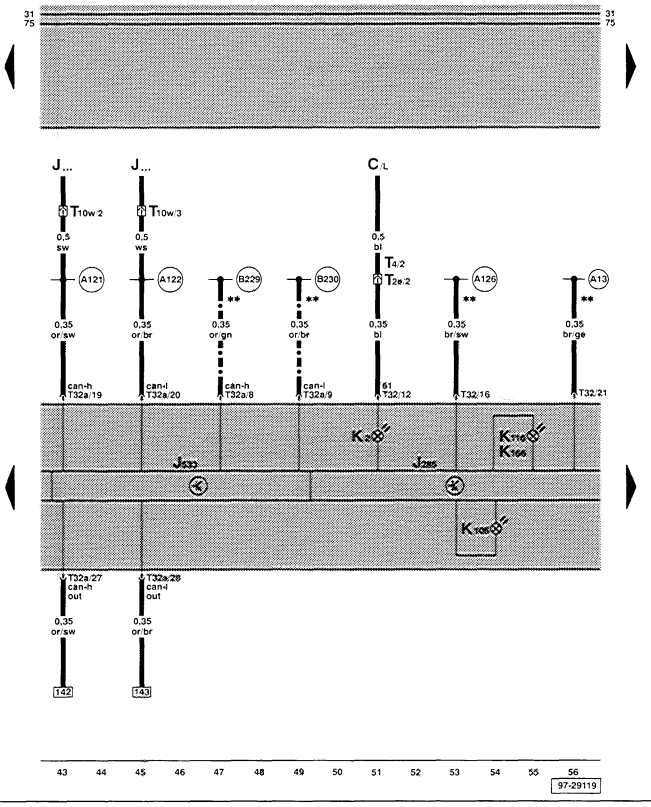
Instrument cluster, tachometer, speedometer, odometer display, anti-theft immobilizer, warning light for anti-theft immobilizer sensor

D2 - Induction coil of anti-theft immobilizer
G5 - Tachometer
G21 - Speedometer
G22 - Speedometer Vehicle Speed Sensor
J217 - Transmission Control Module (TCM)
J285 - Control module with indicator unit in instrument panel insert
J362 - Control module for anti-theft immobilizer
J... - Engine Control Module (ECM)
K117 - Warning light for anti-theft immobilizer sensor
L75 - Digital Display Light
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, in engine compartment, in wiring duct, left
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green
T68a - 68-Pin Connector, on Transmission Control Module (TCM)
Y4 - Odometer Display

(A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness

* - 4 speed automatic transmission/ manual transmission
--- - 5 speed automatic transmission
*** - Through April 20002

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
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ge = yellow
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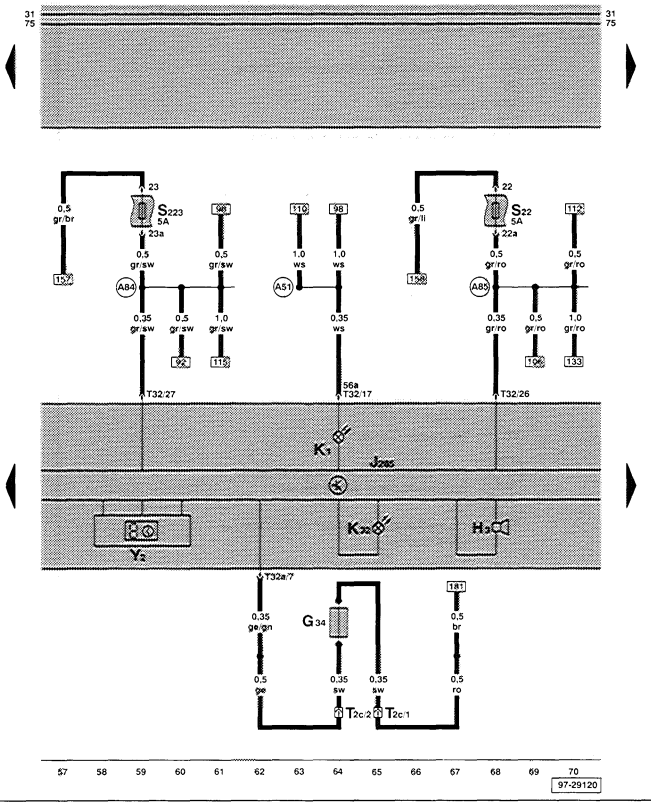
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
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or = orange

Instrument cluster, generator (GEN) warning light, low fuel level warning light, warning light for rear lid unlocked/door ajar indicator lamp

- C - Generator (GEN)
- J285 - Control module with indicator unit in instrument panel insert
- J533 - Data Bus On Board Diagnostic Interface
- J... - Engine Control Module (ECM)
- K2 - Generator (GEN) Warning Light
- K105 - Low Fuel Level Warning Light
- K116 - Warning light for rear lid unlocked (through April 2001)
- K166 - Door Ajar Indicator Lamp (from May 2001)
- T2e - Double Connector, near starter (in vehicles without air conditioning)
- T4 - 4-Pin Connector, near starter (in vehicles with air conditioning)
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green

- (A13) - Wire connection (door contact switch) in instrument panel wiring harness**
- (A121) - Connection (high bus), in instrument panel wiring harness
- (A122) - Connection (low bus), in instrument panel wiring harness
- (A126) - Connection (contact switch in rear lid) in instrument panel wiring harness**
- (B229) - Connection (high bus), in instrument panel wiring harness**
- (B230) - Connection (low bus), in instrument panel wiring harness**

** - See also wiring diagram Comfort System
-•-•- Beginning May 2001

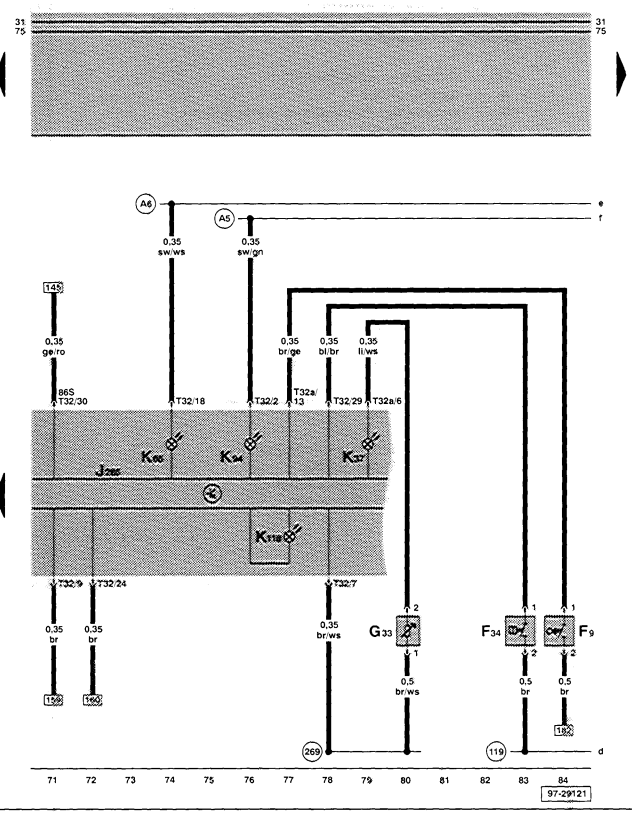


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Instrument cluster, left front brake pad wear sensor, brake pad wear indicator light, headlight high beam indicator light, digital clock

- G34 - Left Front Brake Pad Wear Sensor
- H3 - Warning buzzer
- J285 - Control module with indicator unit in instrument panel insert
- K1 - Headlight High Beam Indicator Light
- K32 - Brake Pad Wear Indicator Light
- S22 - Fuse 22 in fuse holder
- S223 - Fuse 23 in fuse holder
- T2c - Double Connector, near left front brake pad wear sensor
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green
- Y2 - Digital Clock

- (A51) - Wire connection (56), in instrument panel wiring harness
- (A84) - Connection (58L) in instrument panel wiring harness
- (A85) - Connection (58R) in instrument panel wiring harness

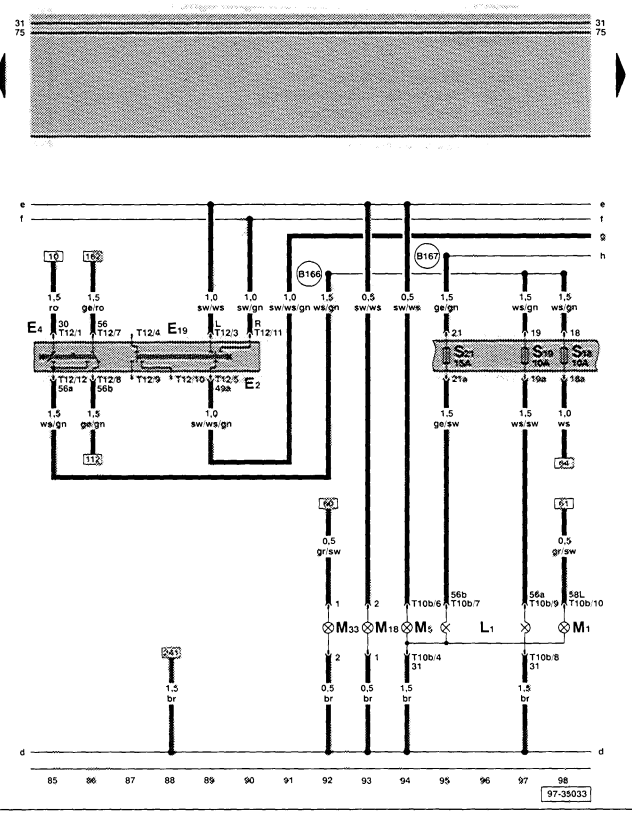


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Instrument cluster, parking brake warning light switch, brake fluid level warning switch, low windshield washer fluid level indication, left and right turn signal indicator lights

- F9 - Parking Brake Warning Light Switch
- F34 - Brake Fluid Level Warning Switch
- G33 - Windshield Washer Fluid Level Sensor
- J285 - Control module with indicator unit in instrument panel insert
- K37 - Low Windshield Washer Fluid Level Indicator Light
- K65 - Left Turn Signal Indicator Light
- K94 - Right Turn Signal Indicator Light
- K118 - Warning light for brake system
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green

- (119) - Ground connection -1-, in headlight wiring harness
- (269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
- (A5) - Plus connection (right turn signal), in instrument panel wiring harness
- (A6) - Plus connection (left turn signal), in instrument panel wiring harness



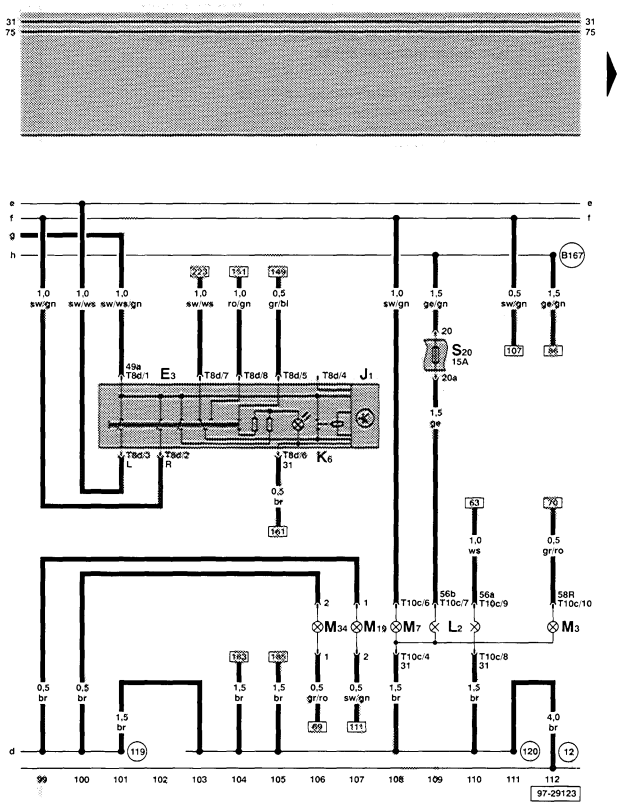
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Turn signal switch, headlight dimmer/flasher switch, left front turn signal light, light for side marker front left, left headlight

- E2 - Turn signal switch
- E4 - Headlight Dimmer/Flasher Switch
- E19 - Park Light Switch
- L1 - Left Headlight
- M1 - Left Parking Light
- M5 - Left Front Turn Signal Light
- M18 - Left, Side Turn Signal Light
- M33 - Light for side marker front left
- S18 - Fuse 18 in fuse holder
- S19 - Fuse 19 in fuse holder
- S21 - Fuse 21 in fuse holder
- T10b - 10-Pin Connector
- T12 - 12-Pin Connector

- (B166) - Connection (56a) in passenger compartment wiring harness
- (B167) - Connection (56b) in passenger compartment wiring harness

- Vehicles with daytime running lights
  ⇒ wiring diagram No. 61



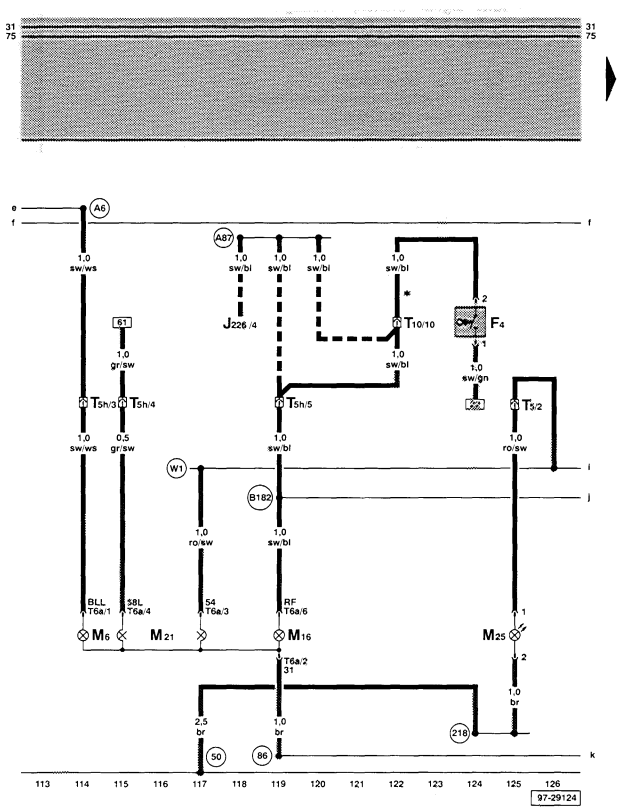
Emergency flasher switch, turn signal relay, right front turn signal light, light for side marker front right, right headlight

E3 - Emergency Flasher Switch**
J1 - Turn Signal Relay
K6 - Indicator light for emergency flasher system
L2 - Right Headlight
M3 - Right Parking Light
M7 - Right Front Turn Signal Light
M19 - Right, Side Turn Signal Light
M34 - Light for side marker front right
S20 - Fuse 20 in fuse holder
T8d - 8-Pin Connector
T10c - 10-Pin Connector

(12) - Ground connection, in engine compartment, left
(119) - Ground connection -1-, in headlight wiring harness
(120) - Ground connection -2-, in headlight wiring harness
(B167) - Connection (56b), in passenger compartment wiring harness

\- Vehicles with daytime running lights
⇒ wiring diagram No. 61
** - Vehicles with Telematic system
⇒ wiring diagram Telematic

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



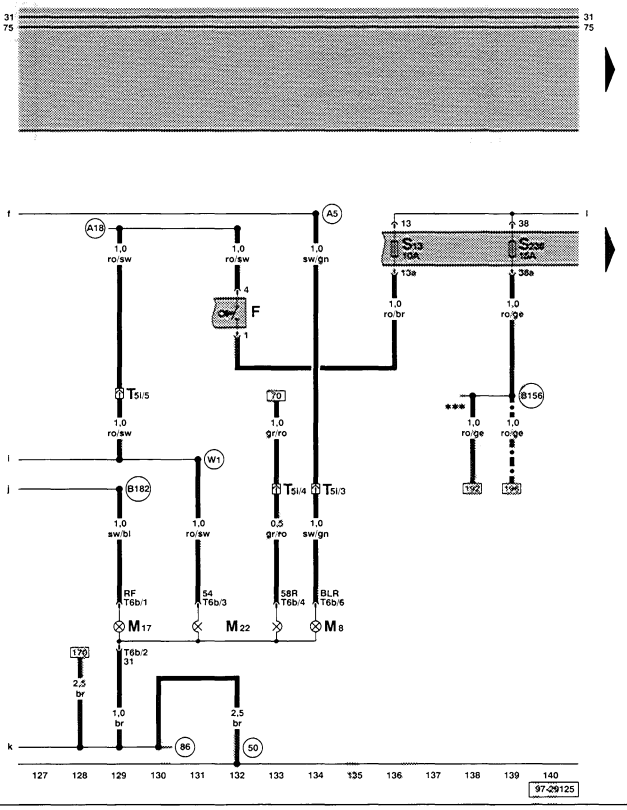
Back-up light switch, left rear turn signal light, left back-up light, left brake/tail light, high-mount brake light

F4 - Back-Up Light Switch
J226 - Park/Neutral Position (PNP) Relay
M6 - Left Rear Turn Signal Light
M16 - Left Back-Up Light
M21 - Left Brake/Tail Light
M25 - High-mount Brake Light (18 light emitting diodes)
T5 - 5-Pin Connector, black, connector station D-pillar, left
T5h - 5-Pin Connector, near left A-pillar, lower part, in harness
T6a - 6-Pin Connector
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left

(50) - Ground connection, in luggage compartment, left
(86) - Ground connection -1-, in rear wiring harness
(218) - Ground connection -1-, in rear lid wiring harness
(A6) - Plus connection (left turn signal), in instrument panel wiring harness
(A87) - Connection (reverse lamp), in instrument panel wiring harness
(B182) - Connection (RF), in passenger compartment wiring harness
(W1) - Plus connection (54), in rear wiring harness

* - Manual transmission only
--- Automatic transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



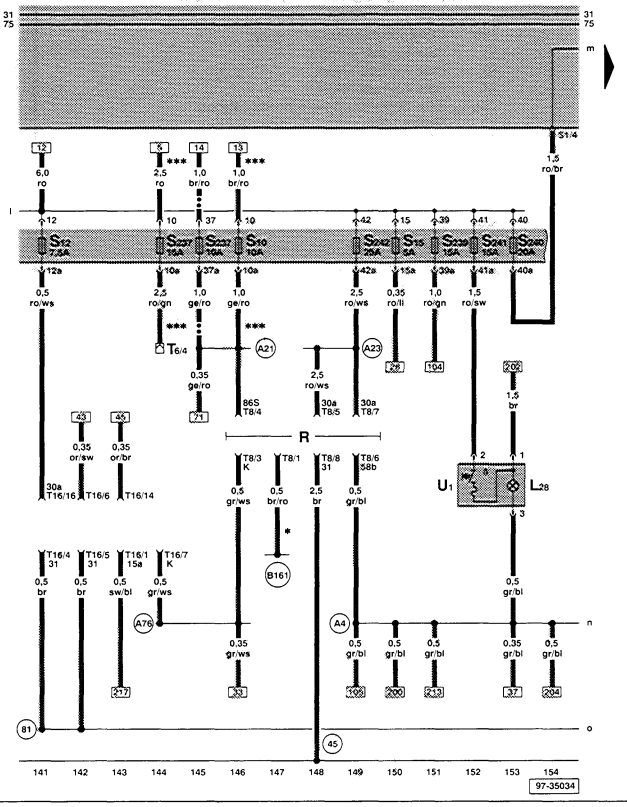
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Brake light switch, right rear turn signal light, right back-up light, right brake/tail light

F - Brake Light Switch
M8 - Right Rear Turn Signal Light
M17 - Right Back-Up Light
M22 - Right Brake/Tail Light
S13 - Fuse 13 in fuse holder
S238 - Fuse 38 in fuse holder
T5i - 5-Pin Connector, near left A-pillar, lower part, in harness
T6b - 6-Pin Connector

(50) - Ground connection, in luggage compartment, left
(86) - Ground connection -1-, in rear wiring harness
(A5) - Plus connection (right turn signal), in instrument panel wiring harness
(A18) - Wire connection (54), in instrument panel wiring harness
(B156) - Plus connection (30a), in wiring harness interior
(B182) - Connection (RF), in passenger compartment wiring harness
(W1) - Plus connection (54), in rear wiring harness

*** - Through April 2001
-•-•- Beginning May 2001



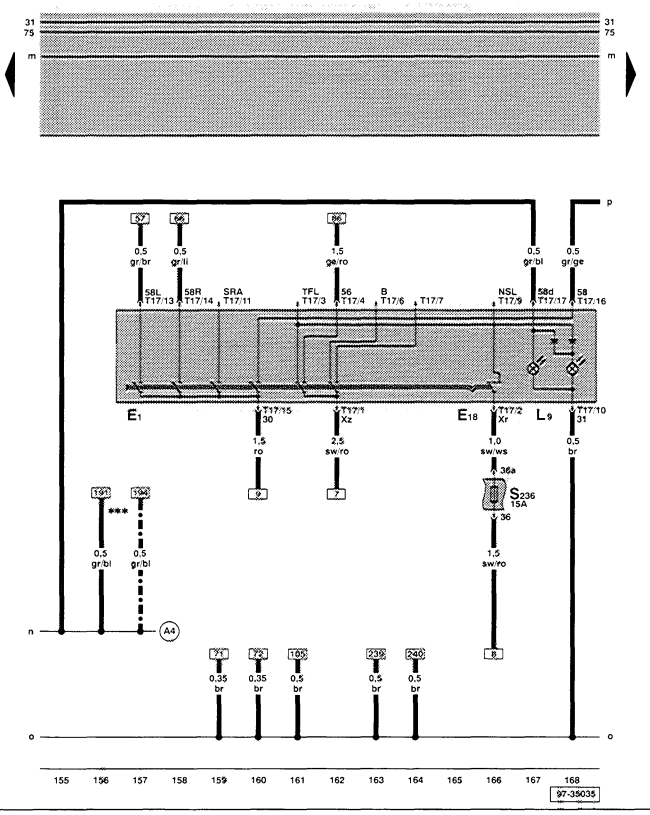
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sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Data Link Connector (DLC), radio connection, cigarette lighter

L28 - Cigarette Lighter Light
R - Radio**
S10 - Fuse 10 in fuse holder
S12 - Fuse 12 in fuse holder
S15 - Fuse 15 in fuse holder
S237 - Fuse 37 in fuse holder
S239 - Fuse 39 in fuse holder
S240 - Fuse 40 in fuse holder
S241 - Fuse 41 in fuse holder
S242 - Fuse 42 in fuse holder
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T8 - 8-Pin Connector**
T16 - Data Link Connector (DLC), below instrument panel, left
U1 - Cigarette Lighter

(45) - Ground connection, behind instrument panel, center
(81) - Ground connection -1-, in instrument panel wiring harness
(A4) - Plus connection (58b), in instrument panel wiring harness
(A21) - Wire connection (86s), in instrument panel wiring harness
(A23) - Wire connection (30a), in instrument panel wiring harness
(A76) - Connection (K-diagnosis wire) in instrument panel wiring harness
(B161) - Connection (anti-theft warning system), in wiring harness interior*

* - Vehicles with anti-theft warning system only (see wiring diagram comfort system/ central locking)
** - See also radio systems beginning August 2001
*** - Beginning November 2001
-••- Through October 2001



Light switch

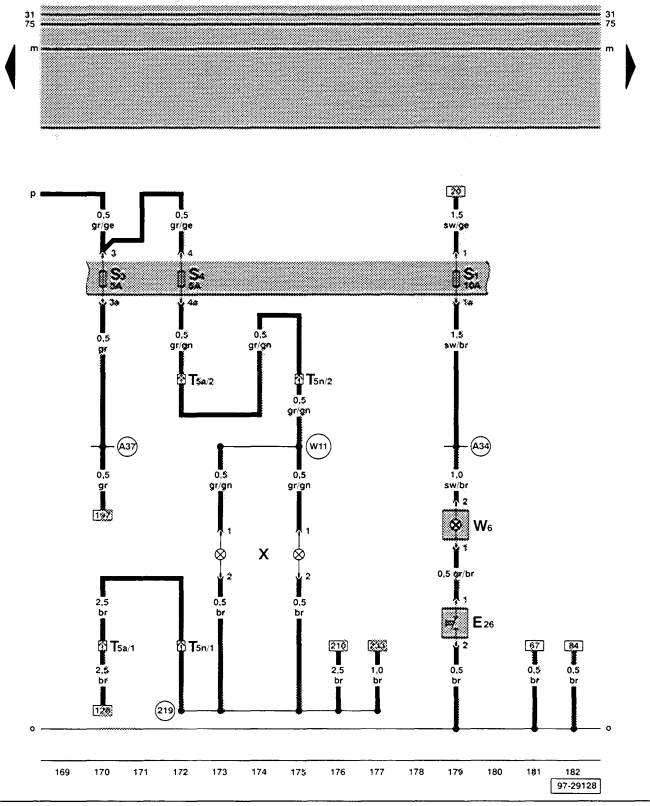
E1 - Light switch
E18 - Rear Fog Light Switch
L9 - Headlight Switch Light
S236 - Fuse 36 in fuse holder
T17 - 17-Pin Connector

(A4) - Plus connection (58b), in instrument panel wiring harness

*** - Through April 2001
-•-•- Beginning May 2001

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

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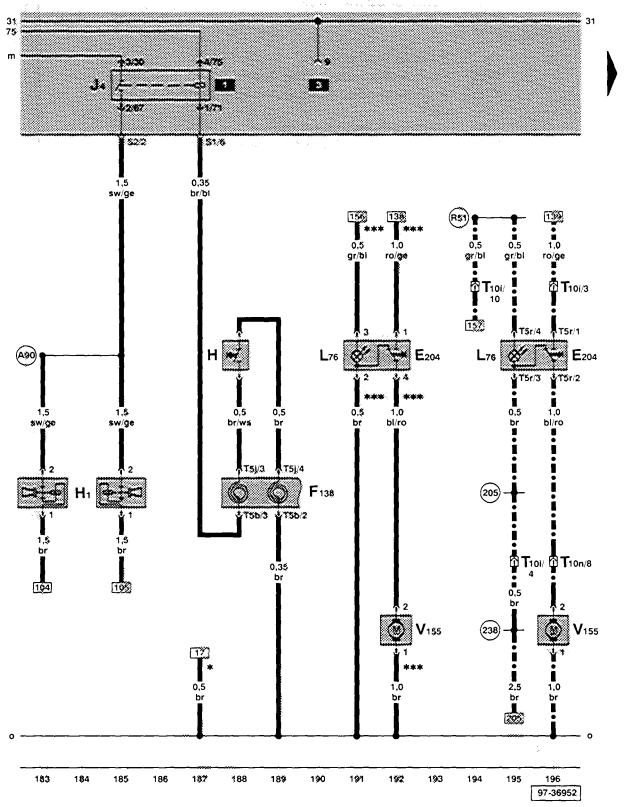
License plate light, glove compartment light

E26 - Glove compartment light switch
S1 - Fuse 1 in fuse holder
S3 - Fuse 3 in fuse holder
S4 - Fuse 4 in fuse holder
T5a - 5-Pin Connector, pink, connector station D-pillar, right
T5n - 5-Pin Connector, pink, in rear lid
W6 - Glove Compartment Light
X - License Plate Light

(219) - Ground connection -2-, in rear lid wiring harness
(A34) - Wire connection (75x), in instrument panel wiring harness
(A37) - Wire connection (58a), in instrument panel wiring harness
(W11) - Wire connection (58), in rear lid wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03



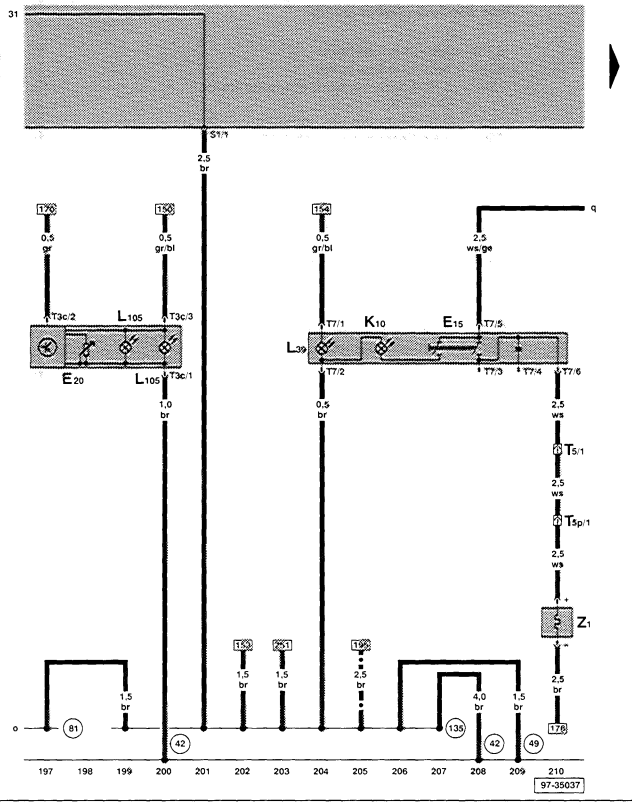
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Dual tone horn, fuel tank door remote

- E204 - Switch for remote/fuel tank door (also see Comfort System with power windows wiring diagram)
- F138 - Airbag Spiral Spring/Return Spring with Slip Ring
- H - Signal horn activation
- H1 - Dual tone horn
- J4 - Dual Horn Relay
- L76 - Push Button Light
- T5b - 5-Pin Connector
- T5j - 5-Pin Connector
- T5r - 5-Pin Connector
- T10i - 10-Pin Connector, black, connector station A-pillar, left
- T10n - 10-Pin Connector, brown, connector station A-pillar, left
- V155 - Motor for fuel tank lid unlock

- (205) - Ground connection, in driver's door wiring harness
- (238) - Ground connection -1-, in wiring harness interior
- (A90) - Connection (dual tone horn), in instrument panel wiring harness
- (R51) - Connection (58b) in door wiring harness, driver side

- * - Manual transmission only, (not 2.0L-Engine - code BBW. Different wiring ⇒ wiring diagram Motor)
- *** - Through April 2001
- -•-•- Beginning May 2001



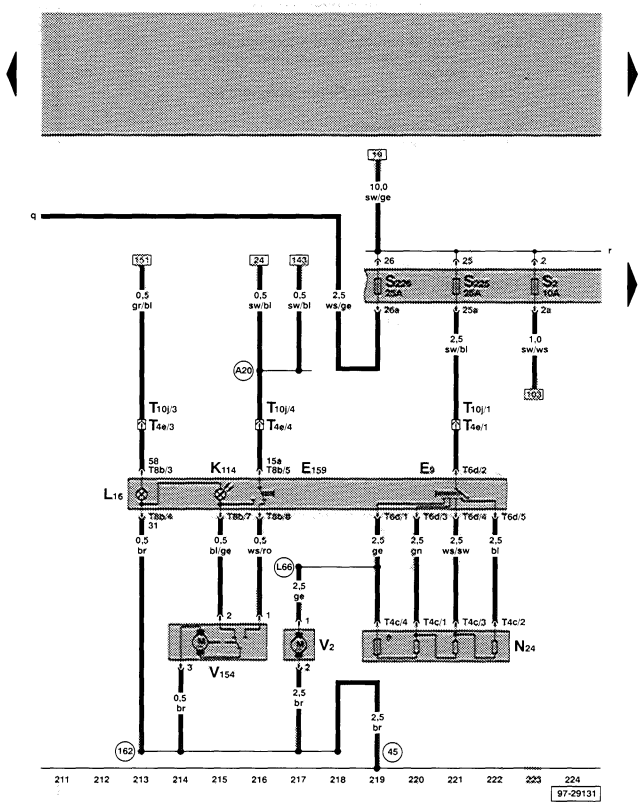
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Instrument panel light dimmer switch, rear window defogger switch, heated rear window

- E15 - Rear window defogger switch
- E20 - Instrument Panel Light Dimmer Switch
- K10 - Indicator light for heated rear windshield
- L39 - Rear Window Defogger Switch Light
- L105 - Illumination for lighting controller
- T3c - 3-Pin Connector
- T5 - 5-Pin Connector, black, connector station D-pillar, left
- T5p - 5-Pin Connector, black, in rear lid
- T7 - 7-Pin Connector
- Z1 - Heated rear window

- (42) - Ground connection, beside steering column
- (49) - Ground connection, on steering column
- (81) - Ground connection -1-, in instrument panel wiring harness
- (135) - Ground connection -2-, in instrument panel wiring harness

-•-•- Beginning May 2001



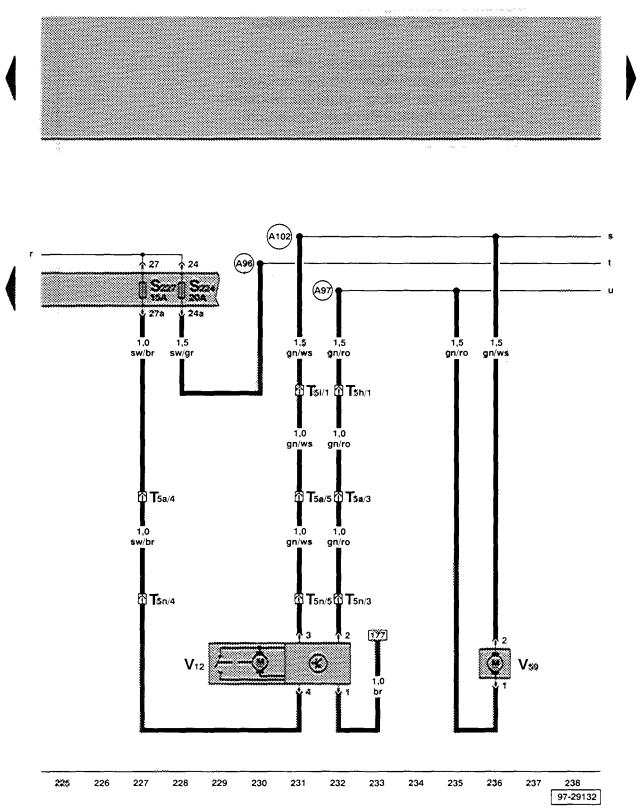
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Fresh air blower switch, fresh air/recirculating flap switch, fresh air blower

- E9 - Fresh Air Blower Switch
- E159 - Fresh Air/Recirculating Flap Switch
- K114 - Fresh Air and Recirculating Air Mode Indicator Light
- L16 - Fresh Air Control Lever Light
- N24 - Fresh Air Blower Series Resistance with Fuse
- S2 - Fuse 2 in fuse holder
- S225 - Fuse 25 in fuse holder
- S226 - Fuse 26 in fuse holder
- T4c - 4-Pin Connector
- T4e - 4-Pin Connector, behind instrument panel, center (in vehicles without air conditioning)
- T6d - 6-Pin Connector
- T8b - 8-Pin Connector
- T10j - 10-Pin Connector, behind instrument panel, center (in vehicles with air conditioning)
- V2 - Fresh Air Blower
- V154 - Servo motor for fresh-/recirculating air door

- (45) - Ground connection, behind instrument panel, center
- (162) - Ground connection, in blower motor wiring harness
- (A20) - Wire connection (15a), in instrument panel wiring harness
- (L66) - Connector, in wiring harness heater blower

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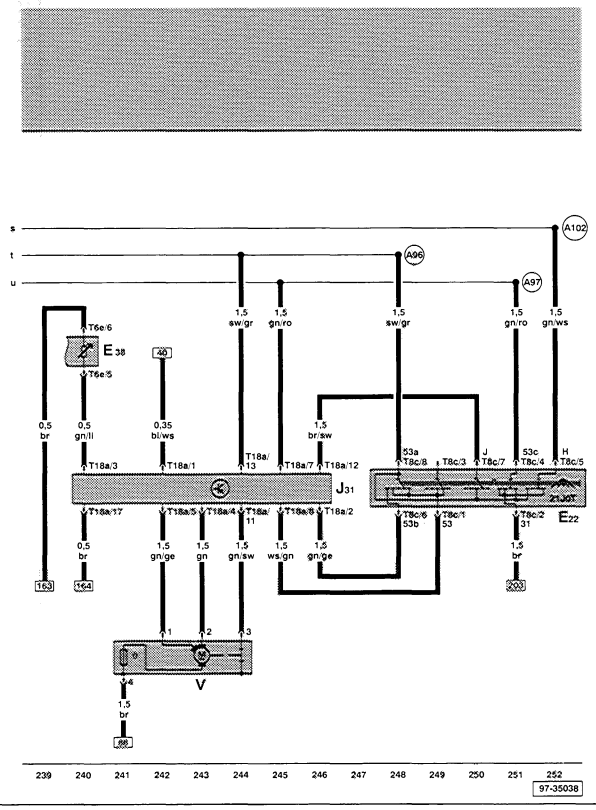
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motor for rear windshield wiper, windshield and rear window washer pump

- S224 - Fuse 24 in fuse holder
- S227 - Fuse 27 in fuse holder
- T5a - 5-Pin Connector, black, connector station D-pillar, right
- T5n - 5-Pin Connector, pink, in rear lid
- T5h - 5-Pin Connector, near left A-pillar, lower part, in harness
- T5i - 5-Pin Connector, near left A-pillar, lower part, in harness
- V12 - Motor for rear windshield wiper
- V59 - Windshield and Rear Window Washer Pump

- (A96) - Connection (53a), in instrument panel wiring harness
- (A97) - Connection (53), in instrument panel wiring harness
- (A102) - Connection (windshield wiper), in instrument panel wiring harness

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Windshield wiper/washer switch, windshield wiper intermittent regulator, windshield wiper motor, wiper/washer intermittent relay

E22 - Windshield Wiper/Washer Switch
E38 - Windshield Wiper Intermittent Regulator
J31 - Wiper/Washer Intermittent Relay, on relais panel
T6e - 6-Pin Connector
T8c - 8-Pin Connector
T18a - 18-Pin Connector
V - Windshield Wiper Motor

(A96) - Connection (53a), in instrument panel wiring harness
(A97) - Connection (53), in instrument panel wiring harness
(A102) - Connection (windshield wiper), in instrument panel wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03

Repair Manual page number 97-493

Repair Manual page number 97-492

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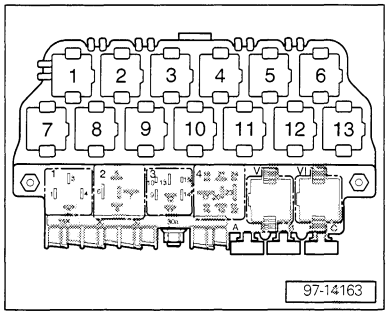
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Repair Manual page number 97-495

Golf/Jetta - Standard Equipment,

from January 2001

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations"



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

3 J207- Starting Interlock Relay (53)

Relay panel:

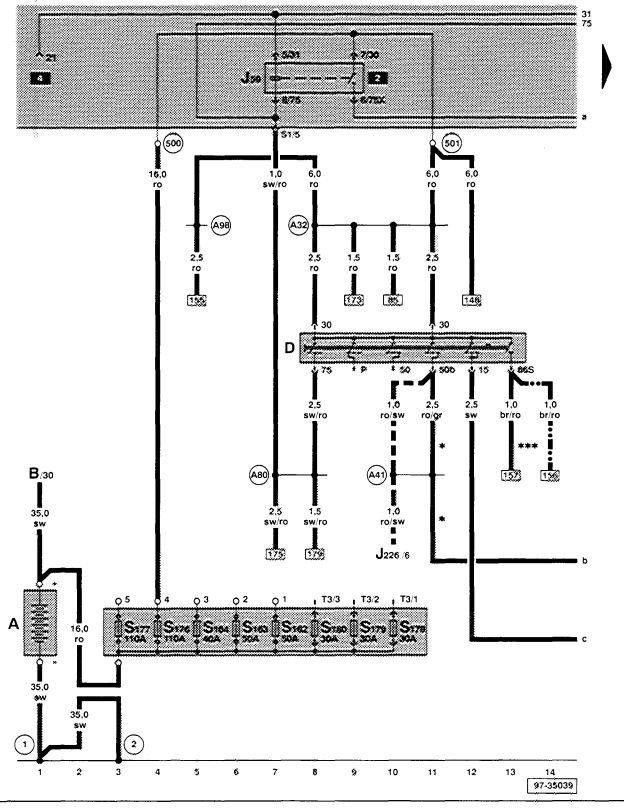
1 J4 - Dual Horn Relay (53)

2 J52 - Load Reduction Relay (100)

V J31 - Wiper/Washer Intermittent Relay (377)

VI J31 - Wiper/Washer Intermittent Relay (377)

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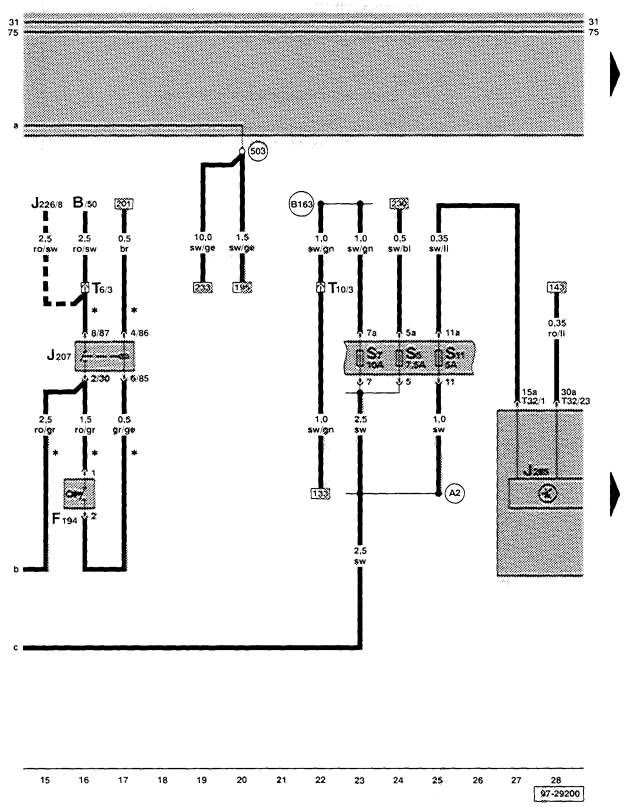
Battery, ignition/starter switch

A - Battery
B - Starter
D - Ignition/Starter Switch
J59 - Load Reduction Relay
J226 - Park/Neutral Position (PNP) Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S164 - Fuse -3- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
S178 - Fuse -6- (30) in fuse bracket/battery
S179 - Fuse -7- (30) in fuse bracket/battery
S180 - Fuse -8- (30) in fuse bracket/battery
T3 - 3-Pin Connector

(1) - Ground strap, battery to body
(2) - Ground strap, transmission to body
(500) - Threaded connection -1- (30) on the relay plate
(501) - Threaded connection -2- (30) on the relay plate
(A32) - Plus connection (30), in instrument panel wiring harness
(A41) - Plus connection (50), in instrument panel wiring harness (gasoline engine only) through April 2001
(A80) - Connection -1- (X), in instrument panel wiring harness
(A98) - Plus connection -4- (30), in instrument panel wiring harness

* - Manual transmission only, (not 2.0L-Engine - code BBW. Different wiring ⇒ wiring diagram Motor)
--- Automatic transmission only
*** - Beginning November 2001
-•-• Through October 2001

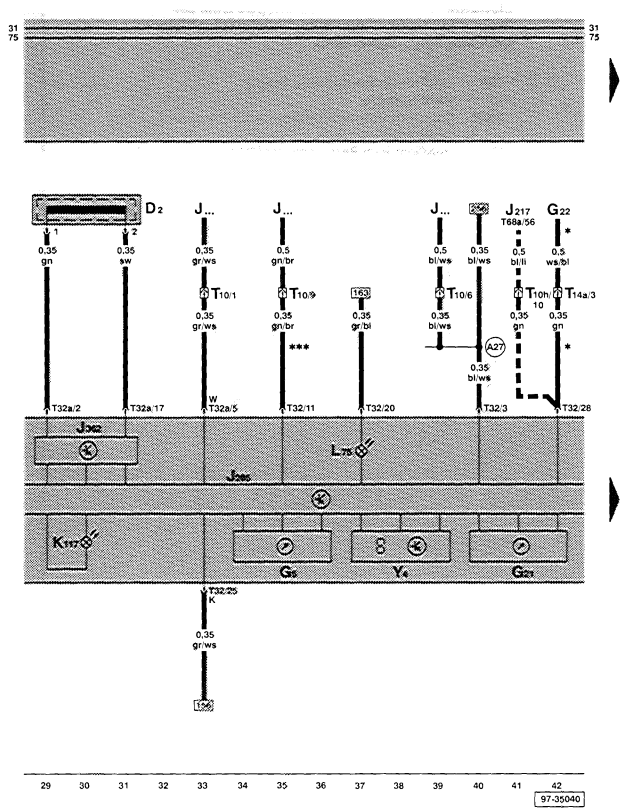
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay

- B - Starter
- F194 - Clutch Pedal Position (CPP) Switch*
- J207 - Starting Interlock Relay*
- J226 - Park/Neutral Position (PNP) Relay
- J285 - Control module with indicator unit in instrument panel insert
- S5 - Fuse 5 in fuse holder
- S7 - Fuse 7 in fuse holder
- S11 - Fuse 11 in fuse holder
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T32 - 32-Pin Connector, blue
- (503) - Threaded connection -2- (75x) on the relay plate
- (A2) - Plus connection (15), in instrument panel wiring harness
- (B163) - Plus connection -1- (15) in wiring harness interior
- * - Manual transmission only, (not 2.0L-Engine - code BBW. Different wiring ⇒ wiring diagram Motor)
- --- - Automatic transmission only

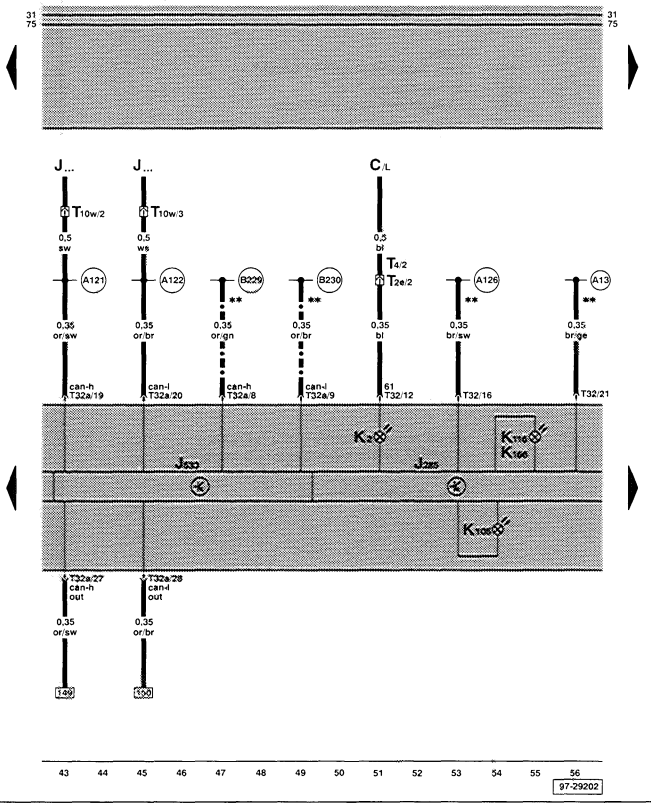
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Instrument cluster, tachometer, speedometer, odometer display, anti-theft immobilizer, warning light for anti-theft immobilizer sensor

- D2 - Induction coil of anti-theft immobilizer
- G5 - Tachometer
- G21 - Speedometer
- G22 - Speedometer Vehicle Speed Sensor
- J217 - Transmission Control Module (TCM)
- J285 - Control module with indicator unit in instrument panel insert
- J362 - Control module for anti-theft immobilizer
- J... - Engine Control Module (ECM)
- K117 - Warning light for anti-theft immobilizer sensor
- L75 - Digital Display Light
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, in engine compartment, in wiring duct, left
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green
- T68a - 68-Pin Connector, on Transmission Control Module (TCM)
- Y4 - Odometer Display
- (A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness
- * - 4 speed automatic transmission/ manual transmission
- --- - 5 speed automatic transmission
- *** - Through April 20002

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



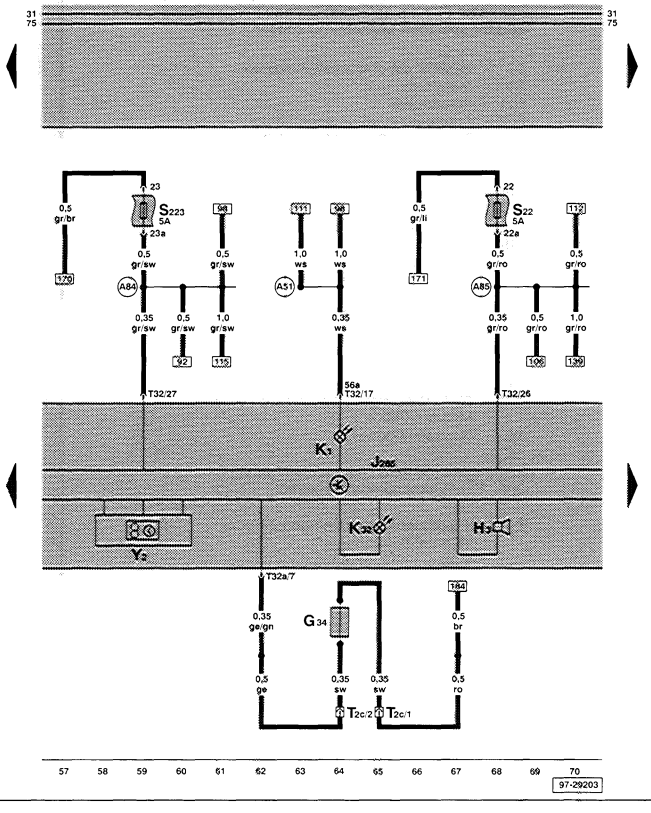
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Instrument cluster, generator (GEN) warning light, low fuel level warning light, warning light for rear lid unlocked/door ajar indicator lamp

- C - Generator (GEN)
- J285 - Control module with indicator unit in instrument panel insert
- J533 - Data Bus On Board Diagnostic Interface
- J... - Engine Control Module (ECM)
- K2 - Generator (GEN) Warning Light
- K105 - Low Fuel Level Warning Light
- K116 - Warning light for rear lid unlocked (through April 2001)
- K166 - Door Ajar Indicator Lamp (from May 2001)
- T2e - Double Connector, near starter (in vehicles without air conditioning)
- T4 - 4-Pin Connector, near starter (in vehicles with air conditioning)
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green

- (A13) - Wire connection (door contact switch) in instrument panel wiring harness**
- (A121) - Connection (high bus), in instrument panel wiring harness
- (A122) - Connection (low bus), in instrument panel wiring harness
- (A126) - Connection (contact switch in rear lid) in instrument panel wiring harness**
- (B229) - Connection (high bus), in instrument panel wiring harness**
- (B230) - Connection (low bus), in instrument panel wiring harness**

** - See also wiring diagram Comfort System
-•-•- Beginning May 2001

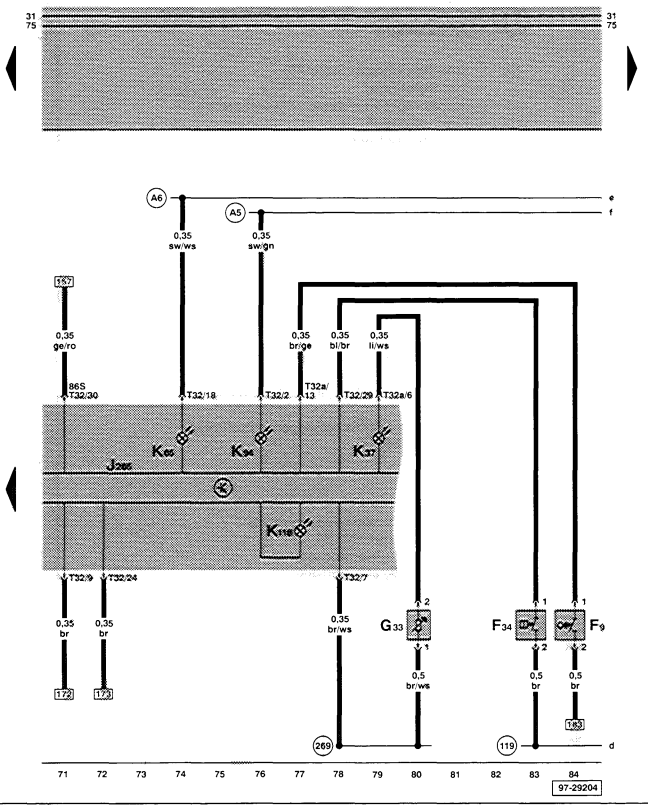


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Instrument cluster, left front brake pad wear sensor, brake pad wear indicator light, headlight high beam indicator light, digital clock

- G34 - Left Front Brake Pad Wear Sensor
- H3 - Warning buzzer
- J285 - Control module with indicator unit in instrument panel insert
- K1 - Headlight High Beam Indicator Light
- K32 - Brake Pad Wear Indicator Light
- S22 - Fuse 22 in fuse holder
- S223 - Fuse 23 in fuse holder
- T2c - Double Connector, near left front brake pad wear sensor
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green
- Y2 - Digital Clock

- (A51) - Wire connection (56), in instrument panel wiring harness
- (A84) - Connection (58L) in instrument panel wiring harness
- (A85) - Connection (58R) in instrument panel wiring harness

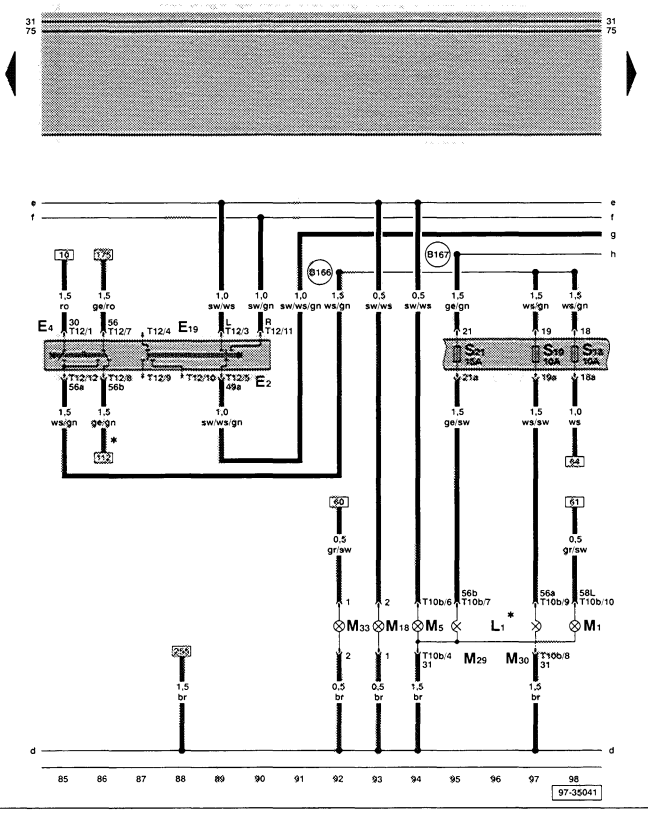


Instrument cluster, parking brake warning light switch, brake fluid level warning switch, low windshield washer fluid level indication, left and right turn signal indicator lights

- F9 - Parking Brake Warning Light Switch
- F34 - Brake Fluid Level Warning Switch
- G33 - Windshield Washer Fluid Level Sensor
- J285 - Control module with indicator unit in instrument panel insert
- K37 - Low Windshield Washer Fluid Level Indicator Light
- K65 - Left Turn Signal Indicator Light
- K94 - Right Turn Signal Indicator Light
- K118 - Warning light for brake system
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green

- (119) - Ground connection -1-, in headlight wiring harness
- (269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
- (A5) - Plus connection (right turn signal), in instrument panel wiring harness
- (A6) - Plus connection (left turn signal), in instrument panel wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



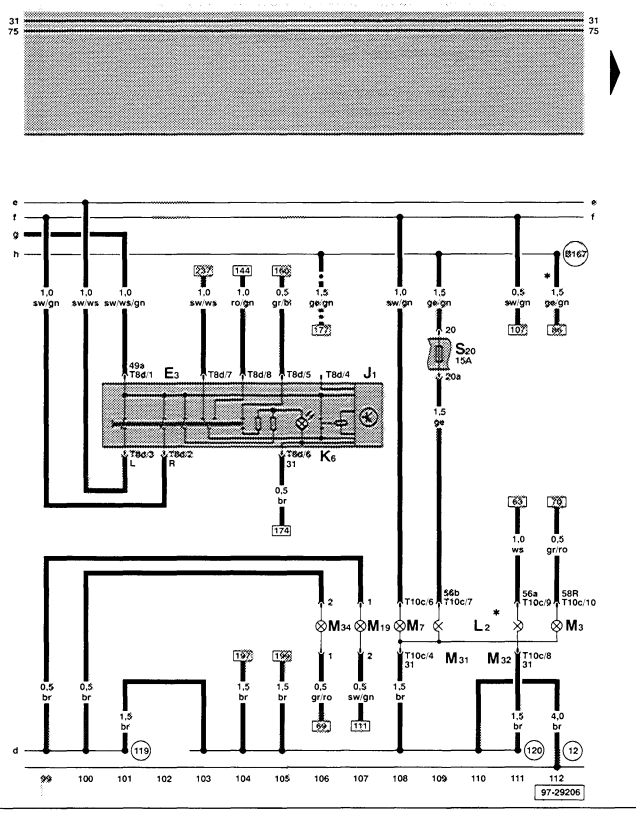
Turn signal switch, headlight dimmer/flasher switch, left front turn signal light, light for side marker front left, left headlight

- E2 - Turn signal switch
- E4 - Headlight Dimmer/Flasher Switch
- E19 - Park Light Switch
- L1 - Left Headlight*
- M1 - Left Parking Light
- M5 - Left Front Turn Signal Light
- M18 - Left, Side Turn Signal Light
- M29 - Left Low Beam Headlight (Golf only)
- M30 - Left High Beam Headlight (Golf only)
- M33 - Light for side marker front left
- S18 - Fuse 18 in fuse holder
- S19 - Fuse 19 in fuse holder
- S21 - Fuse 21 in fuse holder
- T10b - 10-Pin Connector
- T12 - 12-Pin Connector

- (B166) - Connection (56a) in passenger compartment wiring harness
- (B167) - Connection (56b) in passenger compartment wiring harness

* - Jetta only
- Vehicles with daytime running lights
⇒ wiring diagram No. 61

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

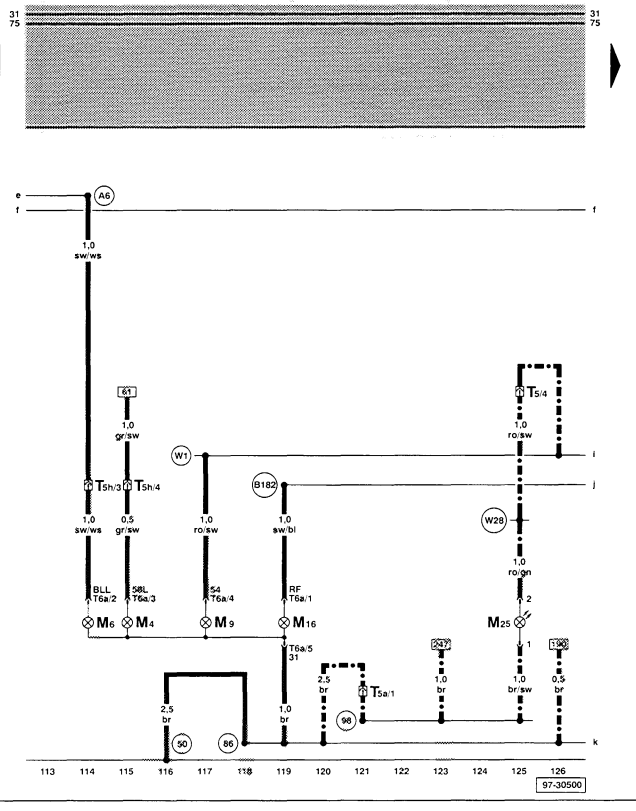
Emergency flasher switch, turn signal relay, right front turn signal light, light for side marker front right, right headlight

- E3 - Emergency Flasher Switch**
- J1 - Turn Signal Relay
- K6 - Indicator light for emergency flasher system
- L2 - Right Headlight*
- M3 - Right Parking Light
- M7 - Right Front Turn Signal Light
- M19 - Right, Side Turn Signal Light
- M31 - Right Low Beam Headlight (Golf only)
- M32 - Right High Beam Headlight (Golf only)
- M34 - Light for side marker front right
- S20 - Fuse 20 in fuse holder
- T8d - 8-Pin Connector
- T10c - 10-Pin Connector

- (12) - Ground connection, in engine compartment, left
- (119) - Ground connection -1-, in headlight wiring harness
- (120) - Ground connection -2-, in headlight wiring harness
- (B167) - Connection (56b), in passenger compartment wiring harness

- * - Jetta only
- -•-•- - Golf only
- - Vehicles with daytime running lights ⇒ wiring diagram No. 61
- ** - Vehicles with Telematic system ⇒ wiring diagram Telematic

Repair Manual page number 97-503



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

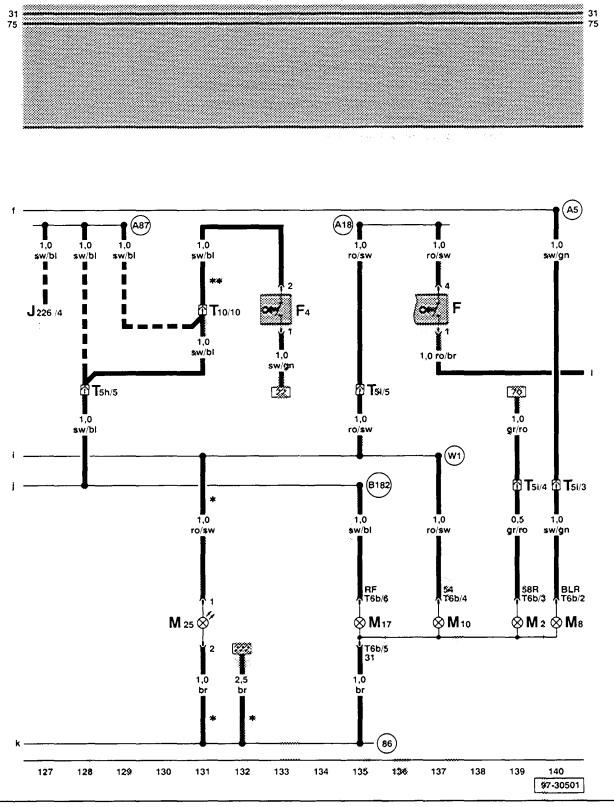
Left rear turn signal light, left back-up light, left brake/tail light, high-mount brake light (Golf only)

- M4 - Left Tail Light
- M6 - Left Rear Turn Signal Light
- M9 - Left Brake Light
- M16 - Left Back-Up Light
- M25 - High-mount Brake Light (32 light emitting diodes)
- T5 - 5-Pin Connector, black, connector station C-pillar, left
- T5a - 5-Pin Connector, pink, connector station C-pillar, left (Golf only)
- T5h - 5-Pin Connector, near left A-piliar, lower part, in harness
- T6a - 6-Pin Connector

- (50) - Ground connection, in luggage compartment, left
- (86) - Ground connection -1-, in rear wiring harness
- (98) - Ground connection, in rear lid wiring harness
- (A6) - Plus connection (left turn signal), in instrument panel wiring harness
- (B182) - Connection (RF), in passenger compartment wiring harness
- (W1) - Plus connection -1- (54), in rear wiring harness
- (W28) - Plus connection -2- (54), in wiring harness taillight assembly

- -•-•- Golf only

Repair Manual page number 97-502



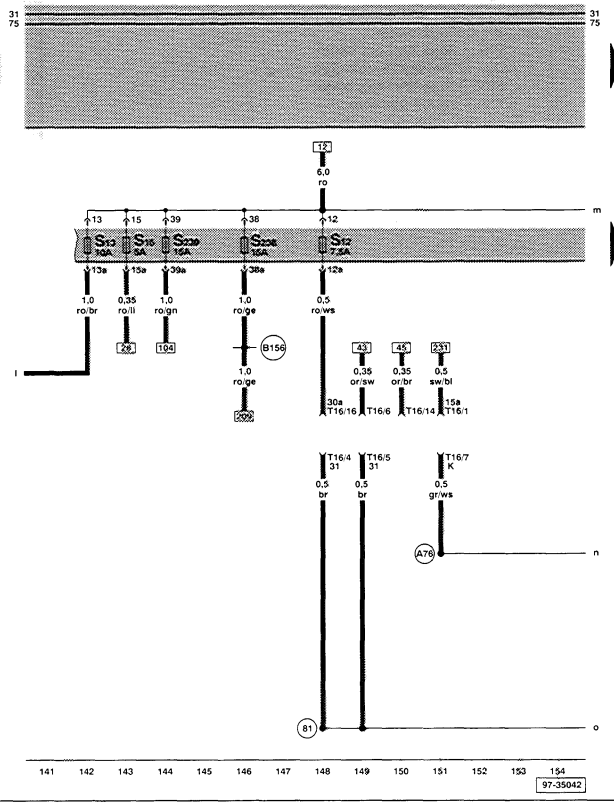
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Back-up light switch, brake light switch, right rear turn signal light, right back-up light, right brake/tail light

- F - Brake Light Switch
- F4 - Back-Up Light Switch
- J226 - Park/Neutral Position (PNP) Relay
- M2 - Right Tail Light
- M8 - Right Rear Turn Signal Light
- M10 - Right Brake Light
- M17 - Right Back-Up Light
- M25 - High-mount Brake Light (18 light emitting diodes)*
- T5h - 5-Pin Connector, near left A-pillar, lower part, in harness
- T5i - 5-Pin Connector, near left A-pillar, lower part, in harness
- T6b - 6-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left

- (86) - Ground connection -1-, in rear wiring harness
- (A5) - Plus connection (right turn signal), in instrument panel wiring harness
- (A18) - Wire connection (54), in instrument panel wiring harness
- (A87) - Connection (reverse lamp), in instrument panel wiring harness
- (B182) - Connection (RF), in passenger compartment wiring harness
- (W1) - Plus connection -1- (54), in rear wiring harness

* - Jetta only
** - Manual transmission only
--- Automatic transmission only

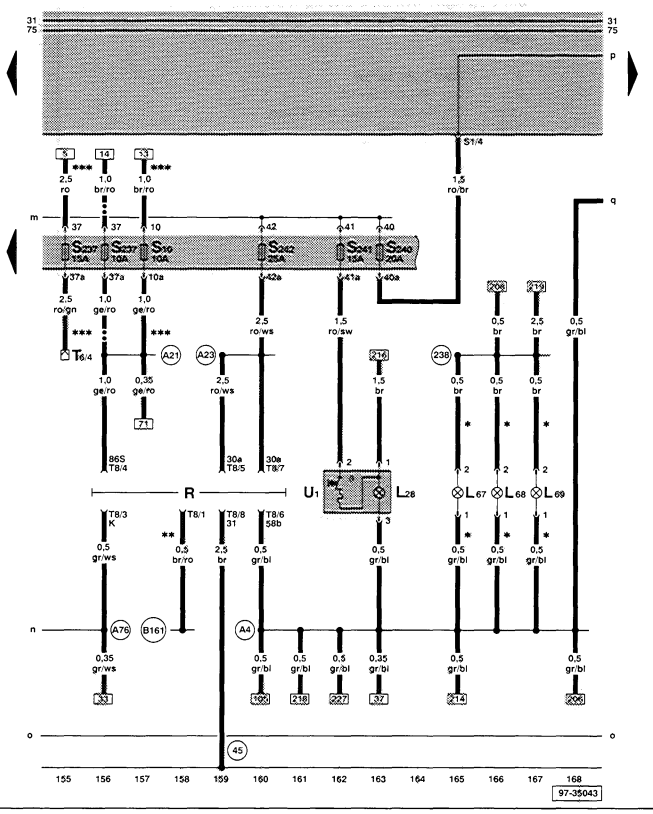


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Data Link Connector (DLC)

- S12 - Fuse 12 in fuse holder
- S13 - Fuse 13 in fuse holder
- S15 - Fuse 15 in fuse holder
- S238 - Fuse 38 in fuse holder
- S239 - Fuse 39 in fuse holder
- T16 - Data Link Connector (DLC), below instrument panel, left

- (81) - Ground connection -1-, in instrument panel wiring harness
- (A76) - Connection (K-diagnosis wire) in instrument panel wiring harness
- (B156) - Plus connector (30a), in wiring harness interior



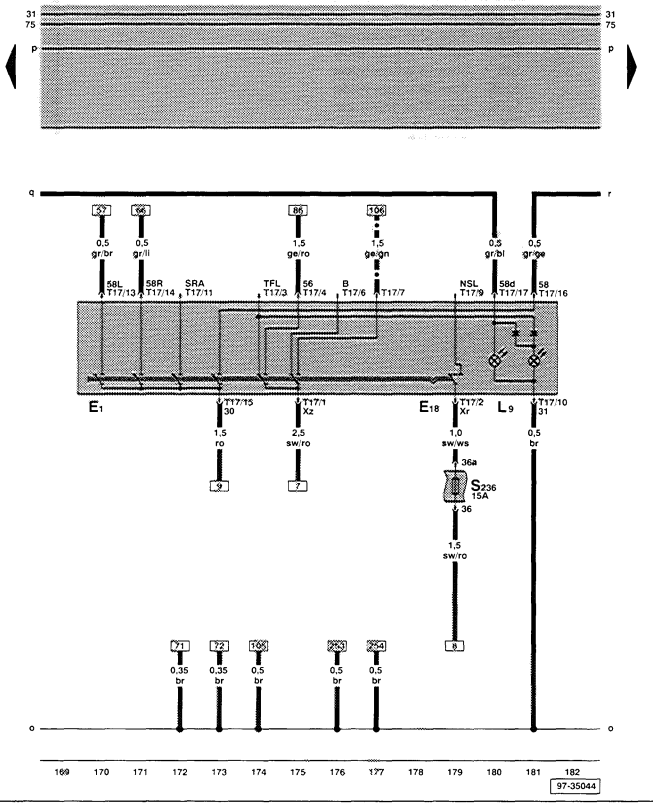
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Radio connection, cigarette lighter, instrument panel vent illumination

- L28 - Cigarette Lighter Light
- L67 - Left Instrument Panel Vent Illumination
- L68 - Center Instrument Panel Vent Illumination
- L69 - Right Instrument Panel Vent Illumination
- R - Radio****
- S10 - Fuse 10 in fuse holder
- S237 - Fuse 37 in fuse holder
- S240 - Fuse 40 in fuse holder
- S241 - Fuse 41 in fuse holder
- S242 - Fuse 42 in fuse holder
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T8 - 8-Pin Connector****
- U1 - Cigarette Lighter

- (45) - Ground connection, behind instrument panel, center
- (238) - Ground connection -1-, in wiring harness interior
- (A4) - Plus connection (58b), in instrument panel wiring harness
- (A21) - Wire connection (86s), in instrument panel wiring harness
- (A23) - Wire connection (30a), in instrument panel wiring harness
- (A76) - Connection (K-diagnosis wire) in instrument panel wiring harness
- (B161) - Connection (anti-theft warning system), in wiring harness interior**

- * - Jetta only
- ** - Vehicles with anti-theft warning system only (see wiring diagram comfort system/ central locking)
- *** - Beginning November 2001
- **** - See also radio systems beginning August 2001
- -•••- Through October 2001



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

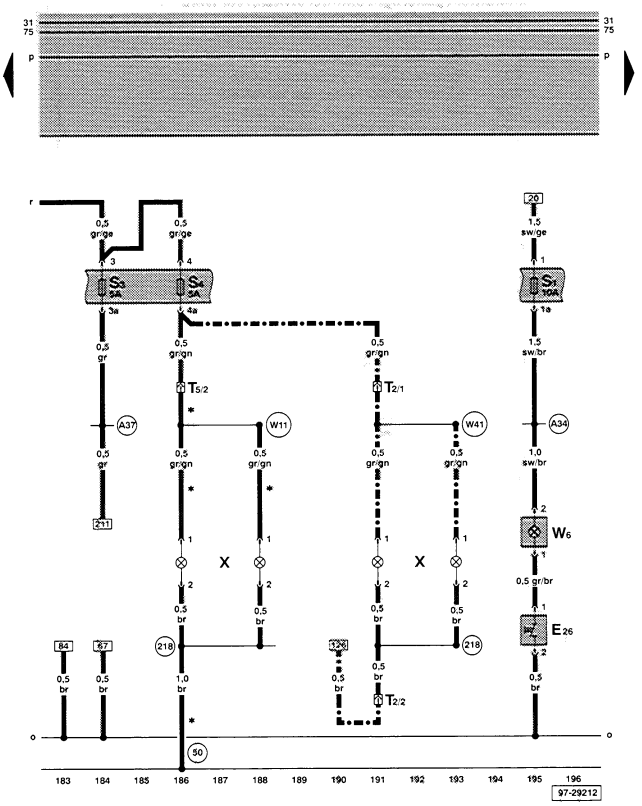
Light switch

- E1 - Light switch
- E18 - Rear Fog Light Switch
- L9 - Headlight Switch Light
- S236 - Fuse 36 in fuse holder
- T17 - 17-Pin Connector

-•-•- Golf only

Repair Manual page number 97-507

Repair Manual page number 97-506



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

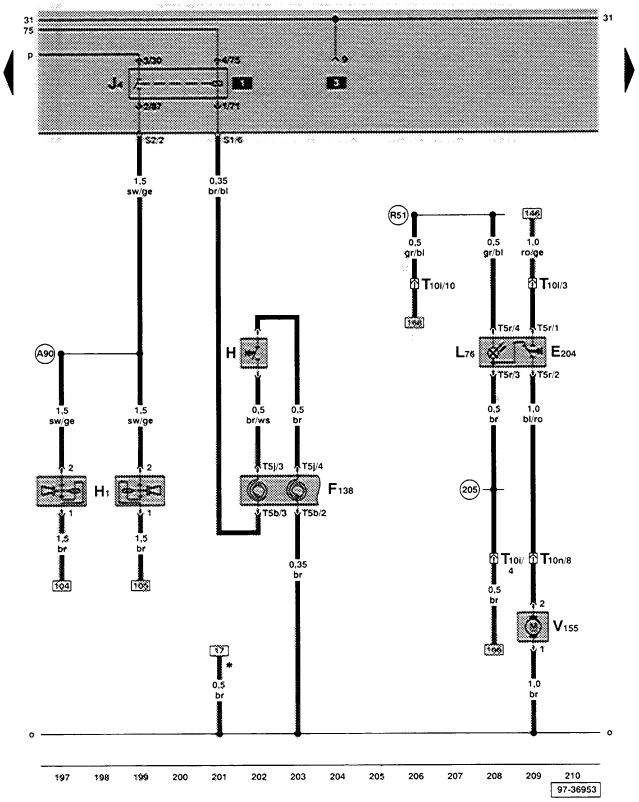
License plate light, glove compartment light

- E26 - Glove compartment light switch
- S1 - Fuse 1 in fuse holder
- S3 - Fuse 3 in fuse holder
- S4 - Fuse 4 in fuse holder
- T2 - Double Connector, in luggage compartment, left (Golf only)
- T5 - 5-Pin Connector, black, connector station C-pillar, left
- W6 - Glove Compartment Light
- X - License Plate Light

- (50) - Ground connection, in luggage compartment, left
- (218) - Ground connection -1-, in rear lid wiring harness
- (A34) - Wire connection (75x), in instrument panel wiring harness
- (A37) - Wire connection (58a), in instrument panel wiring harness
- (W11) - Wire connection (58), in rear lid wiring harness
- (W41) - Plus connection (58), in wiring harness

* - Jetta only
-•-•- Golf only

Edition 04.03



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

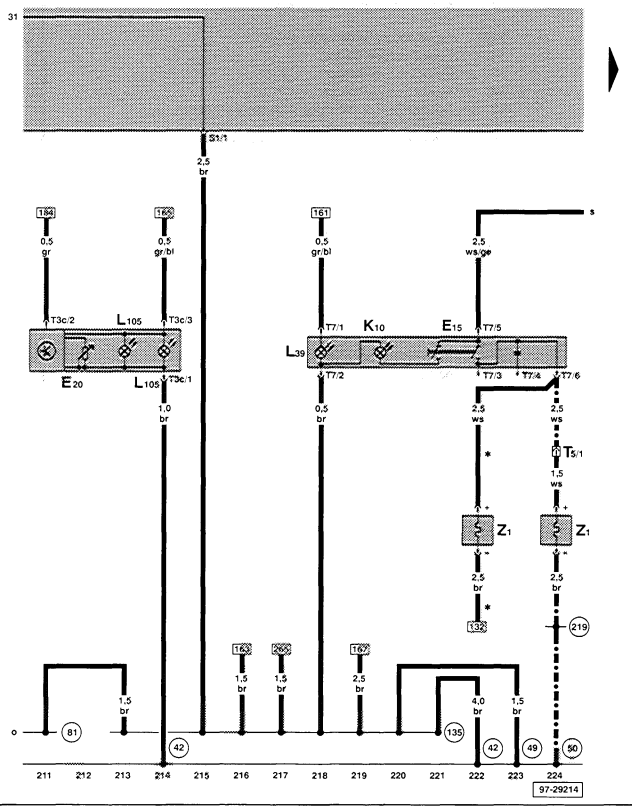
Dual tone horn, fuel tank door remote

- E204 - Switch for remote/fuel tank door (also see Comfort System with power windows wiring diagram)
- F138 - Airbag Spiral Spring/Return Spring with Slip Ring
- H - Signal horn activation
- H1 - Dual tone horn
- J4 - Dual Horn Relay
- L76 - Push Button Light
- T5b - 5-Pin Connector
- T5j - 5-Pin Connector
- T5r - 5-Pin Connector
- T10l - 10-Pin Connector, black, connector station A-pillar, left
- T10n - 10-Pin Connector, brown, connector station A-pillar, left
- V155 - Motor for fuel tank lid unlock

- (205) - Ground connection, in driver's door wiring harness
- (A90) - Connection (dual tone horn), in instrument panel wiring harness
- (R51) - Connection (58b) in door wiring harness, driver side

* - Manual transmission only, (not 2.0L-Engine - code BBW. Different wiring ⇒ wiring diagram Motor)

Edition 09.03



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

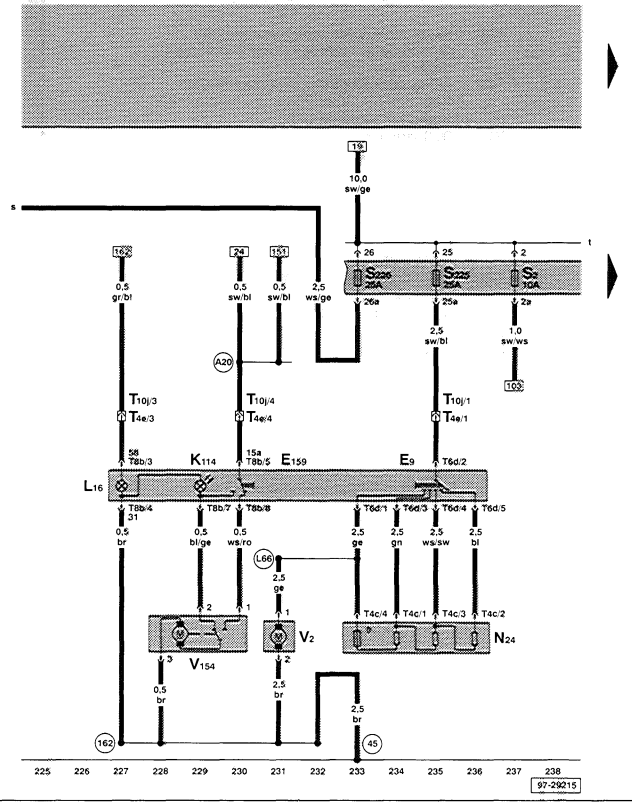
Instrument panel light dimmer switch, rear window defogger switch, heated rear window

- E15 - Rear window defogger switch
- E20 - Instrument Panel Light Dimmer Switch
- K10 - Indicator light for heated rear windshield
- L39 - Rear Window Defogger Switch Light
- L105 - Illumination for lighting controller
- T3c - 3-Pin Connector
- T5 - 5-Pin Connector, black, connector station C-pillar, left
- T7 - 7-Pin Connector
- Z1 - Heated rear window

- (42) - Ground connection, beside steering column
- (49) - Ground connection, on steering column
- (50) - Ground connection, in luggage compartment, left
- (81) - Ground connection -1-, in instrument panel wiring harness
- (135) - Ground connection -2-, in instrument panel wiring harness
- (219) - Ground connection -2-, in rear lid wiring harness

* - Jetta only
-•-•- Golf only

Repair Manual page number 97-511



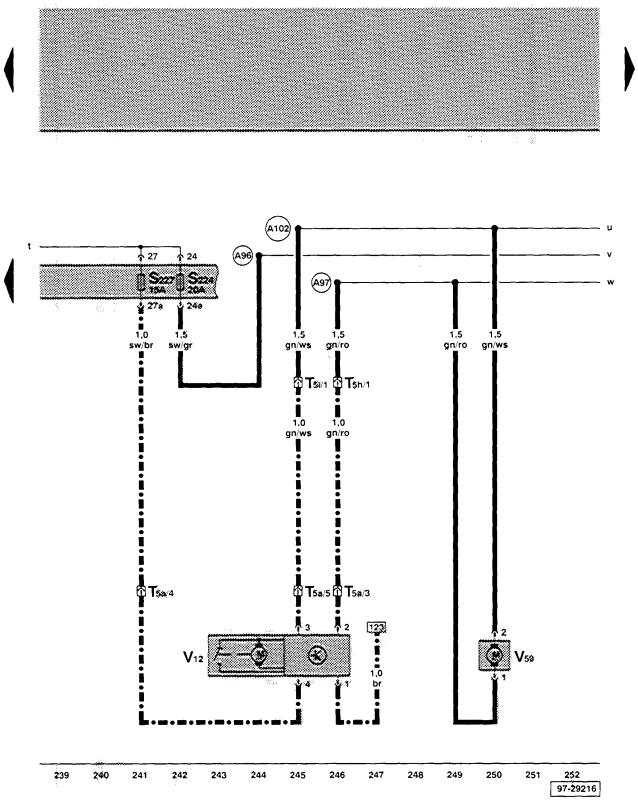
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Fresh air blower switch, fresh air/recirculating flap switch, fresh air blower

- E9 - Fresh Air Blower Switch
- E159 - Fresh Air/Recirculating Flap Switch
- K114 - Fresh Air and Recirculating Air Mode Indicator Light
- L16 - Fresh Air Control Lever Light
- N24 - Fresh Air Blower Series Resistance with Fuse
- S2 - Fuse 2 in fuse holder
- S225 - Fuse 25 in fuse holder
- S226 - Fuse 26 in fuse holder
- T4c - 4-Pin Connector
- T4e - 4-Pin Connector, behind instrument panel, center (in vehicles without air conditioning)
- T6d - 6-Pin Connector
- T8b - 8-Pin Connector
- T10j - 10-Pin Connector, behind instrument panel, center (in vehicles with air conditioning)
- V2 - Fresh Air Blower
- V154 - Servo motor for fresh-/recirculating air door

- (45) - Ground connection, behind instrument panel, center
- (162) - Ground connection, in blower motor wiring harness
- (A20) - Wire connection (15a), in instrument panel wiring harness
- (L66) - Connection, in wiring harness heater blower

Repair Manual page number 97-510



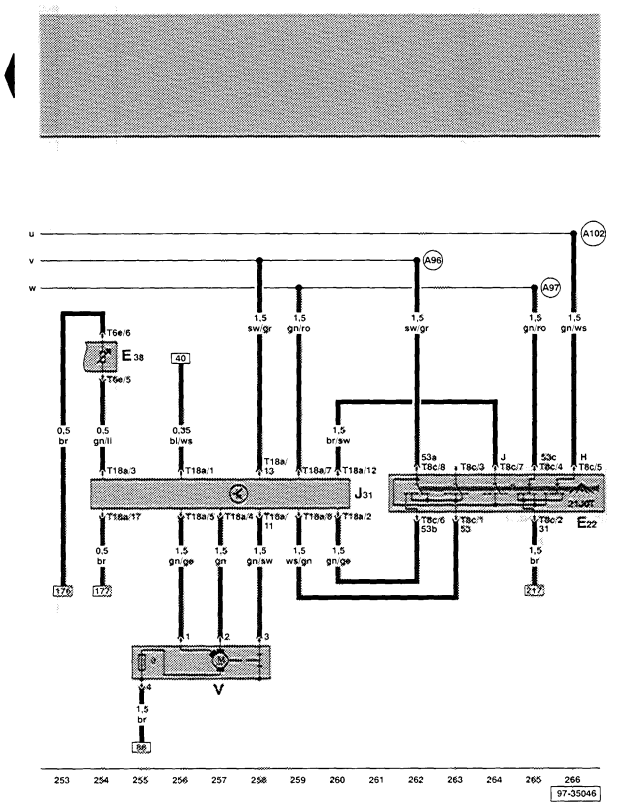
Motor for rear windshield wiper, windshield and rear window washer pump

S224 - Fuse 24 in fuse holder
S227 - Fuse 27 in fuse holder
T5a - 5-Pin Connector, pink, connector station C-pillar, left
T5h - 5-Pin Connector, near left A-pillar, lower part, in harness
T5i - 5-Pin Connector, near left A-pillar, lower part, in harness
V12 - Motor for rear windshield wiper
V59 - Windshield and Rear Window Washer Pump

(A96) - Connection (53a), in instrument panel wiring harness
(A97) - Connection (53), in instrument panel wiring harness
(A102) - Connection (windshield wiper), in instrument panel wiring harness

-•-•-- Golf only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Windshield wiper/washer switch, windshield wiper intermittent regulator, windshield wiper motor, wiper/washer intermittent relay

E22 - Windshield Wiper/Washer Switch
E38 - Windshield Wiper Intermittent Regulator
J31 - Wiper/Washer Intermittent Relay, on relais panel
T6e - 6-Pin Connector
T8c - 8-Pin Connector
T18a - 18-Pin Connector
V - Windshield Wiper Motor

(A96) - Connection (53a), in instrument panel wiring harness
(A97) - Connection (53), in instrument panel wiring harness
(A102) - Connection (windshield wiper), in instrument panel wiring harness

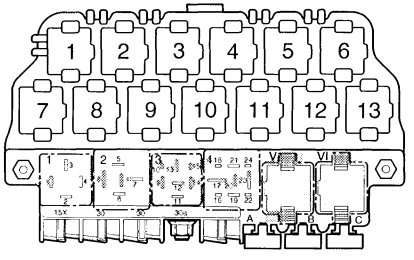
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Comfort system (vehicles without power windows),

from January 2001

- **Anti-theft warning system**
- **Central locking system with remote control**
- **Fuel tank lid unlock system**
- **Heated outside mirrors**
- **Interior lights**
- **Luggage compartment light**
- **Power sunroof**
- **Rear lid unlock system**

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



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Relay location on the thirteenfold auxiliary relay panel, above relay panel:

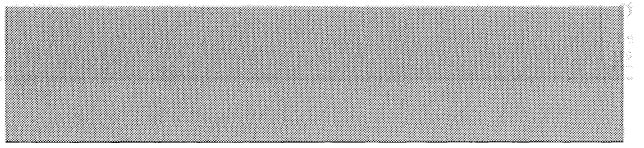
2 Relay for motor remote unlock rear lid (79)

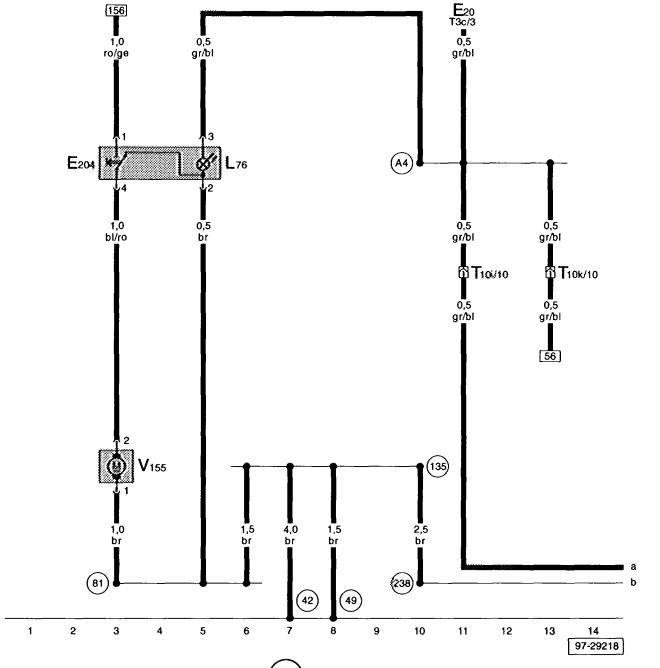
Relay panel:

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



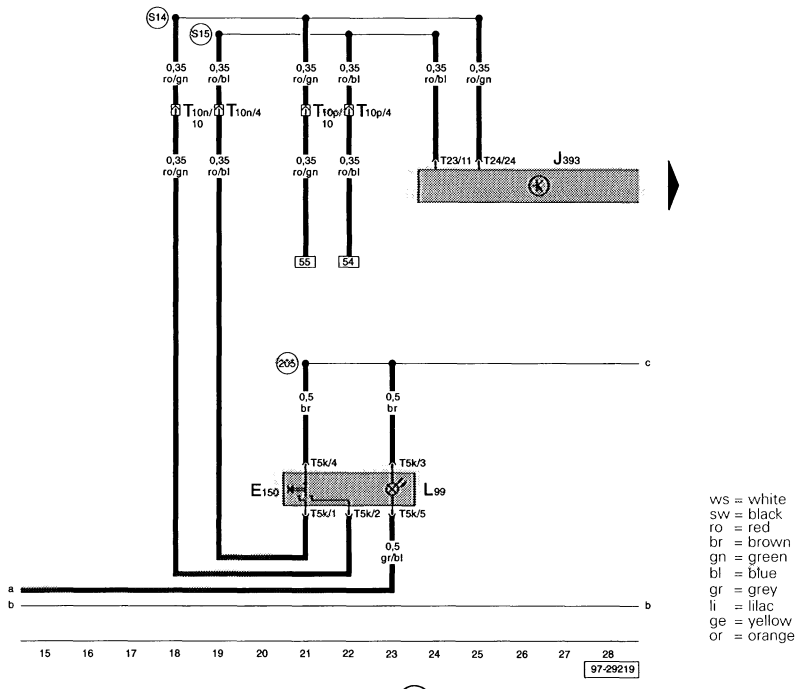


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E20 - Instrument Panel Light Dimmer Switch
E204 - Switch for remote/fuel tank door
L76 - Push Button Light
T3c - 3-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10k - 10-Pin Connector, black, connector station A-pillar, right
V155 - Motor for fuel tank lid unlock

(42) - Ground connection, beside steering column
(49) - Ground connection, on steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(238) - Ground connection -1-, in wiring harness interior
(A4) - Plus connection (58b), in instrument panel wiring harness

Switch for remote/fuel tank door, motor for fuel tank lid unlock

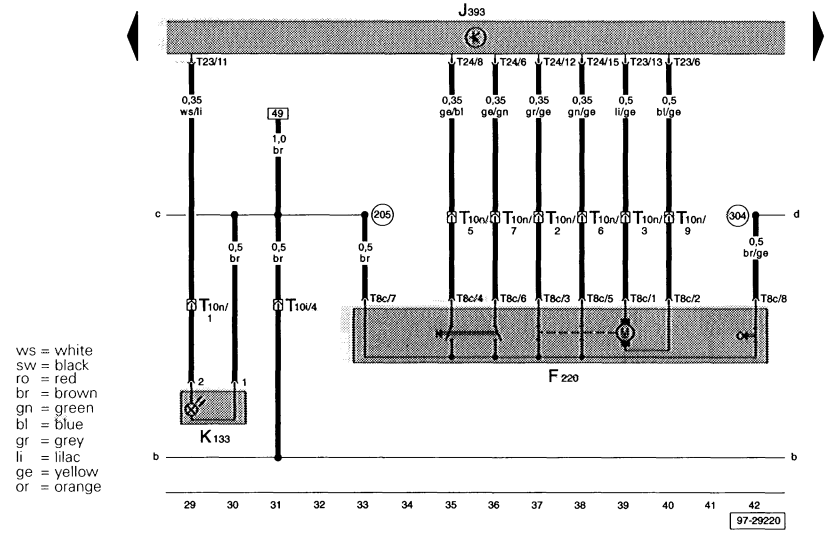


E150 - Switch for interior lock, driver side
J393 - Central control module for comfort system, behind instrument panel, left
L99 - Lighting for switch interior lock
T5k - 5-Pin Connector
T10n - 10-Pin Connector, brown, connector station A-pillar, left
T10p - 10-Pin Connector, brown, connector station A-pillar, right
T23 - 23-Pin Connector
T24 - 24-Pin Connector

(205) - Ground connection, in driver's door wiring harness
(S14) - Wire connection (open), in central locking system wiring harness
(S15) - Wire connection (closed), in central locking system wiring harness

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Central control module for comfort system, switch for interior lock (driver side)

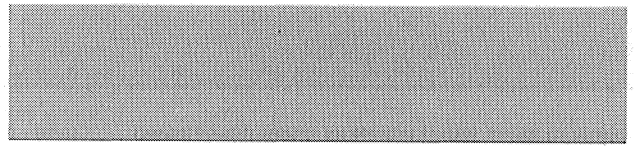


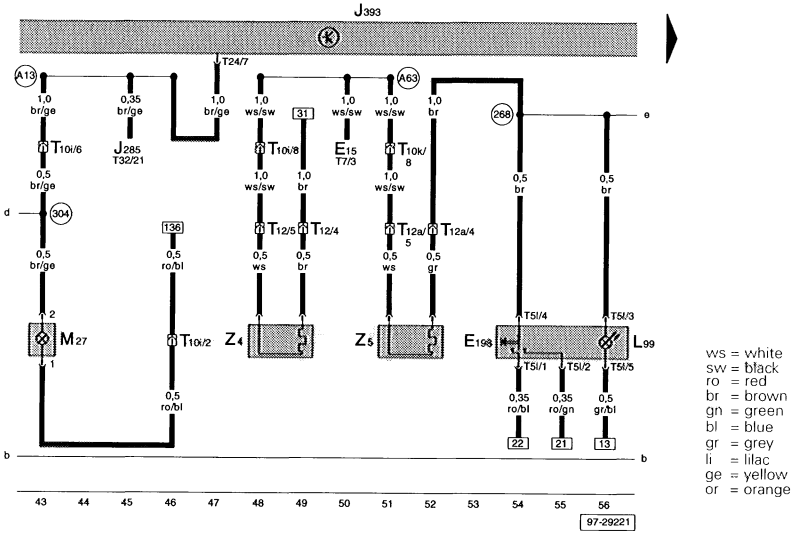
F220 - Lock unit for central locking, driver side
J393 - Central control module for comfort system, behind instrument panel, left
K133 - Warning light for central locking -SAFE-
T8c - 8-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10n - 10-Pin Connector, brown, connector station A-pillar, left
T23 - 23-Pin Connector
T24 - 24-Pin Connector

(205) - Ground connection, in driver's door wiring harness
(304) - Ground connector -3-, in wiring harness door cable - driver side

Central control module for comfort system, lock unit for central locking (driver side), warning light for central locking -SAFE-

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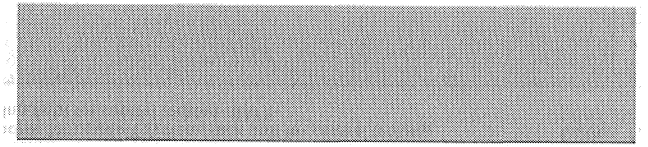
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sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

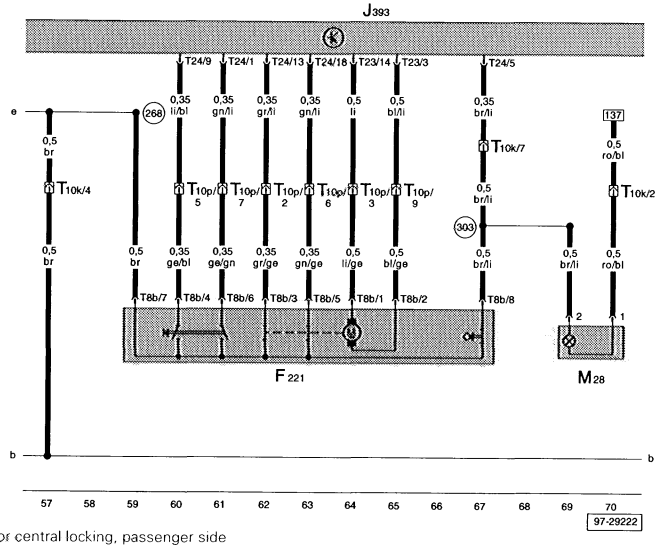
E15 - Rear window defogger switch
E198 - Switch for interior lock, passenger side
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
L99 - Lighting for switch interior lock
M27 - Left Door Warning Light
T5l - 5-Pin Connector
T7 - 7-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10k - 10-Pin Connector, black, connector station A-pillar, right
T12 - 12-Pin Connector, in driver's door
T12a - 12-Pin Connector, in front passenger's door
T24 - 24-Pin Connector
T32 - 32-Pin Connector, blue
Z4 - Heated outside mirror, driver side
Z5 - Heated outside mirror, passenger side

(268) - Ground connector -2-, in wiring harness door cable - passenger side
(304) - Ground connector -3-, in wiring harness door cable - driver side
(A13) - Wire connection (door contact switch) in instrument panel wiring harness
(A63) - Connector (mirror adjustment/-heated) in instrument panel wiring harness

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Central control module for comfort system, switch for interior lock (passenger side), left door warning light, heated outside mirrors





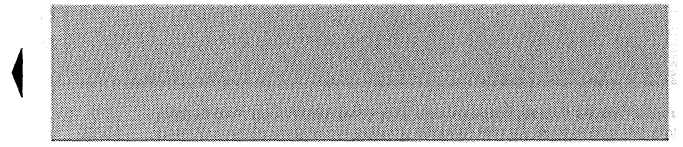
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

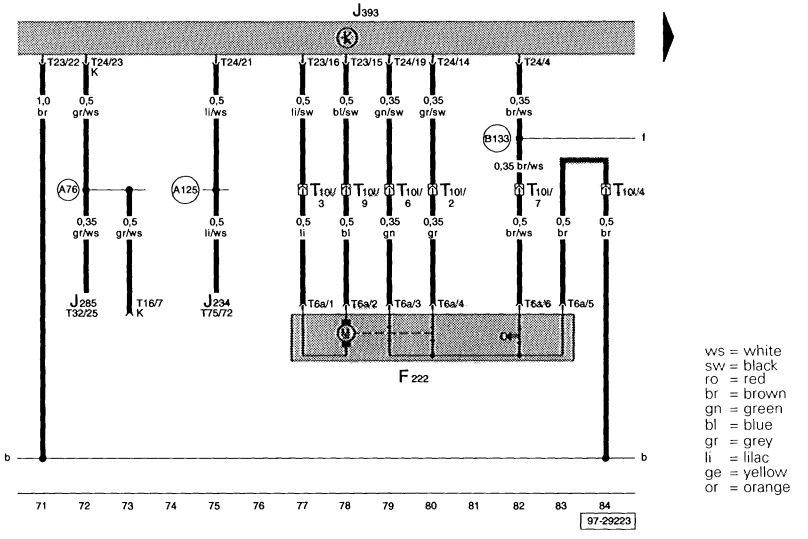
F221 - Lock unit for central locking, passenger side
J393 - Central control module for comfort system, behind instrument panel, left
M28 - Right Door Warning Light
T8b - 8-Pin Connector
T10k - 10-Pin Connector, black, connector station A-pillar, right
T10p - 10-Pin Connector, brown, connector station A-pillar, right
T23 - 23-Pin Connector
T24 - 24-Pin Connector

(268) - Ground connector -2-, in wiring harness door cable - passenger side
(303) - Ground connector -3-, in wiring harness door cable - passenger side

Central control module for comfort system, lock unit for central locking (passenger side), right door warning light

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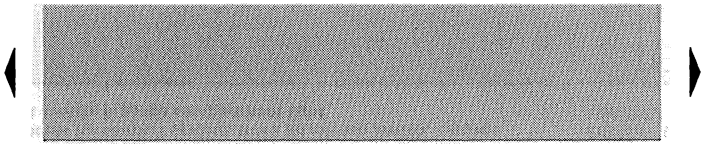


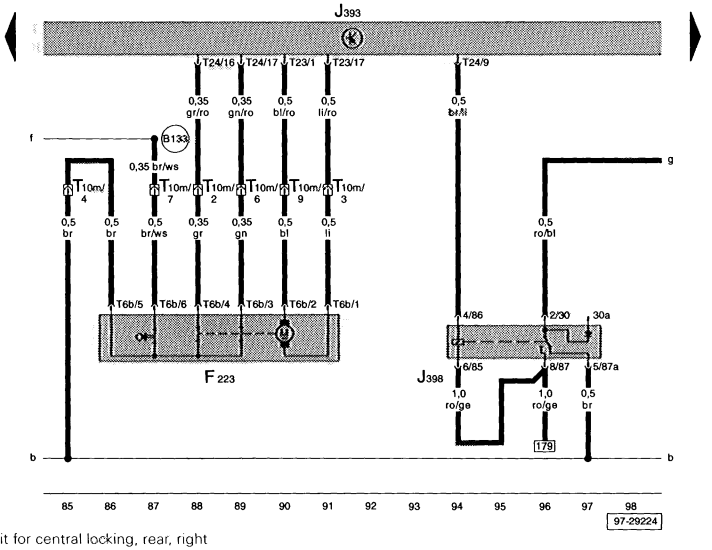
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F222 - Lock unit for central locking, rear, left
J234 - Airbag Control Module, behind console, lower part
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
T6a - 6-Pin Connector
T10l - 10-Pin Connector, black, connector station B-pillar, left
T16 - Data Link Connector (DLC), below instrument panel, left
T23 - 23-Pin Connector
T24 - 24-Pin Connector
T32 - 32-Pin Connector, blue
T75 - 75-Pin Connector

(A76) - Connector (K-diagnosis wire) in instrument panel wiring harness
(A125) - Connection (crash signal) in instrument panel wiring harness
(B133) - Connector (central locking open), in wiring harness interior

Central control module for comfort system, lock unit for central locking (rear left)



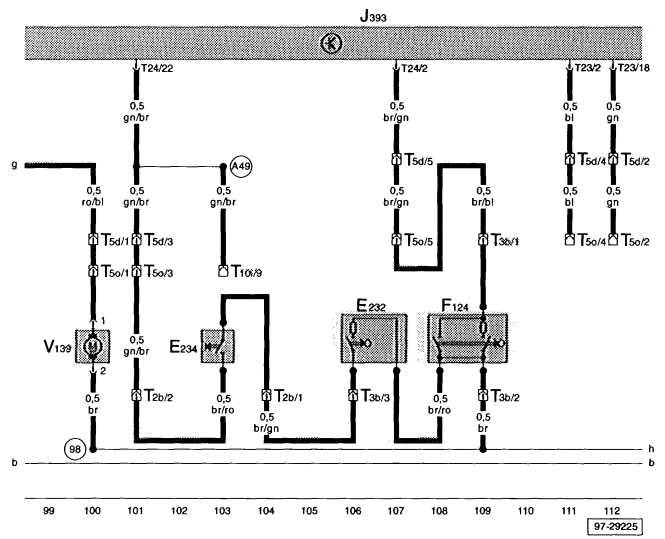


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F223 - Lock unit for central locking, rear, right
J393 - Central control module for comfort system, behind instrument panel, left
J398 - Relay for motor remote unlock rear lid, on the thirteenfold auxiliary relay panel, above relay panel
T6b - 6-Pin Connector
T10m - 10-Pin Connector, black, connector station B-pillar, right
T23 - 23-Pin Connector
T24 - 24-Pin Connector

(B133) - Connector (central locking open), in wiring harness interior

Central control module for comfort system, lock unit for central locking (rear right), relay for motor remote unlock rear lid

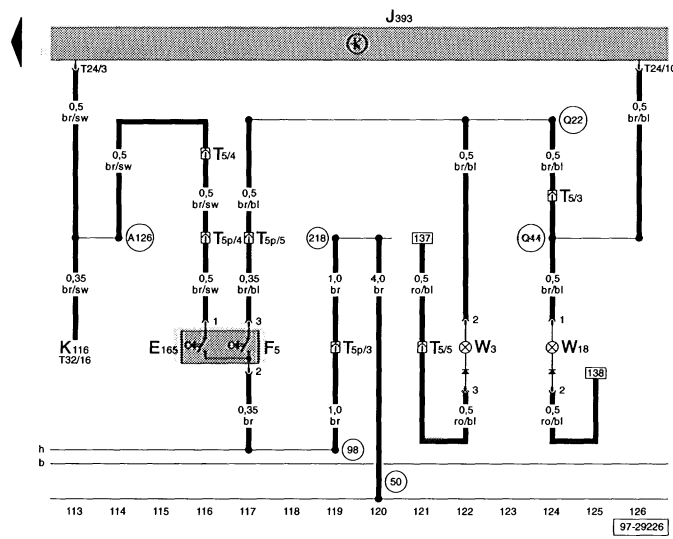


E232 - Rear Lid Remote Lock Key Switch
E234 - Switch for unlocking, rear lid handle
F124 - Trunk Lock Alarm/Central Locking Switch
J393 - Central control module for comfort system, behind instrument panel, left
T2b - Double Connector, in rear lid
T3b - 3-Pin Connector, in rear lid
T5d - 5-Pin Connector, brown, connector station D-pillar, right
T5o - 5-Pin Connector, brown, in rear lid
T10i - 10-Pin Connector, black, connector station A-pillar, left
T23 - 23-Pin Connector
T24 - 24-Pin Connector
V139 - Motor to unlock rear lid

(98) - Ground connection, in rear lid wiring harness
(A49) - Wire connection -1-, in instrument panel wiring harness

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Central control module for comfort system, rear lid remote lock key switch, switch for unlocking (rear lid handle), trunk lock alarm/central locking switch, motor to unlock rear lid

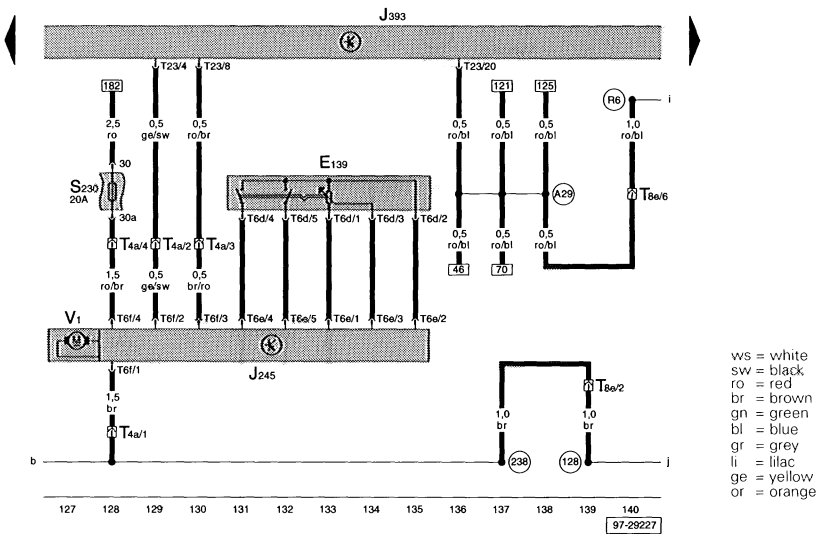


E165 - Trunk Lid Release Switch
F5 - Luggage Compartment Light Switch
J393 - Central control module for comfort system, behind instrument panel, left
K116 - Warning light for rear lid unlocked, in Instrument cluster
T5 - 5-Pin Connector, black, connector station D-pillar, left
T5p - 5-Pin Connector, black, in rear lid
T24 - 24-Pin Connector
T32 - 32-Pin Connector, blue, on Instrument cluster
W3 - Luggage compartment Light
W18 - Left Luggage Compartment Light

(50) - Ground connection, in luggage compartment, left
(98) - Ground connection, in rear lid wiring harness
(218) - Ground connection -1-, in rear lid wiring harness
(A126) - Connection (contact switch in rear lid) in instrument panel wiring harness
(Q22) - Wire connection -1-, in rear lid wiring harness
(Q44) - Wire connection -2-, in tailgate wiring harness

Central control module for comfort system, trunk lid release switch, luggage compartment light switch, luggage compartment light

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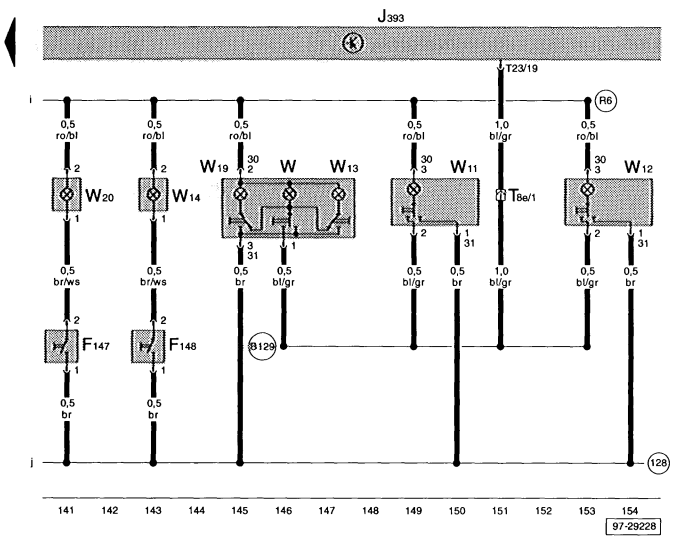
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E139 - Sunroof Regulator
J245 - Power Sunroof Control Module
J393 - Central control module for comfort system, behind instrument panel, left
S230 - Fuse 30 in fuse holder
T4a - 4-Pin Connector, behind instrument panel, left
T6d - 6-Pin Connector
T6e - 6-Pin Connector
T6f - 6-Pin Connector
T8e - 8-Pin Connector, behind instrument panel, left
T23 - 23-Pin Connector
V1 - Sunroof Motor

(128) - Ground connection -1-, in interior light wiring harness
(238) - Ground connection -1-, in wiring harness interior
(A29) - Wire connection (interior light), in instrument panel wiring harness
(R6) - Plus connection -1-, in interior light wiring harness

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Central control module for comfort system, power sunroof control module, sunroof regulator, sunroof motor



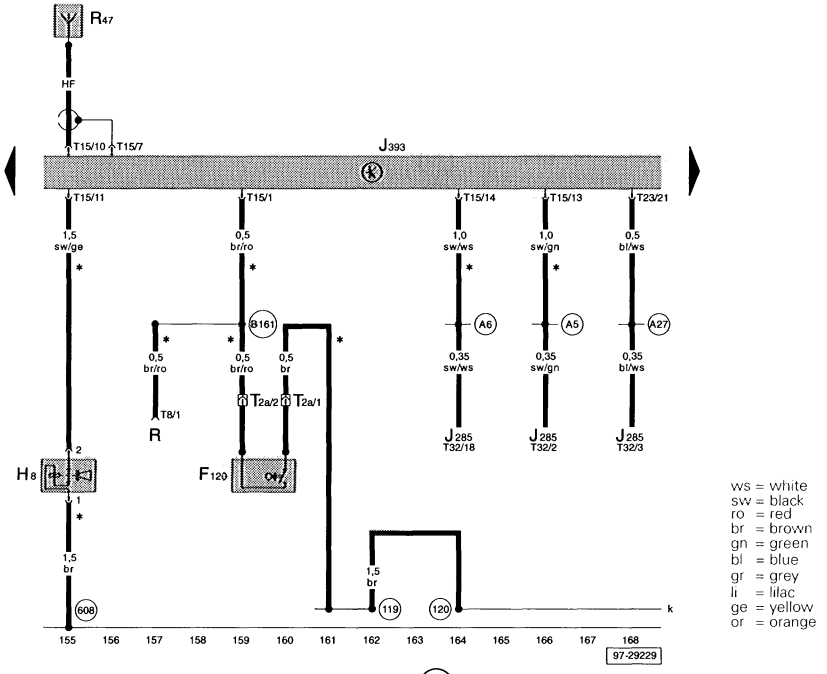
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F147 - Left Make-Up Mirror Light Switch
F148 - Right Make-Up Mirror Light Switch
J393 - Central control module for comfort system, behind instrument panel, left
T8e - 8-Pin Connector, behind instrument panel, left
T23 - 23-Pin Connector
W - Front Interior Light
W11 - Left Rear Reading Light
W12 - Right Rear Reading Light
W13 - Right Front Map/Reading Light
W14 - Right Make-up Mirror Light
W19 - Left Front Reading Light
W20 - Left Make-up Mirror Light

(128) - Ground connection -1-, in interior light wiring harness
(B129) - Connector (interior light 3/li.) in wiring harness interior
(R6) - Plus connection -1-, in interior light wiring harness

Central control module for comfort system, interior lights, make-up mirror lights

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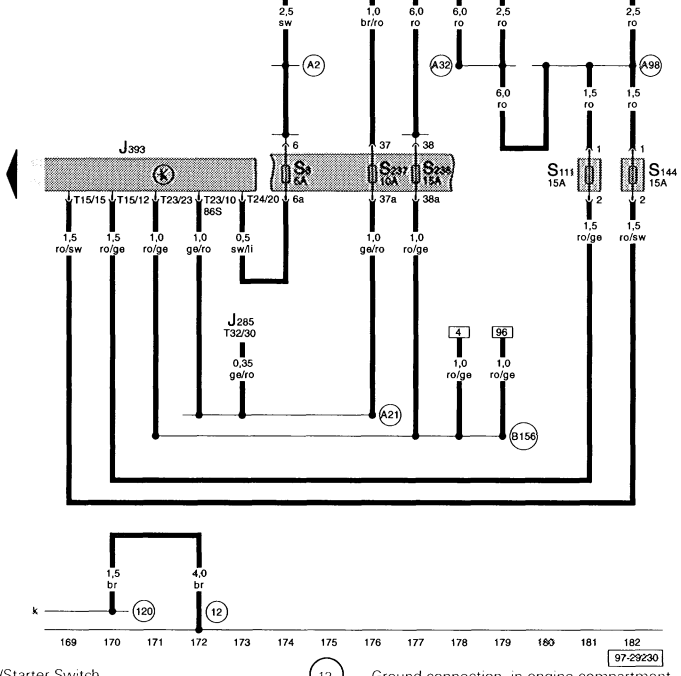
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

- F120 - Hood Alarm Switch*
- H8 - Alarm Horn*
- J285 - Control module with indicator unit in instrument panel insert
- J393 - Central control module for comfort system, behind instrument panel, left
- R - Radio
- R47 - Antenna wire for central locking and antitheft warning system
- T2a - Double Connector, near headlight, right
- T8 - 8-Pin Connector, on radio
- T15 - 15-Pin Connector
- T23 - 23-Pin Connector
- T32 - 32-Pin Connector, blue, on instrument cluster

- (119) - Ground connection -1-, in headlight wiring harness
- (120) - Ground connection -2-, in headlight wiring harness
- (608) - Ground connection (in center plenum chamber)
- (A5) - Plus connection (right turn signal), in instrument panel wiring harness
- (A6) - Plus connection (left turn signal), in instrument panel wiring harness
- (A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness
- (B161) - Connector (anti-theft warning system), in wiring harness interior

* - Vehicles with anti-theft warning system only

Central control module for comfort system, antitheft warning system, antenna wire for central locking and antitheft warning system



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

- D - Ignition/Starter Switch
- J285 - Control module with indicator unit in instrument panel insert
- J393 - Central control module for comfort system, behind instrument panel, left
- S6 - Fuse 6 in fuse holder
- S111 - Alarm System and Anti-Theft Fuse, above the thirteenfold auxiliary relay panel
- S144 - Fuse for central locking/anti-theft warning system, above the thirteenfold auxiliary relay panel
- S237 - Fuse 37 in fuse holder
- S238 - Fuse 38 in fuse holder
- T15 - 15-Pin Connector
- T23 - 23-Pin Connector
- T24 - 24-Pin Connector
- T32 - 32-Pin Connector, blue

- (12) - Ground connection, in engine compartment, left
- (120) - Ground connection -2-, in headlight wiring harness
- (501) - Threaded connection -2- (30) on the relay plate
- (A2) - Plus connection (15), in instrument panel wiring harness
- (A21) - Wire connection (86s), in instrument panel wiring harness
- (A32) - Plus connection (30), in instrument panel wiring harness
- (A98) - Plus connector -4- (30), in instrument panel wiring harness
- (B156) - Plus connector (30a), in wiring harness interior

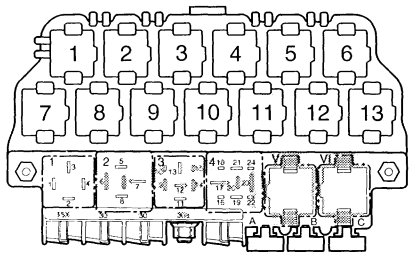
Central control module for comfort system

Comfort System (vehicles with power windows),

from January 2001

- Anti-theft warning system
- Central locking system with remote control
- Fuel tank lid unlock system
- Heated power mirrors
- Interior lights
- Luggage compartment light
- Power sunroof
- Power windows
- Rear lid unlock system

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97-14163

Relay location on the thirteenfold auxiliary relay panel, above relay panel:

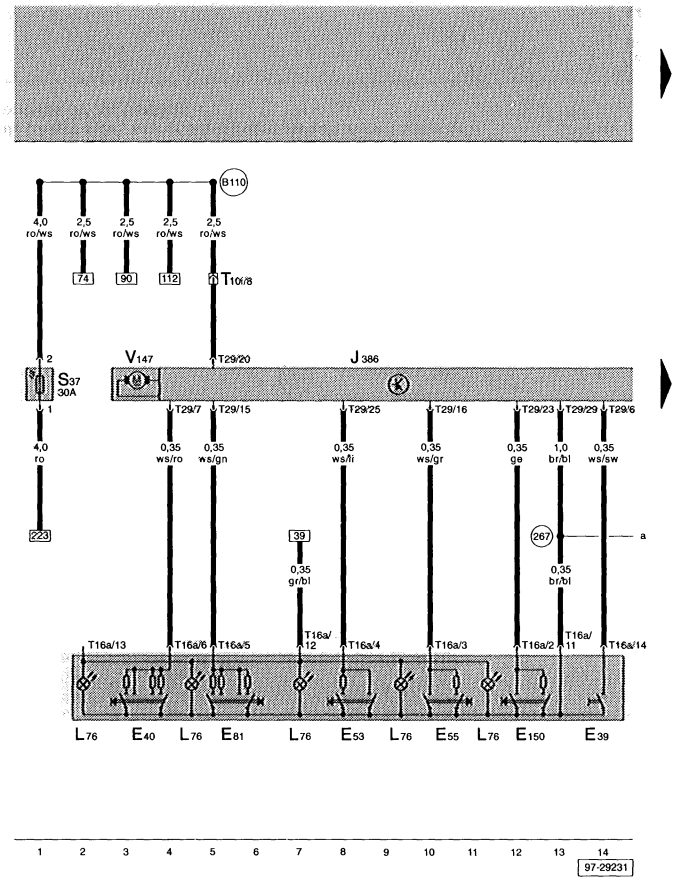
2 Relay for motor remote unlock rear lid (79)

Relay panel:

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

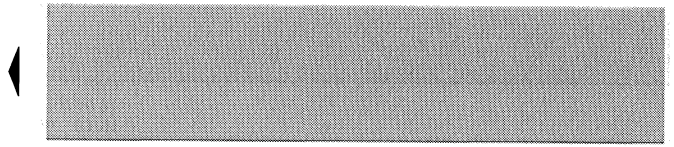


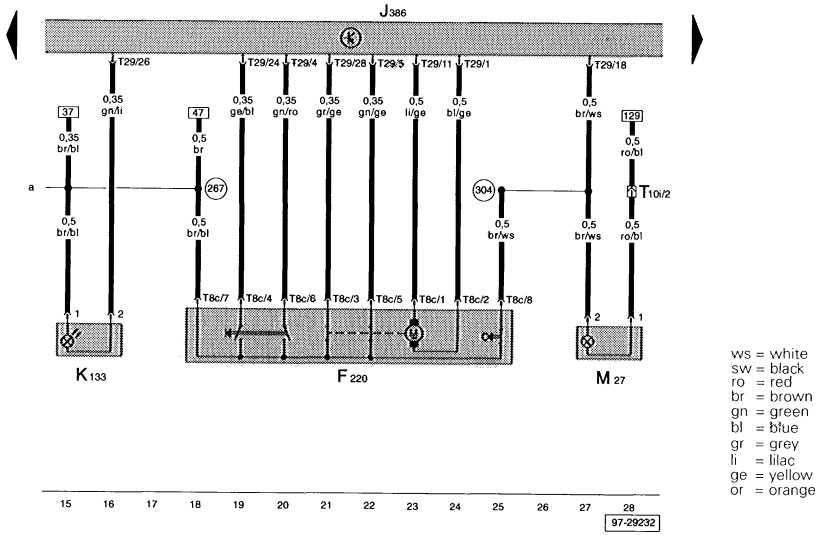
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E39 - Safety switch for window regulator rear
E40 - Switch for window regulator front left
E53 - Switch for window regulator rear left, driver
E55 - Switch for window regulator rear right, driver
E81 - Switch for window regulator front right, driver
E150 - Switch for interior lock, driver side
J386 - Door control module, driver side
L76 - Push Button Light
S37 - Fuse for window regulator (circuit breaker), on thirteen position auxiliary relay panel
T10i - 10-Pin Connector, black, connector station A-pillar, left
T16a - 16-Pin Connector
T29 - 29-Pin Connector
V147 - Motor for window regulator, driver side

(267) - Ground connector -2-, in wiring harness door cable - driver side
(B110) - Connection (30, window regulator) in wiring harness interior

Door control module (driver side), switch for window regulator, safety switch for window regulator rear, switch for interior lock (driver side)





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

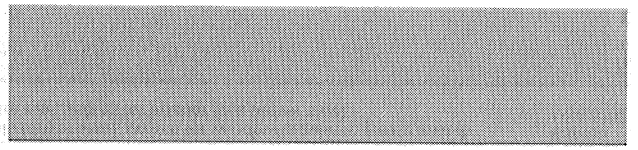
F220 - Lock unit for central locking, driver side
J386 - Door control module, driver side
K133 - Warning light for central locking -SAFE-
M27 - Left Door Warning Light
T8c - 8-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T29 - 29-Pin Connector

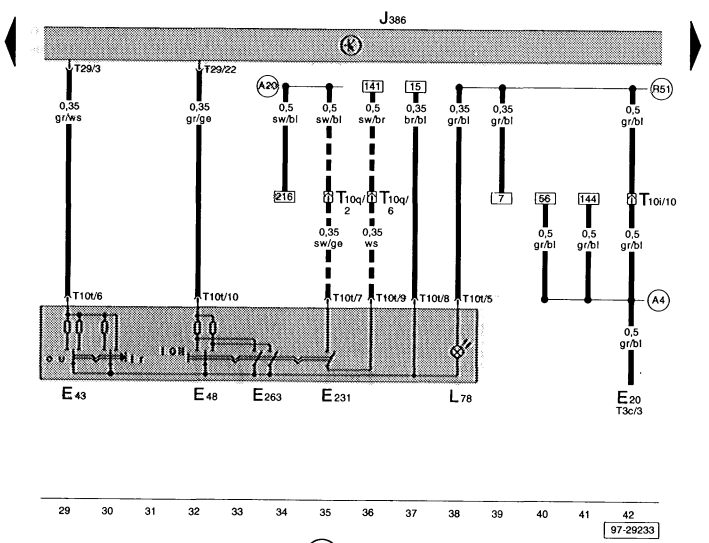
(267) - Ground connector -2-, in wiring harness door cable - driver side
(304) - Ground connector -3-, in wiring harness door cable - driver side

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Door control module (driver side), lock unit for central locking (driver side), warning light for central locking -SAFE-, left door warning light

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ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E20 - Instrument Panel Light Dimmer Switch
E43 - Mirror Adjustment Switch
E48 - Mirror Selector Switch
E231 - Switch for outside mirror heating
E263 - Mirror fold-away Switch*
J386 - Door control module, driver side
L78 - Mirror Adjusting Switch Light
T3c - 3-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10q - 10-Pin Connector, blue, connector station A-pillar, left
T10t - 10-Pin Connector
T29 - 29-Pin Connector

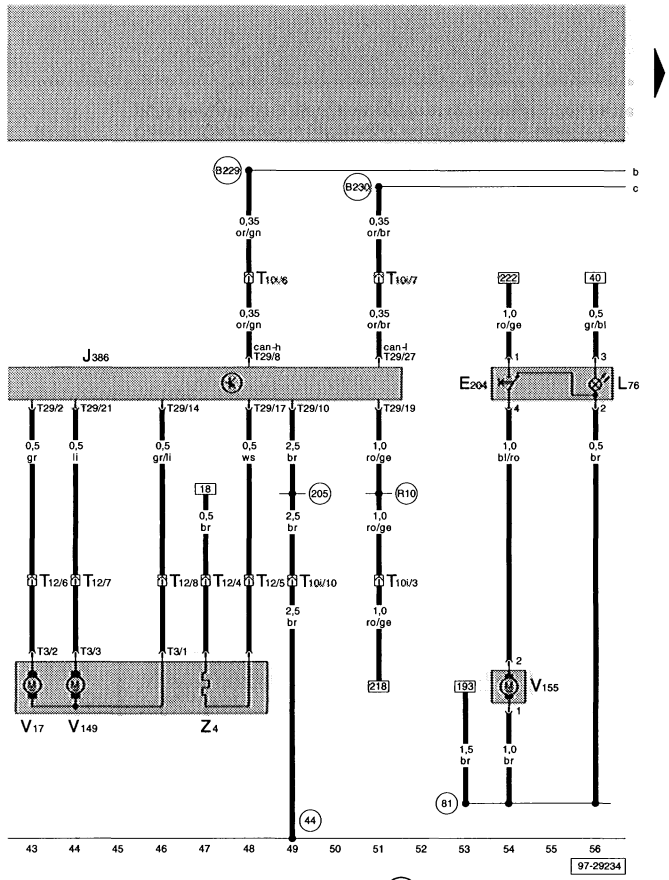
(A4) - Plus connection (58b), in instrument panel wiring harness
(A20) - Wire connection (15a), in instrument panel wiring harness
(R51) - Connection (58b), in driver's door wiring harness

* - Mirror fold-away function for some export countrys only
--- Vehicles with seperate heated outside mirrors only

Door control module (driver side), mirror adjustment switch, mirror selector switch, switch for outside mirror heating

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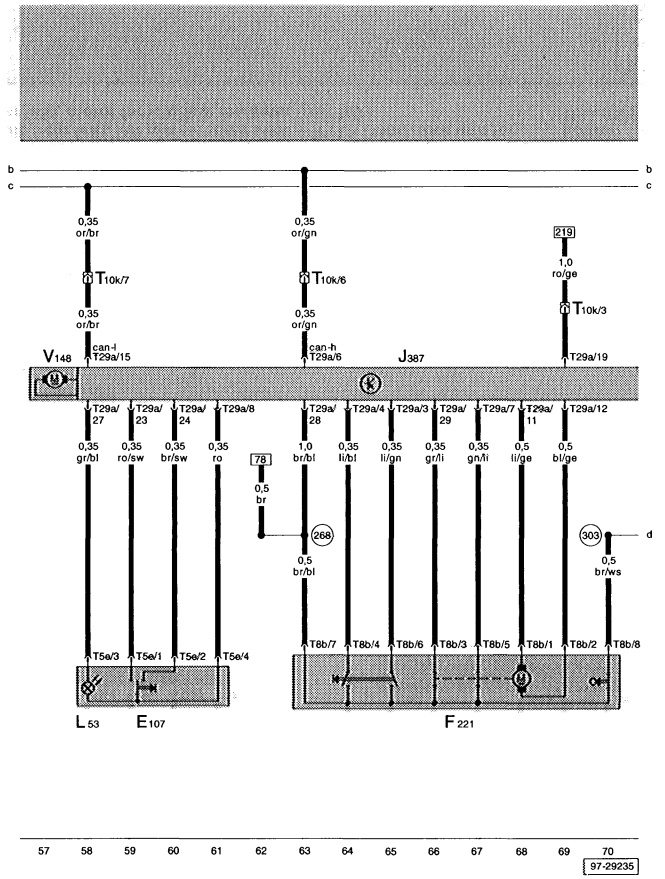
Repair Manual page number **97-531**



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E204 - Switch for remote/fuel tank door
J386 - Door control module, driver side
L76 - Push Button Light
T3 - 3-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T12 - 12-Pin Connector
T29 - 29-Pin Connector
V17 - Driver's Side Mirror Adjustment Motor
V149 - Motor for mirror adjustment, driver side
V155 - Motor for fuel tank lid unlock
Z4 - Heated outside mirror, driver side

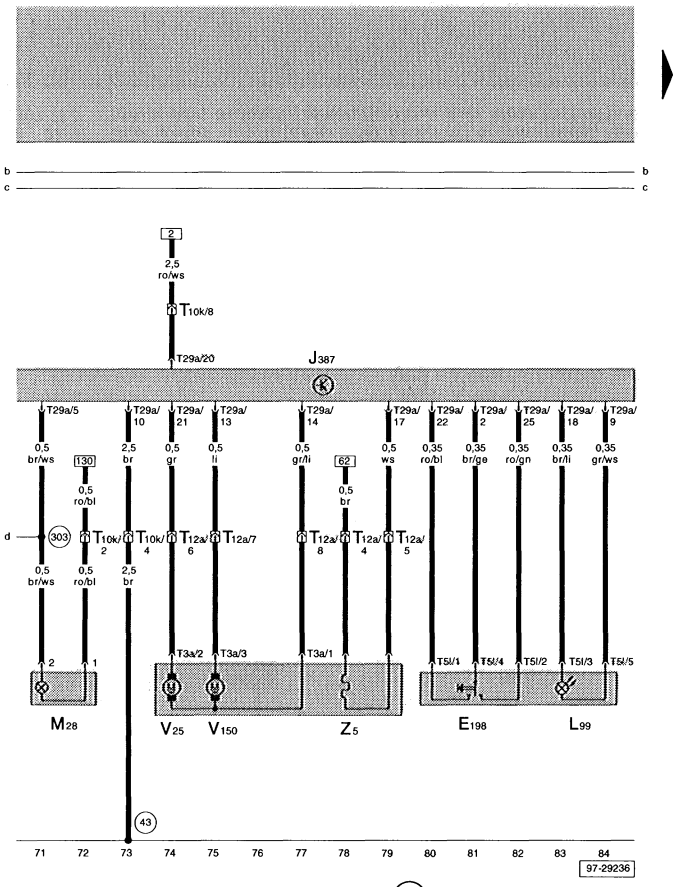
(44) - Ground connection, on left A-pillar, lower part
(81) - Ground connection -1-, in instrument panel wiring harness
(205) - Ground connection, in driver's door wiring harness
(B229) - Connection (high bus), in instrument panel wiring harness
(B230) - Connection (low bus), in instrument panel wiring harness
(R10) - Plus connection -1- (30a), in driver's door wiring harness



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E107 - Switch for window regulator, in passenger door
F221 - Lock unit for central locking, passenger side
J387 - Door control module, passenger side
L53 - Power Window Switch Light
T5e - 5-Pin Connector
T8b - 8-Pin Connector
T10k - 10-Pin Connector, black, connector station A-pillar, right
T29a - 29-Pin Connector
V148 - Motor for window regulator, passenger side

(268) - Ground connector -2-, in wiring harness door cable - passenger side
(303) - Ground connector -3-, in wiring harness door cable - passenger side



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

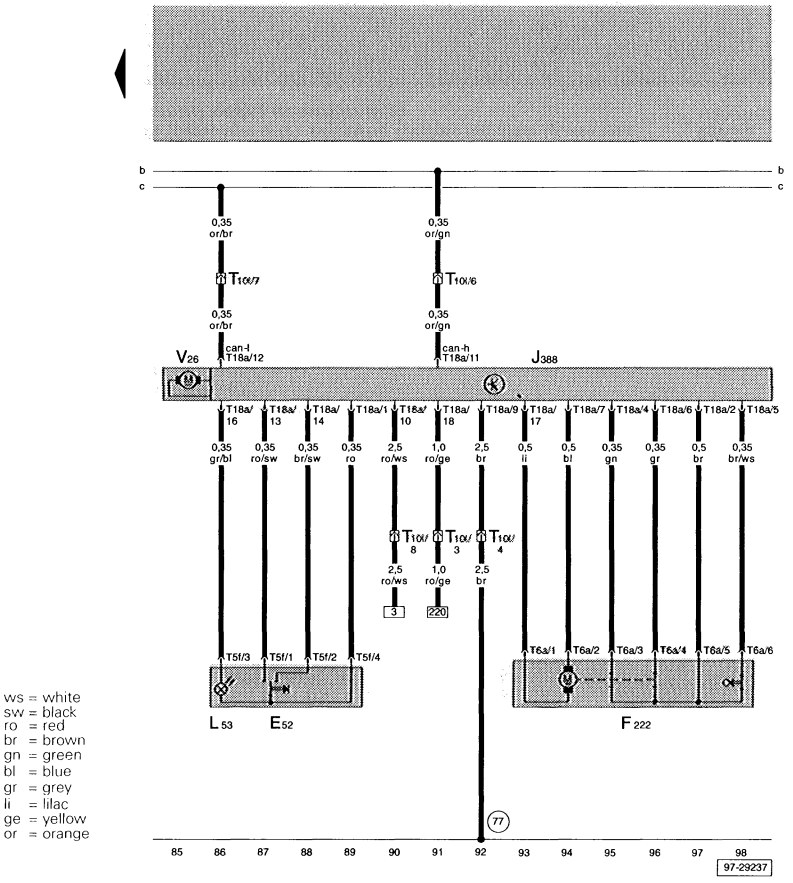
E198 - Switch for interior lock, passenger side
J387 - Door control module, passenger side
L99 - Lighting for switch interior lock
M28 - Right Door Warning Light
T3a - 3-Pin Connector
T5l - 5-Pin Connector
T10k - 10-Pin Connector, black, connector station A-pillar, right
T12a - 12-Pin Connector
T29a - 29-Pin Connector
V25 - Passenger's Side Mirror Adjustment Motor
V150 - Motor for mirror adjustment, passenger side
Z5 - Heated outside mirror, passenger side

(43) - Ground connection, on right A-pillar, lower part

(303) - Ground connector -3-, in wiring harness door cable - passenger side

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Door control module (passenger side), switch for interior lock (passenger side), right door warning light, power mirror (passenger side), heated outside mirror



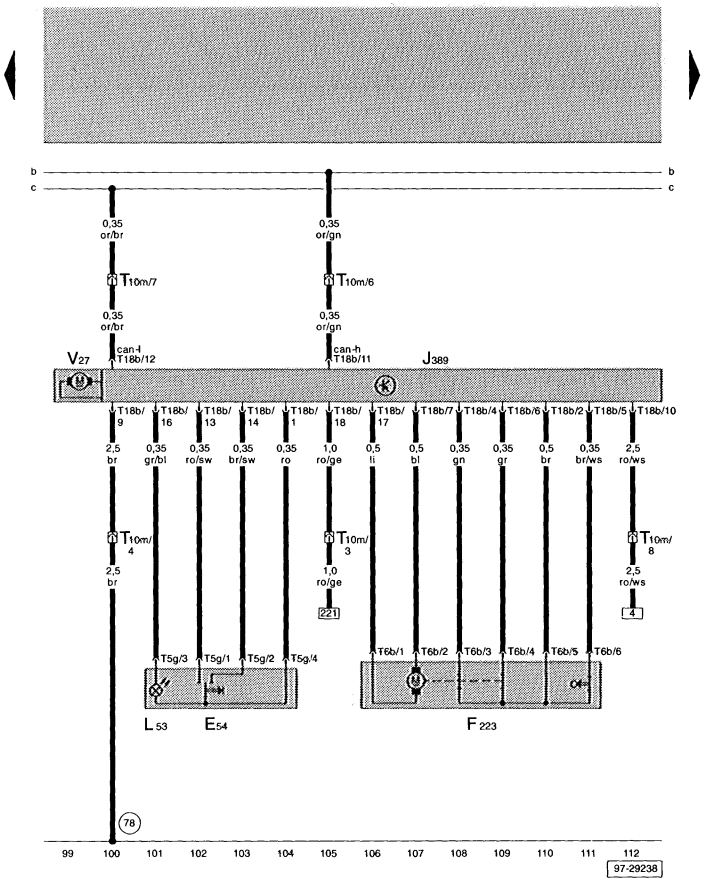
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E52 - Left Rear Window Switch, (In LR Door)
F222 - Lock unit for central locking, rear, left
J388 - Door control module, rear, left
L53 - Power Window Switch Light
T5f - 5-Pin Connector
T6a - 6-Pin Connector
T10l - 10-Pin Connector, black, connector station B-pillar, left
T18a - 18-Pin Connector
V26 - Motor for window regulator, rear, left

(77) - Ground connection, on left B-pillar, lower part

Door control module (rear left), left rear window switch (In LR Door), lock unit for central locking (rear left), motor for window regulator (rear left)

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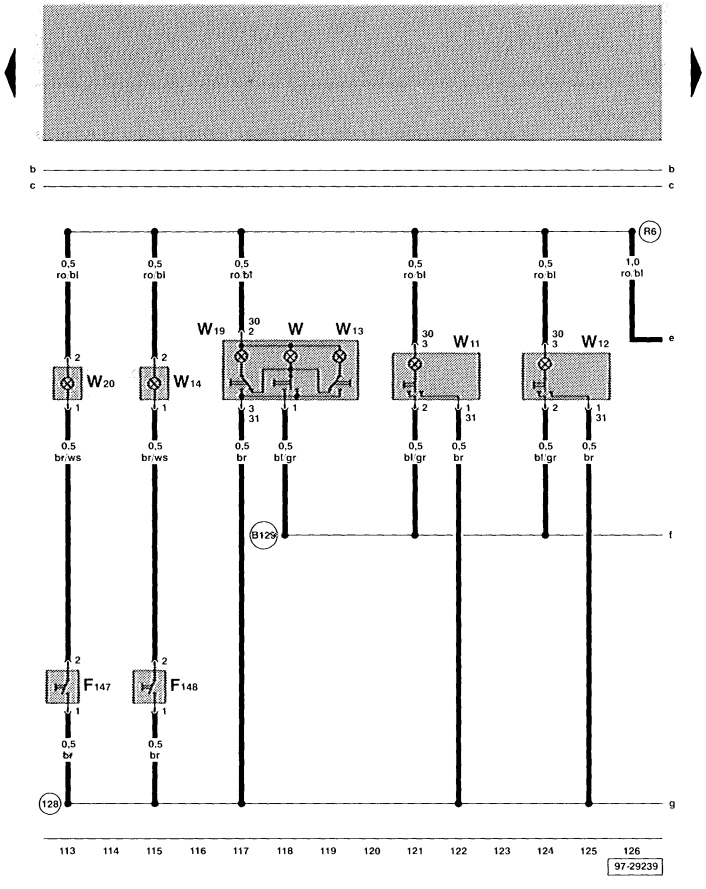


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E54 - Right Rear Window Switch, (In RR Door)
F223 - Lock unit for central locking, rear, right
J389 - Door control module, rear, right
L53 - Power Window Switch Light
T5g - 5-Pin Connector
T6b - 6-Pin Connector
T10m - 10-Pin Connector, black, connector station B-pillar, right
T18b - 18-Pin Connector
V27 - Motor for window regulator, rear, right

(78) - Ground connection, on right B-pillar, lower part

Door control module (rear right), right rear window switch (In RR Door), lock unit for central locking (rear right), motor for window regulator (rear right)

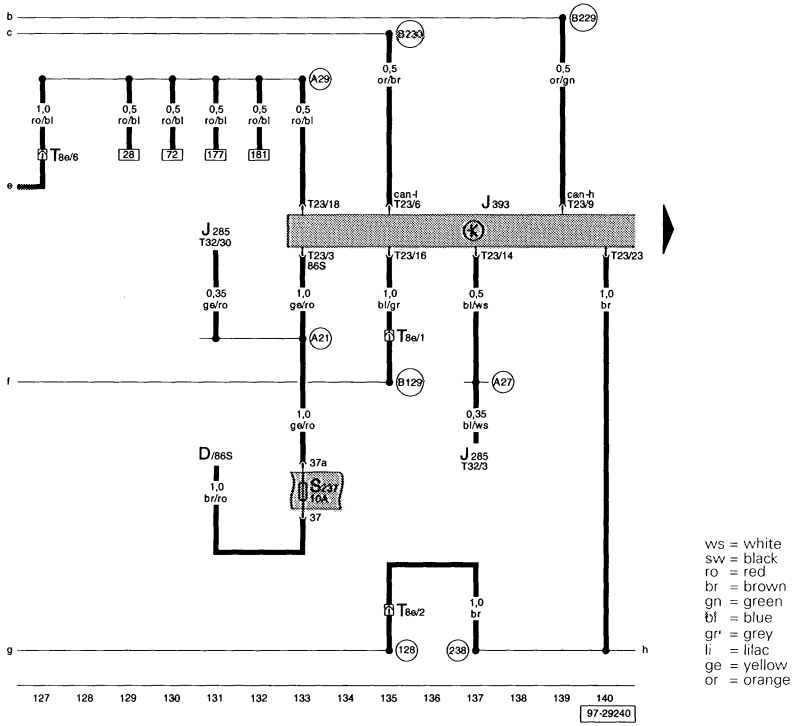


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F147 - Left Make-Up Mirror Light Switch
F148 - Right Make-Up Mirror Light Switch
W - Front Interior Light
W11 - Left Rear Reading Light
W12 - Right Rear Reading Light
W13 - Right Front Map/Reading Light
W14 - Right Make-up Mirror Light
W19 - Left Front Reading Light
W20 - Left Make-up Mirror Light

(128) - Ground connection -1-, in interior light wiring harness
(B129) - Connector (interior light 3/L) in wiring harness interior
(R6) - Plus connection -1-, in interior light wiring harness

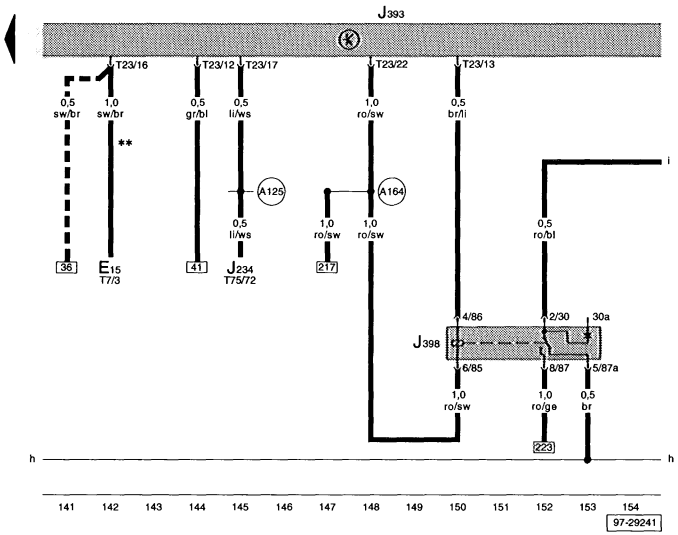
Interior lights, make-up mirror lights



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

D - Ignition/Starter Switch
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
S237 - Fuse 37 in fuse holder
T8e - 8-Pin Connector, behind instrument panel, left
T23 - 23-Pin Connector
T32 - 32-Pin Connector, blue

(128) - Ground connection -1-, in interior light wiring harness
(238) - Ground connection -1-, in wiring harness interior
(A21) - Wire connection (86s), in instrument panel wiring harness
(A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness
(A29) - Wire connection (interior light), in instrument panel wiring harness
(B129) - Connector (interior light 3/L) in wiring harness interior
(B229) - Connection (high bus), in instrument panel wiring harness
(B230) - Connection (low bus), in instrument panel wiring harness

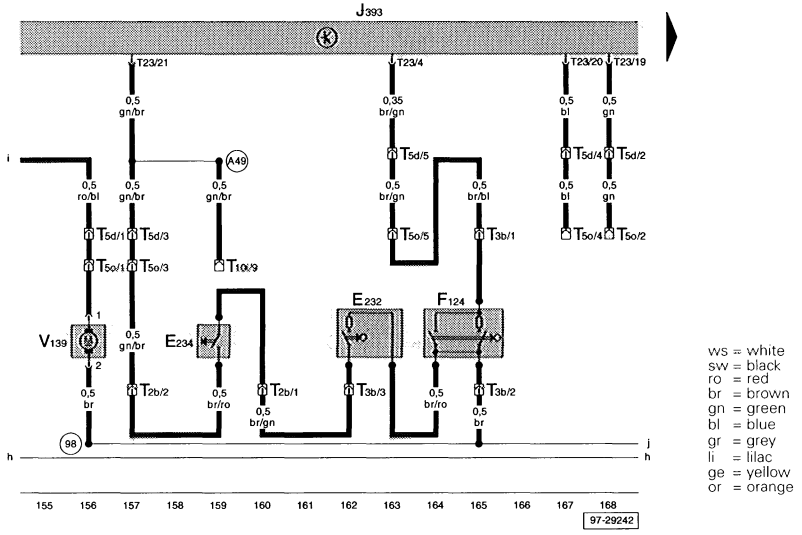


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E15 - Rear window defogger switch
J234 - Airbag Control Module
J393 - Central control module for comfort system, behind instrument panel, left
J398 - Relay for motor remote unlock rear lid, on the thirteenfold auxiliary relay panel, above relay panel
T7 - 7-Pin Connector
T23 - 23-Pin Connector
T75 - 75-Pin Connector

(A125) - Connection (crash signal) in instrument panel wiring harness
(A164) - Plus connection 2 (30a), in instrument panel wiring harness

- - - Vehicles with seperate heated outside mirrors only
** - Vehicles without seperate heated outside mirrors only



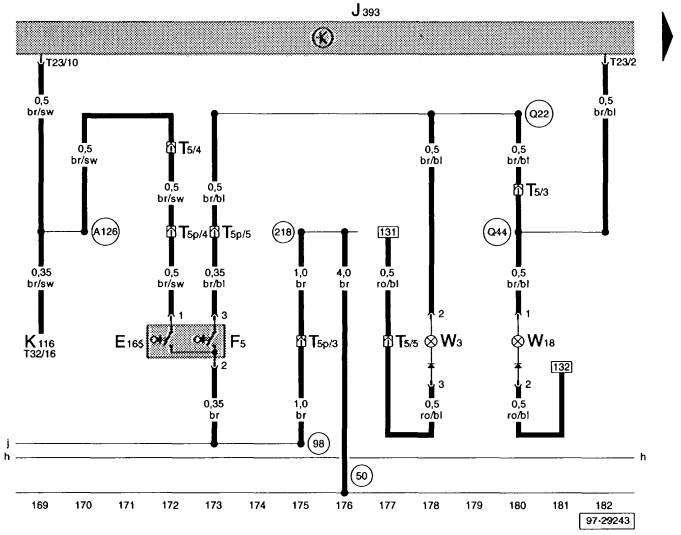
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E232 - Rear Lid Remote Lock Key Switch
E234 - Switch for unlocking, rear lid handle
F124 - Trunk Lock Alarm/Central Locking Switch
J393 - Central control module for comfort system, behind instrument panel, left
T2b - Double Connector, in rear lid
T3b - 3-Pin Connector, in rear lid
T5d - 5-Pin Connector, brown, connector station D-pillar, right
T5o - 5-Pin Connector, brown, in rear lid
T10i - 10-Pin Connector, black, connector station A-pillar, left
T23 - 23-Pin Connector
V139 - Motor to unlock rear lid

(98) - Ground connection, in rear lid wiring harness
(A49) - Wire connection -1-, in instrument panel wiring harness

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Central control module for comfort system, rear lid remote lock key switch, switch for unlocking (rear lid handle), trunk lock alarm/central locking switch, motor to unlock rear lid



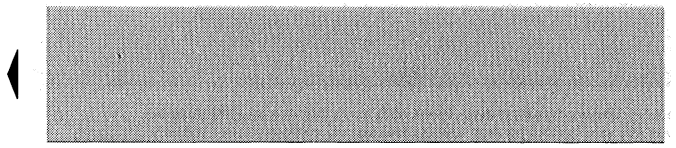
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

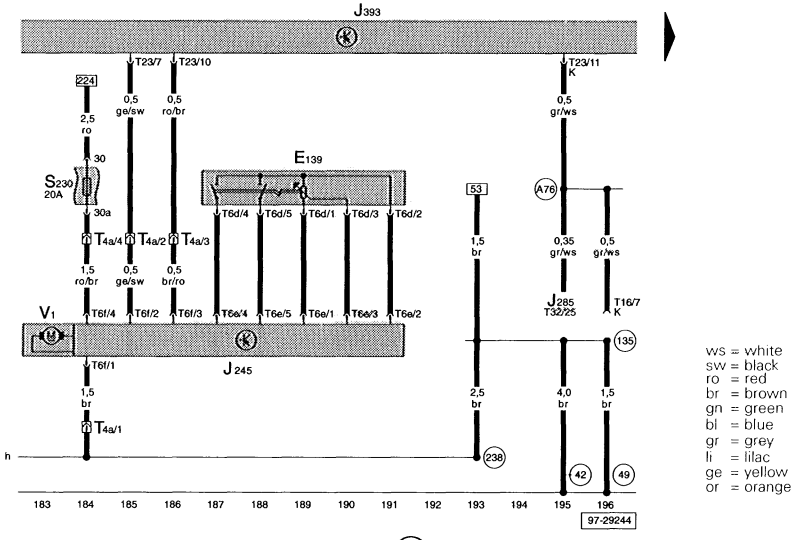
E165 - Trunk Lid Release Switch
F5 - Luggage Compartment Light Switch
J393 - Central control module for comfort system, behind instrument panel, left
K116 - Warning light for rear lid unlocked, in Instrument cluster
T5 - 5-Pin Connector, black, connector station D-pillar, left
T5p - 5-Pin Connector, black, in rear lid
T23 - 23-Pin Connector
T32 - 32-Pin Connector, blue, on Instrument cluster
W3 - Luggage compartment Light
W18 - Left Luggage Compartment Light

(50) - Ground connection, in luggage compartment, left
(98) - Ground connection, in rear lid wiring harness
(218) - Ground connection -1-, in rear lid wiring harness
(A126) - Connection (contact switch in rear lid) in instrument panel wiring harness
(Q22) - Wire connection -1-, in rear lid wiring harness
(Q44) - Wire connection -2-, in tailgate wiring harness

Central control module for comfort system, trunk lid release switch, luggage compartment light switch, luggage compartment light

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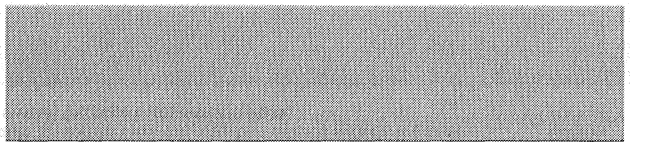


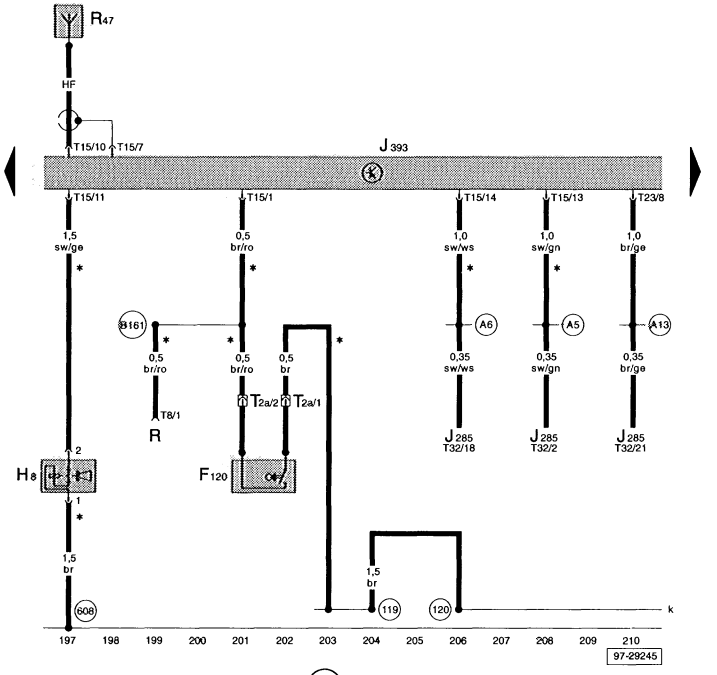


E139 - Sunroof Regulator
J245 - Power Sunroof Control Module
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
S230 - Fuse 30 in fuse holder
T4a - 4-Pin Connector, behind instrument panel, left
T6d - 6-Pin Connector
T6e - 6-Pin Connector
T6f - 6-Pin Connector
T16 - Data Link Connector (DLC), below instrument panel, left
T23 - 23-Pin Connector
T32 - 32-Pin Connector, blue, on Instrument cluster
V1 - Sunroof Motor

(42) - Ground connection, beside steering column
(49) - Ground connection, on steering column
(135) - Ground connection -2-, in instrument panel wiring harness
(238) - Ground connection -1-, in wiring harness interior
(A76) - Connector (K-diagnosis wire) in instrument panel wiring harness

Central control module for comfort system, power sunroof control module, sunroof regulator, sunroof motor



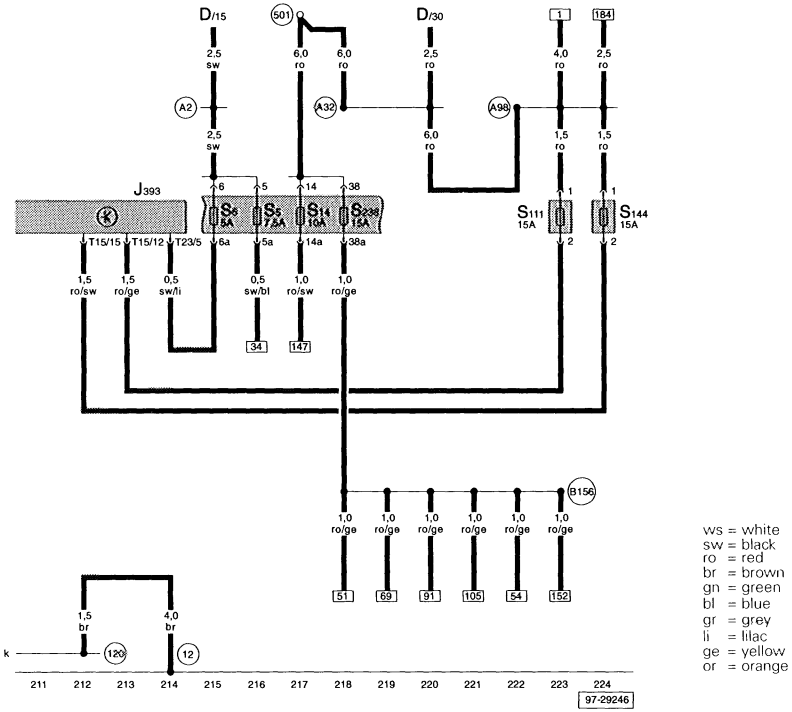


F120 - Hood Alarm Switch*
H8 - Alarm Horn*
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
R - Radio
R47 - Antenna wire for central locking and antitheft warning system
T2a - Double Connector, near headlight, right
T8 - 8-Pin Connector, on radio
T15 - 15-Pin Connector*
T23 - 23-Pin Connector
T32 - 32-Pin Connector, blue, on instrument cluster

(119) - Ground connection -1-, in headlight wiring harness
(120) - Ground connection -2-, in headlight wiring harness
(608) - Ground connection (in center plenum chamber)
(A5) - Plus connection (right turn signal), in instrument panel wiring harness
(A6) - Plus connection (left turn signal), in instrument panel wiring harness
(A13) - Wire connection (door contact switch) in instrument panel wiring harness
(B161) - Connector (anti-theft warning system), in wiring harness interior

* - Vehicles with anti-theft warning system only

Central control module for comfort system, antitheft warning system, antenna wire for central locking and antitheft warning system



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

D - Ignition/Starter Switch
J393 - Central control module for comfort system, behind instrument panel, left
S5 - Fuse 5 in fuse holder
S6 - Fuse 6 in fuse holder
S14 - Fuse 14 in fuse holder
S111 - Alarm System and Anti-Theft Fuse, above the thirteenfold auxiliary relay panel*
S144 - Fuse for central locking/anti-theft warning system, above the thirteenfold auxiliary relay panel*
S238 - Fuse 38 in fuse holder
T15 - 15-Pin Connector*
T23 - 23-Pin Connector

(12) - Ground connection, in engine compartment, left
(120) - Ground connection -2-, in headlight wiring harness
(501) - Threaded connection -2- (30) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness
(B156) - Plus connector (30a), in wiring harness interior

* - Vehicles with anti-theft warning system only

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97-544

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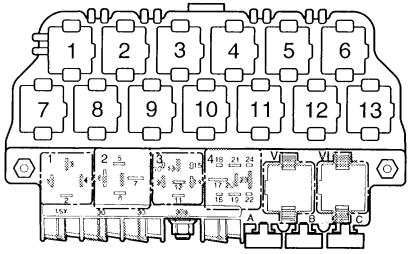
Repair Manual page number
97-545

Comfort system (vehicles without power windows),

from May 2001

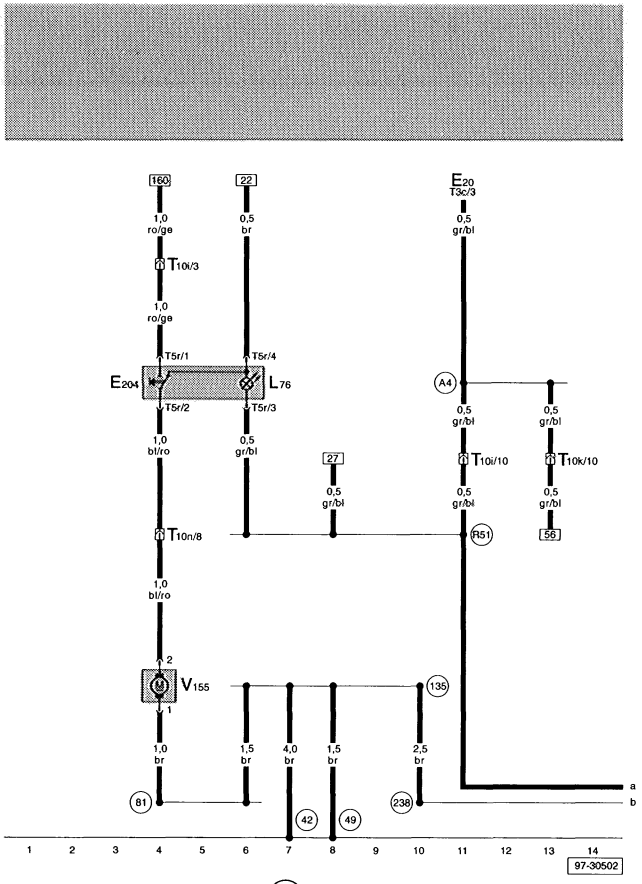
- **Anti-theft warning system**
- **Central locking system with remote control**
- **Fuel tank lid unlock system**
- **Heated outside mirrors**
- **Interior lights**
- **Luggage compartment light**
- **Power sunroof**
- **Rear lid unlock system**

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

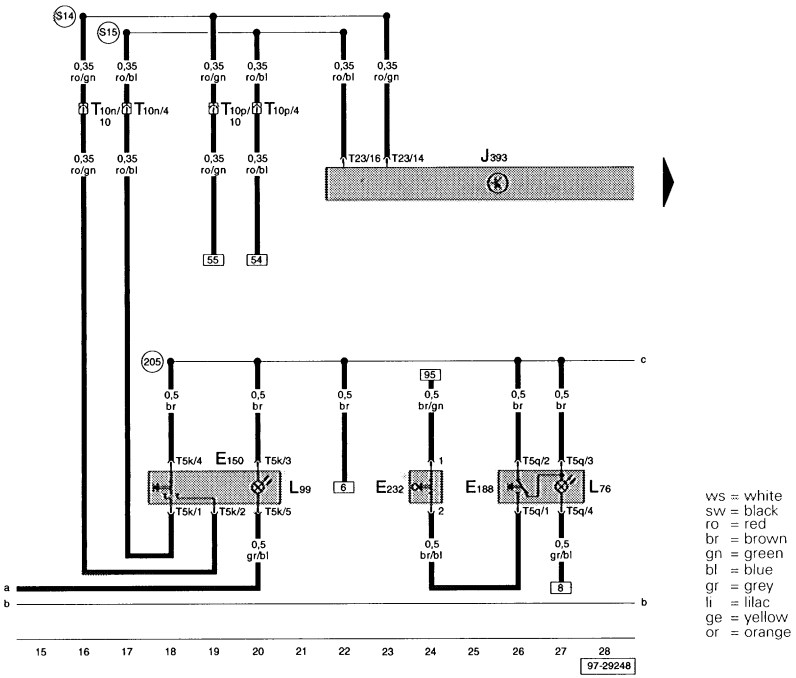


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E20 - Instrument Panel Light Dimmer Switch
E204 - Switch for remote/fuel tank door
L76 - Push Button Light
T3c - 3-Pin Connector
T5r - 5-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10k - 10-Pin Connector, black, connector station A-pillar, right
T10n - 10-Pin Connector, brown, connector station A-pillar, left
V155 - Motor for fuel tank lid unlock

(42) - Ground connection, beside steering column
(49) - Ground connection, on steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(238) - Ground connection -1-, in wiring harness interior
(A4) - Plus connection (58b), in instrument panel wiring harness
(R51) - Connection (58b) in door wiring harness, driver side

Switch for remote/fuel tank door, motor for fuel tank lid unlock

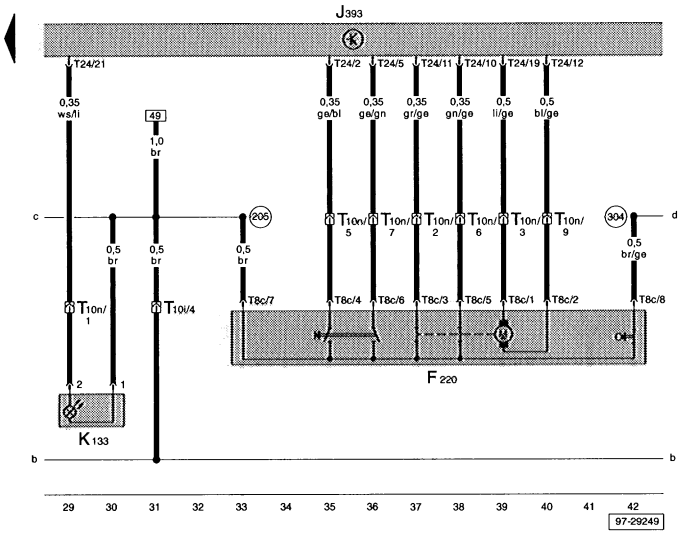


E150 - Switch for interior lock, driver side
E188 - Switch for remote unlock, rear lid, driver side
E232 - Key switch for switching off remote unlock rear lid
J393 - Central control module for comfort system, behind instrument panel, left
L76 - Push Button Light
L99 - Lighting for switch interior lock
T5k - 5-Pin Connector
T5q - 5-Pin Connector
T10n - 10-Pin Connector, brown, connector station A-pillar, left
T10p - 10-Pin Connector, brown, connector station A-pillar, right
T23 - 23-Pin Connector

(205) - Ground connection, in driver's door wiring harness
(S14) - Wire connection (open), in central locking system wiring harness
(S15) - Wire connection (closed), in central locking system wiring harness

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Central control module for comfort system, switch for interior lock (driver side), switch for remote unlock rear lid

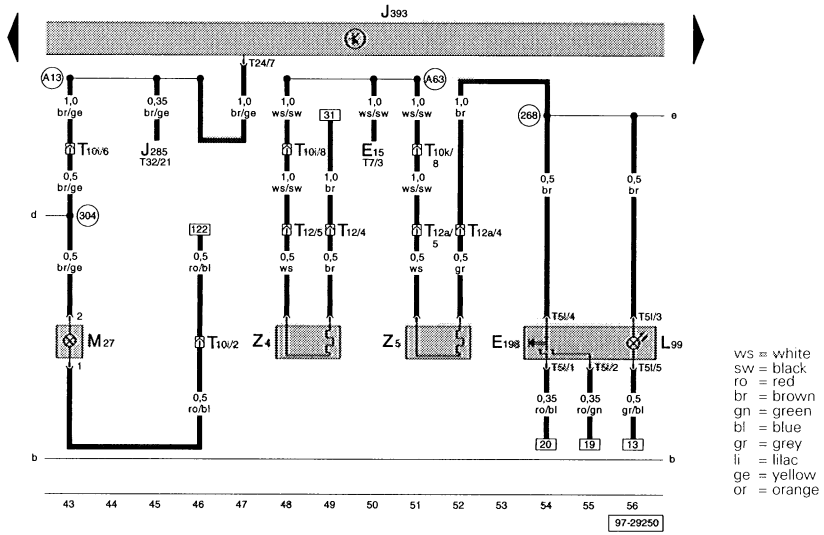


F220 - Lock unit for central locking, driver side
J393 - Central control module for comfort system, behind instrument panel, left
K133 - Warning light for central locking -SAFE-
T8c - 8-Pin Connector
T10l - 10-Pin Connector, black, connector station A-pillar, left
T10n - 10-Pin Connector, brown, connector station A-pillar, left
T24 - 24-Pin Connector

(205) - Ground connection, in driver's door wiring harness
(304) - Ground connector -3-, in wiring harness door cable - driver side

Central control module for comfort system, lock unit for central locking, warning light for central locking -SAFE-

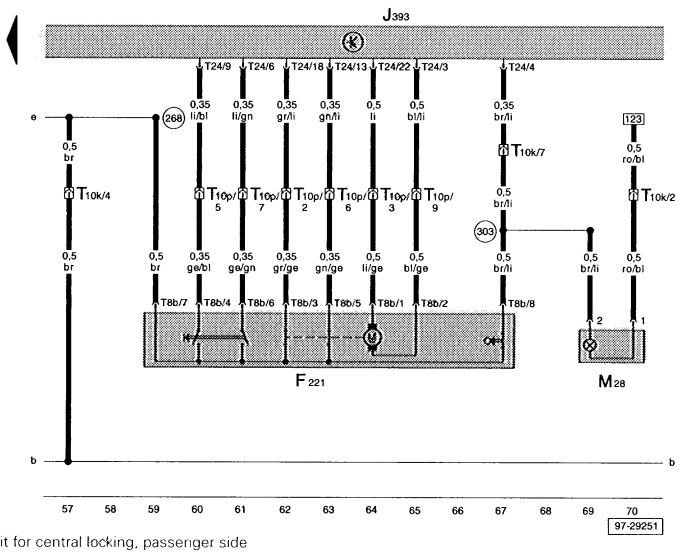
Edition 03/01
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ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E15 - Rear window defogger switch
E198 - Switch for interior lock, passenger side
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
L99 - Lighting for switch interior lock
M27 - Left Door Warning Light
T5l - 5-Pin Connector
T7 - 7-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10k - 10-Pin Connector, black, connector station A-pillar, right
T12 - 12-Pin Connector, in driver's door
T12a - 12-Pin Connector, in front passenger's door
T24 - 24-Pin Connector
T32 - 32-Pin Connector, blue
Z4 - Heated outside mirror, driver side
Z5 - Heated outside mirror, passenger side

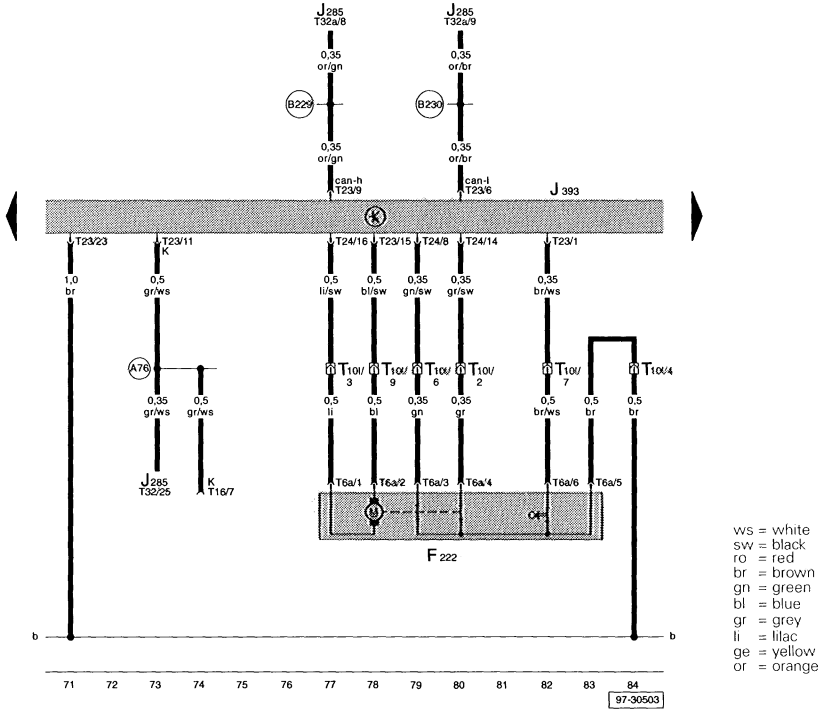
(268) - Ground connector -2-, in wiring harness door cable - passenger side
(304) - Ground connector -3-, in wiring harness door cable - driver side
(A13) - Wire connection (door contact switch) in instrument panel wiring harness
(A63) - Connector (mirror adjustment/-heated) in instrument panel wiring harness



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F221 - Lock unit for central locking, passenger side
J393 - Central control module for comfort system, behind instrument panel, left
M28 - Right Door Warning Light
T8b - 8-Pin Connector
T10k - 10-Pin Connector, black, connector station A-pillar, right
T10p - 10-Pin Connector, brown, connector station A-pillar, right
T24 - 24-Pin Connector

(268) - Ground connector -2-, in wiring harness door cable - passenger side
(303) - Ground connector -3-, in wiring harness door cable - passenger side

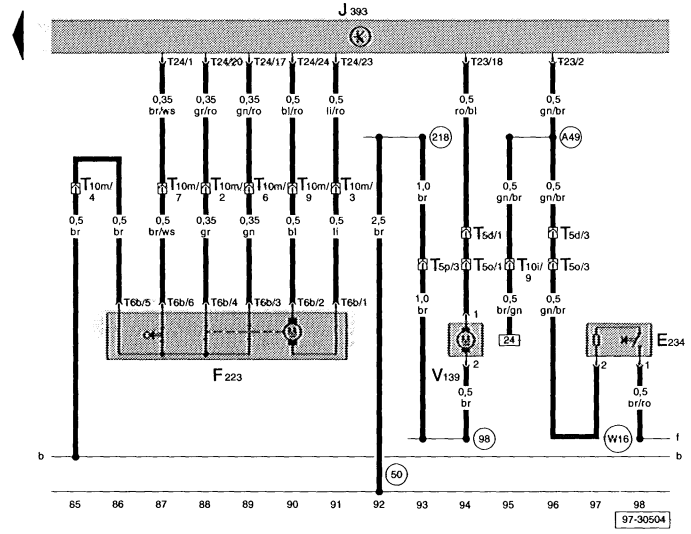


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F222 - Lock unit for central locking, rear, left
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
T6a - 6-Pin Connector
T10l - 10-Pin Connector, black, connector station B-pillar, left
T16 - Data Link Connector (DLC), below instrument panel, left
T23 - 23-Pin Connector
T24 - 24-Pin Connector
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

A76 - Connector (K-diagnosis wire) in instrument panel wiring harness
B229 - Connection (high bus), in instrument panel wiring harness
B230 - Connection (low bus), in instrument panel wiring harness

Central control module for comfort system, lock unit for central locking (rear left)

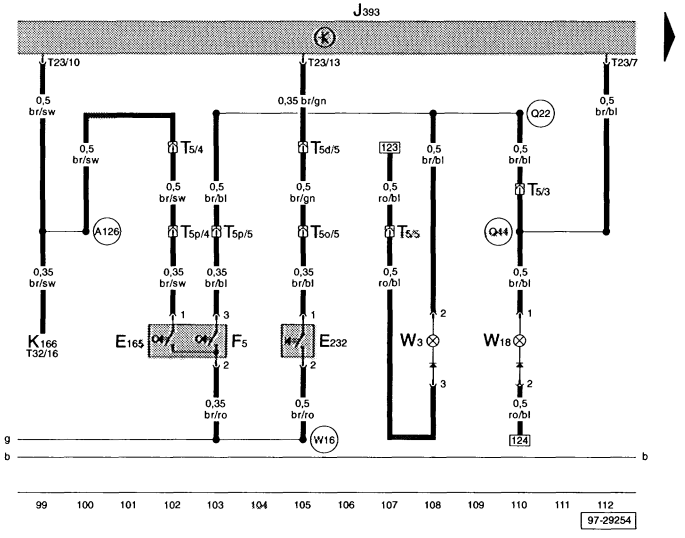


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E234 - Switch for unlocking, rear lid handle
F223 - Lock unit for central locking, rear, right
J393 - Central control module for comfort system, behind instrument panel, left
T5d - 5-Pin Connector, brown, connector station D-pillar, right
T5o - 5-Pin Connector, brown, in rear lid
T5p - 5-Pin Connector, black, in rear lid
T6b - 6-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10m - 10-Pin Connector, black, connector station B-pillar, right
T23 - 23-Pin Connector
T24 - 24-Pin Connector
V139 - Motor to unlock rear lid

50 - Ground connection, in luggage compartment, left
98 - Ground connection, in rear lid wiring harness
218 - Ground connection -1-, in rear lid wiring harness
A49 - Wire connection -1-, in instrument panel wiring harness
W16 - Connector (contact switch) in lock cylinder for rear hatch central locking), in wiring harness, rear

Central control module for comfort system, lock unit for central locking (rear right), switch for unlocking (rear lid handle), motor to unlock rear lid



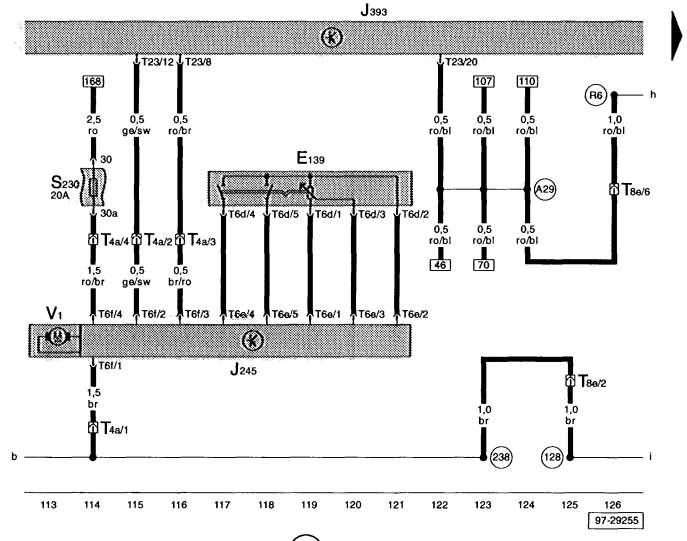
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E165 - Trunk Lid Release Switch
E232 - Rear Lid Remote Lock Key Switch
F5 - Luggage Compartment Light Switch
J393 - Central control module for comfort system, behind instrument panel, left
K166 - Door Ajar Indicator Lamp, in instrument cluster
T5 - 5-Pin Connector, black, connector station D-pillar, left
T5d - 5-Pin Connector, brown, connector station D-pillar, right
T5o - 5-Pin Connector, brown, in rear lid
T5p - 5-Pin Connector, black, in rear lid
T23 - 23-Pin Connector
T24 - 24-Pin Connector
T32 - 32-Pin Connector, blue, on Instrument cluster

W3 - Luggage compartment Light
W18 - Left Luggage Compartment Light

(A126) - Connection (contact switch in rear lid) in instrument panel wiring harness
(Q22) - Wire connection -1-, in rear lid wiring harness
(Q44) - Wire connection -2-, in tailgate wiring harness
(W16) - Connector (contact switch) in lock cylinder for rear hatch central locking), in wiring harness, rear

Central control module for comfort system, trunk lid release switch, luggage compartment light switch, luggage compartment light, rear lid remote lock key switch

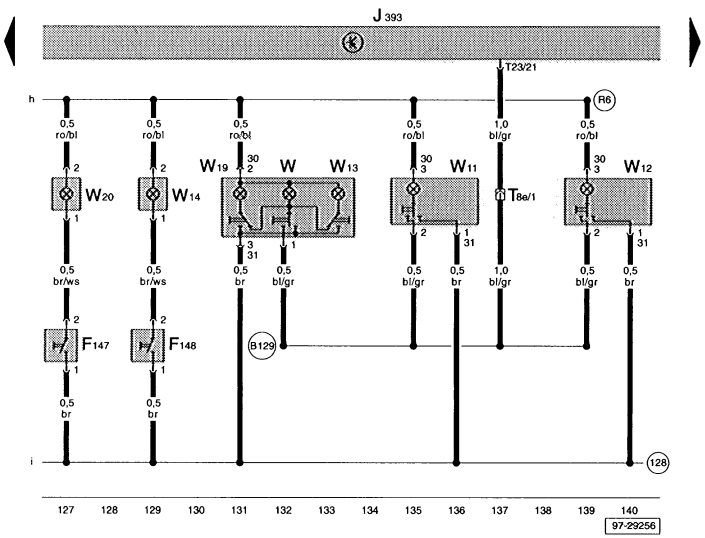


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E139 - Sunroof Regulator
J245 - Power Sunroof Control Module
J393 - Central control module for comfort system, behind instrument panel, left
S230 - Fuse 30 in fuse holder
T4a - 4-Pin Connector, behind instrument panel, left
T6d - 6-Pin Connector
T6e - 6-Pin Connector
T6f - 6-Pin Connector
T8e - 8-Pin Connector, behind instrument panel, left
T23 - 23-Pin Connector
V1 - Sunroof Motor

(128) - Ground connection -1-, in interior light wiring harness
(238) - Ground connection -1-, in wiring harness interior
(A29) - Wire connection (interior light), in instrument panel wiring harness
(R6) - Plus connection -1-, in interior light wiring harness

Central control module for comfort system, power sunroof control module, sunroof regulator, sunroof motor

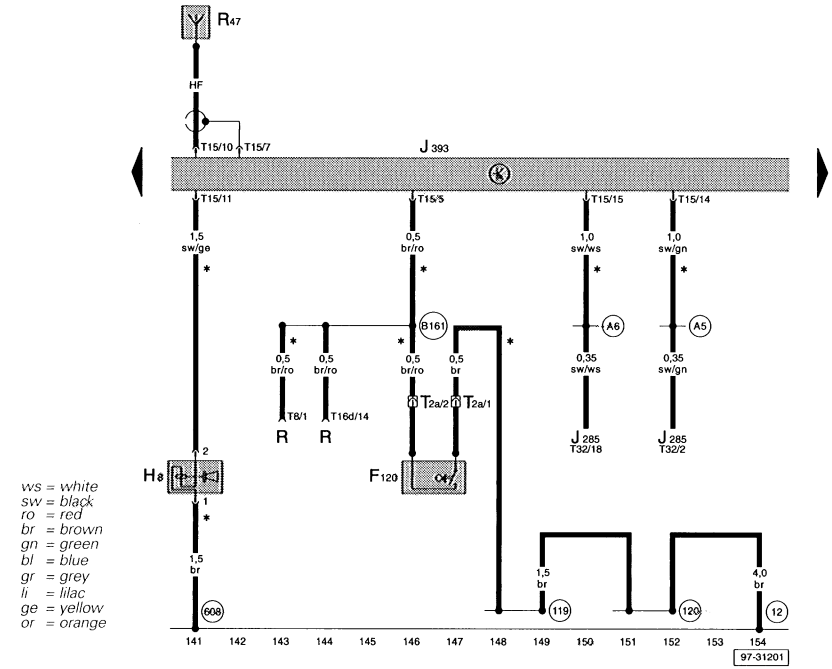


F147 - Left Make-Up Mirror Light Switch
F148 - Right Make-Up Mirror Light Switch
J393 - Central control module for comfort system, behind instrument panel, left
W - Front Interior Light
W11 - Left Rear Reading Light
W12 - Right Rear Reading Light
W13 - Right Front Map/Reading Light
W14 - Right Make-up Mirror Light
W19 - Left Front Reading Light
W20 - Left Make-up Mirror Light
T8e - 8-Pin Connector, behind left A-pillar trim, center
T23 - 23-Pin Connector

(128) - Ground connection -1-, in interior light wiring harness

(B129) - Connector (interior light 3/L) in wiring harness interior
(R6) - Plus connection -1-, in interior light wiring harness

Edition 12/01 **Central control module for comfort system, interior lights, make-up mirror lights**
USA.5102.12.21

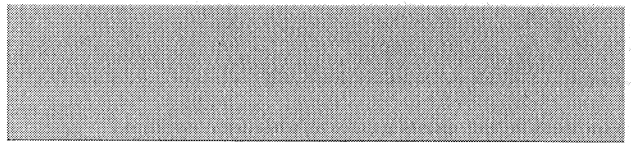


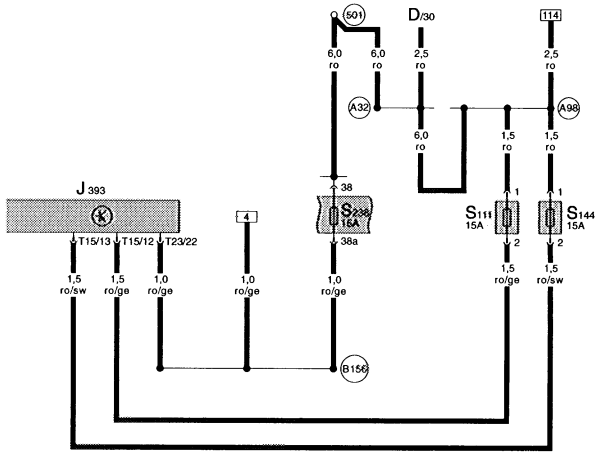
F120 - Hood Alarm Switch*
H8 - Alarm Horn*
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
R - Radio
R47 - Antenna wire for central locking and antitheft warning system
T2a - Double Connector, near headlight, right
T8 - 8-Pin Connector (through July 2001)
T15 - 15-Pin Connector
T16d - 16-Pin Connector (beginning August 2001)
T32 - 32-Pin Connector, blue, on instrument cluster

(12) - Ground connection, in engine compartment, left
(119) - Ground connection -1-, in headlight wiring harness
(120) - Ground connection -2-, in headlight wiring harness
(608) - Ground connection (in center plenum chamber)
(A5) - Plus connection (right turn signal), in instrument panel wiring harness
(A6) - Plus connection (left turn signal), in instrument panel wiring harness
(B161) - Connector (anti-theft warning system), in wiring harness interior

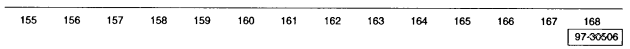
* - Vehicles with anti-theft warning system only

Central control module for comfort system, antitheft warning system, antenna wire for central locking and antitheft warning system **Edition 12/01**
USA.5102.12.21





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



D - Ignition/Starter Switch
J393 - Central control module for comfort system, behind instrument panel, left
S111 - Alarm System and Anti-Theft Fuse, above the thirteenfold auxiliary relay panel
S144 - Fuse for central locking/anti-theft warning system, above the thirteenfold auxiliary relay panel
S238 - Fuse 38 in fuse holder
T15 - 15-Pin Connector
T23 - 23-Pin Connector

(501) - Threaded connection -2- (30) on the relay plate
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness
(B156) - Plus connector (30a), in wiring harness interior

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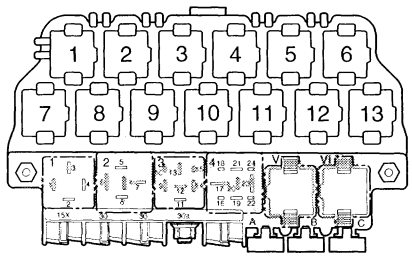
Repair Manual page number 97-559

Comfort System (vehicles with power windows),

from May 2001

- Anti-theft warning system
- Central locking system with remote control
- Fuel tank lid unlock system
- Heated power mirrors
- Interior lights
- Luggage compartment light
- Power sunroof
- Power windows
- Rear lid unlock system

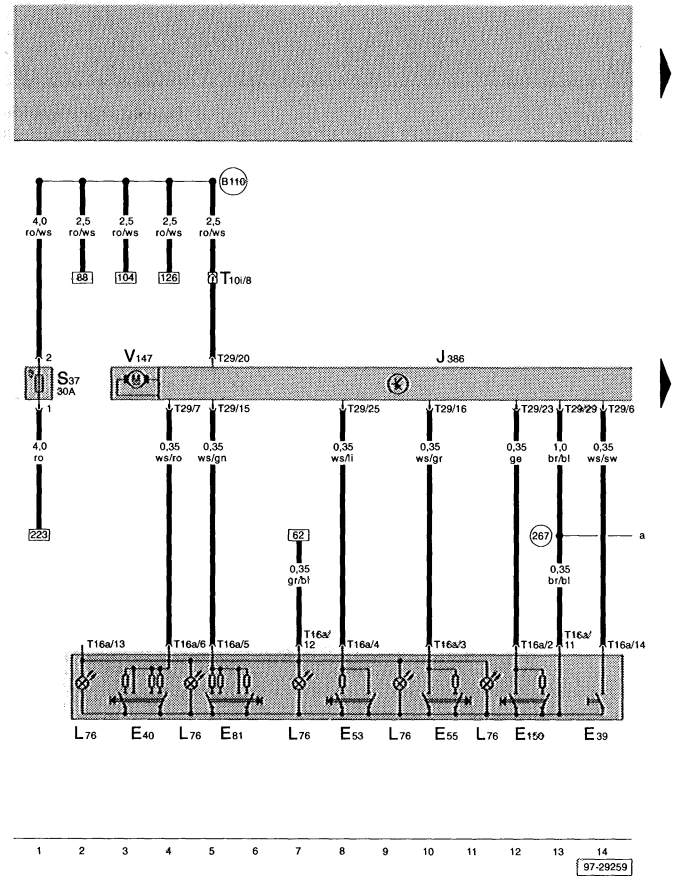
Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97-14163

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



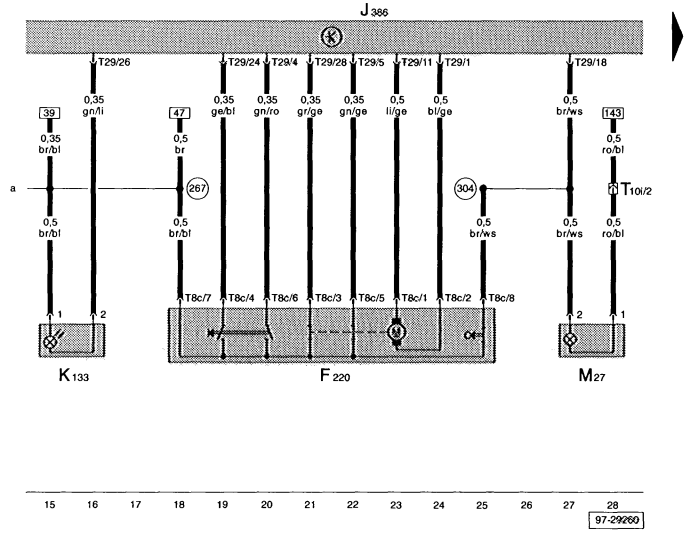
97-29259

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E39 - Safety switch for window regulator rear
E40 - Switch for window regulator front left
E53 - Switch for window regulator rear left, driver
E55 - Switch for window regulator rear right, driver
E81 - Switch for window regulator front right, driver
E150 - Switch for interior lock, driver side
J386 - Door control module, driver side
L76 - Push Button Light
S37 - Fuse for window regulator (circuit breaker), on thirteen position auxiliary relay panel
T10i - 10-Pin Connector, black, connector station A-pillar, left
T16a - 16-Pin Connector
T29 - 29-Pin Connector
V147 - Motor for window regulator, driver side

(267) - Ground connector -2-, in wiring harness door cable - driver side
(B110) - Connection (30, window regulator) in wiring harness interior

Door control module (driver side), switch for window regulator, safety switch for window regulator rear, switch for interior lock (driver side)

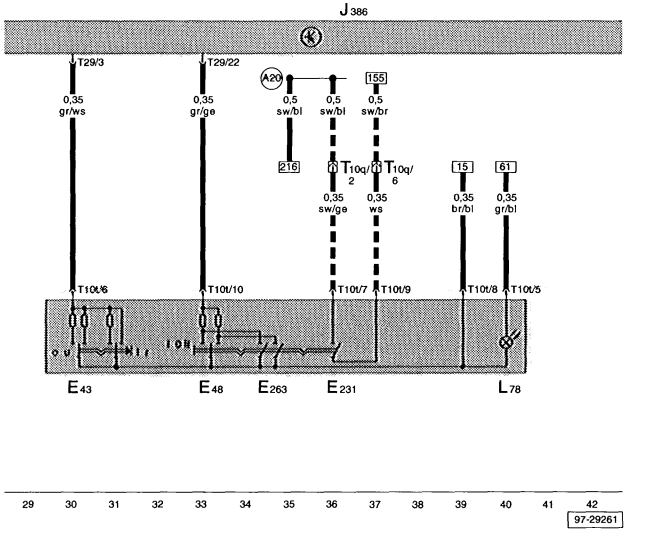


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F220 - Lock unit for central locking, driver side
J386 - Door control module, driver side
K133 - Warning light for central locking -SAFE-
M27 - Left Door Warning Light
T8c - 8-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T29 - 29-Pin Connector

267 - Ground connector -2-, in wiring harness door cable - driver side
304 - Ground connector -3-, in wiring harness door cable - driver side

Door control module (driver side), lock unit for central locking (driver side), warning light for central locking -SAFE-, left door warning light



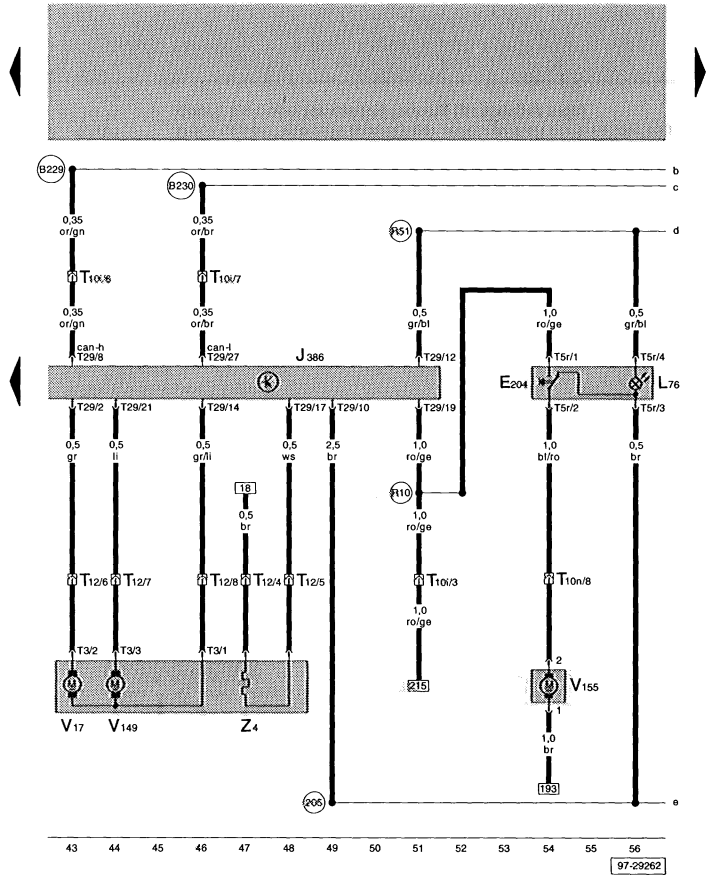
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E43 - Mirror Adjustment Switch
E48 - Mirror Selector Switch
E231 - Switch for outside mirror heating
E263 - Mirror fold-away Switch*
J386 - Door control module, driver side
L78 - Mirror Adjusting Switch Light
T10q - 10-Pin Connector, blue, connector station A-pillar, left
T10t - 10-Pin Connector
T29 - 29-Pin Connector

(A20) - Wire connection (15a), in instrument panel wiring harness

* - Mirror fold-away function for some export countrys only
--- Vehicles with seperate heated outside mirrors only

Door control module (driver side), mirror adjustment switch, mirror selector switch, switch for outside mirror heating



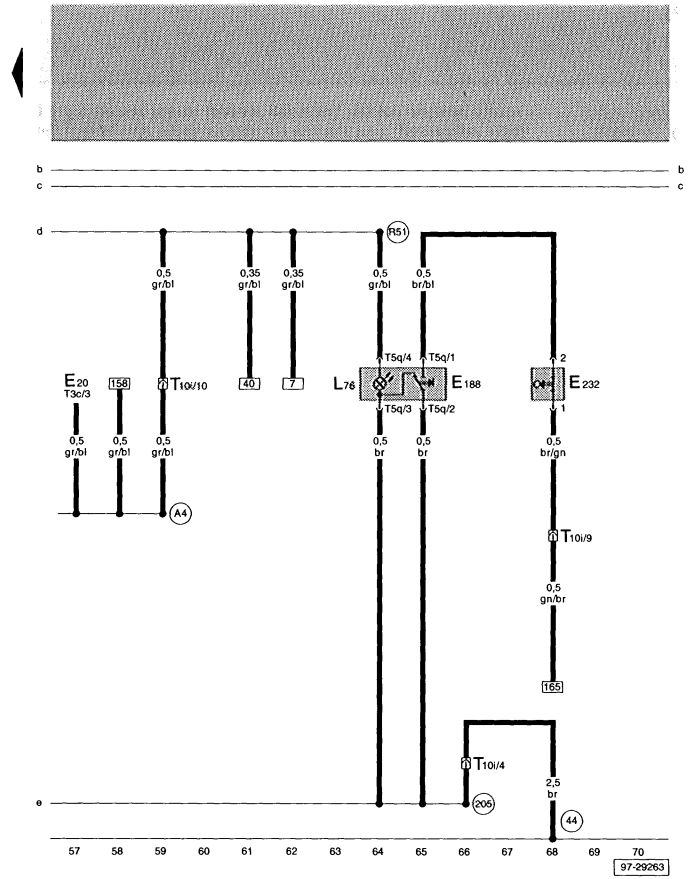
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E204 - Switch for remote/fuel tank door
J386 - Door control module, driver side
L76 - Push Button Light
T3 - 3-Pin Connector
T5r - 5-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10n - 10-Pin Connector, brown, connector station A-pillar, left
T12 - 12-Pin Connector
T29 - 29-Pin Connector
V17 - Driver's Side Mirror Adjustment Motor
V149 - Motor for mirror adjustment, driver side
V155 - Motor for fuel tank lid unlock
Z4 - Heated outside mirror, driver side

(205) - Ground connection, in driver's door wiring harness
(B229) - Connection (high bus), in instrument panel wiring harness
(B230) - Connection (low bus), in instrument panel wiring harness
(R10) - Plus connection -1- (30a), in driver's door wiring harness
(R51) - Connection (58b), in driver's door wiring harness

Edition 03/01
USA.5102.10.21

Door control module (driver side), switch for remote/fuel tank door, motor for fuel tank lid unlock, power mirror (driver side), heated outside mirror (driver side)



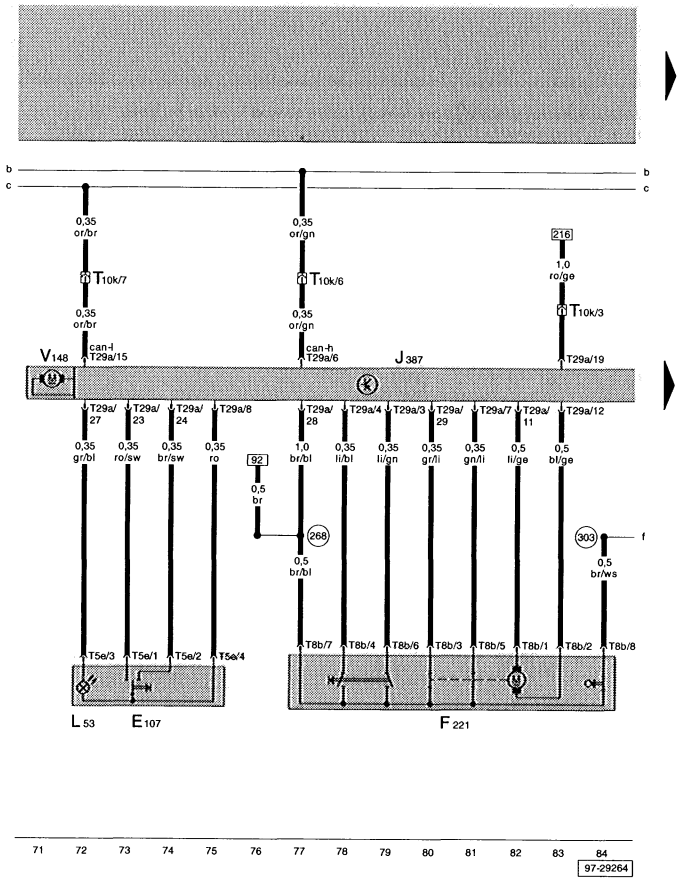
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E20 - Instrument Panel Light Dimmer Switch
E188 - Switch for remote unlock, rear lid, driver side
E232 - Key switch for switching off remote unlock rear lid
L76 - Push Button Light
T3c - 3-Pin Connector
T5q - 5-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left

(44) - Ground connection, on left A-pillar, lower part
(205) - Ground connection, in driver's door wiring harness
(A4) - Plus connection (58b), in instrument panel wiring harness
(R51) - Connection (58b), in driver's door wiring harness

Switch for remote unlock rear lid (driver side), key switch for switching off remote unlock rear lid

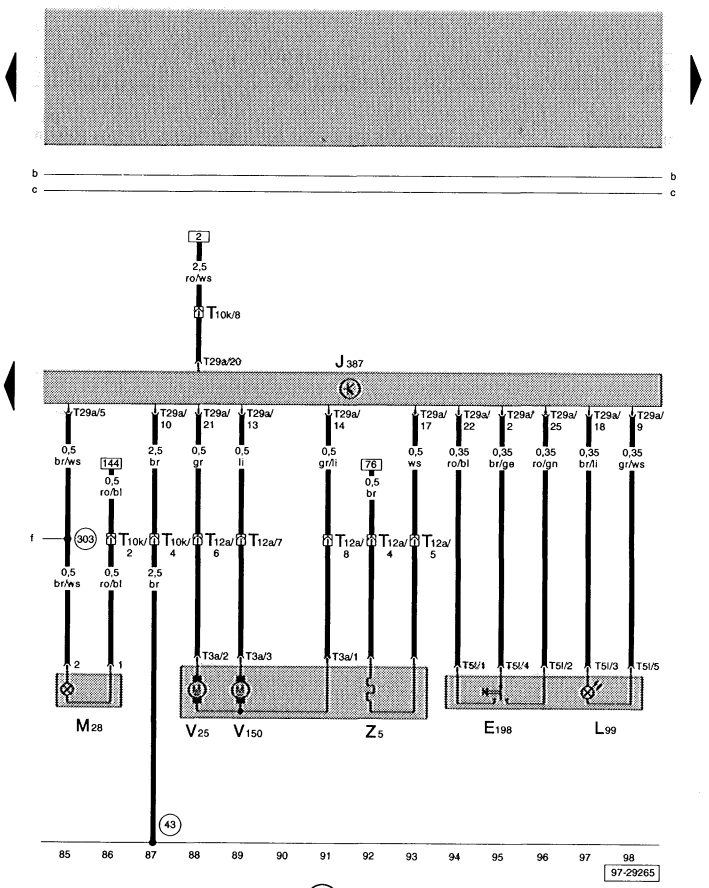
Edition 03/01
USA.5102.10.21



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E107 - Switch for window regulator, in passenger door
F221 - Lock unit for central locking, passenger side
J387 - Door control module, passenger side
L53 - Power Window Switch Light
T5e - 5-Pin Connector
T8b - 8-Pin Connector
T10k - 10-Pin Connector, black, connector station A-pillar, right
T29a - 29-Pin Connector
V148 - Motor for window regulator, passenger side

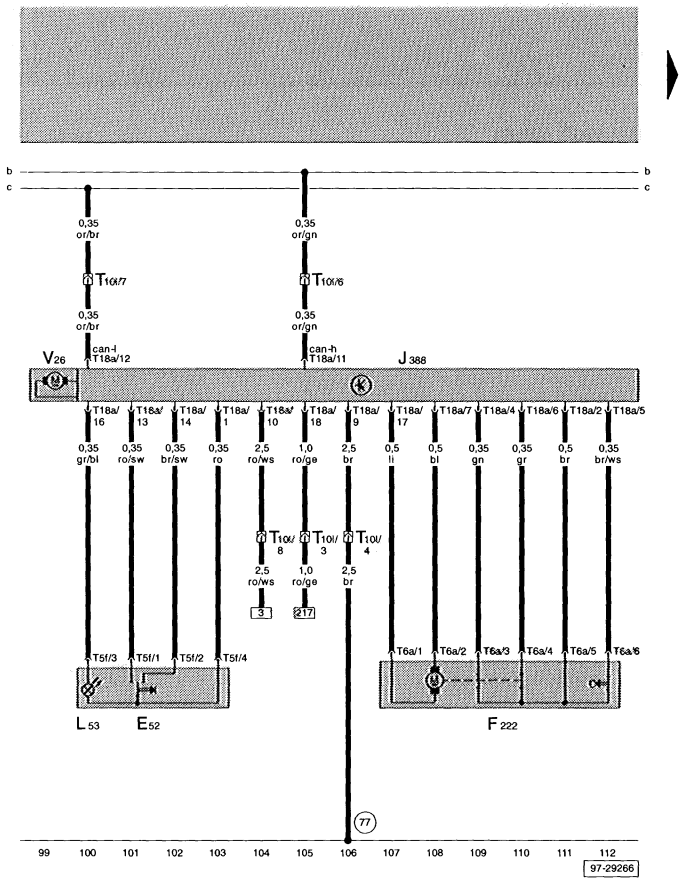
(268) - Ground connector -2-, in wiring harness door cable - passenger side
(303) - Ground connector -3-, in wiring harness door cable - passenger side



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E198 - Switch for interior lock, passenger side
J387 - Door control module, passenger side
L99 - Lighting for switch interior lock
M28 - Right Door Warning Light
T3a - 3-Pin Connector
T5l - 5-Pin Connector
T10k - 10-Pin Connector, black, connector station A-pillar, right
T12a - 12-Pin Connector
T29a - 29-Pin Connector
V25 - Passenger's Side Mirror Adjustment Motor
V150 - Motor for mirror adjustment, passenger side
Z5 - Heated outside mirror, passenger side

(43) - Ground connection, on right A-pillar, lower part
(303) - Ground connector -3-, in wiring harness door cable - passenger side

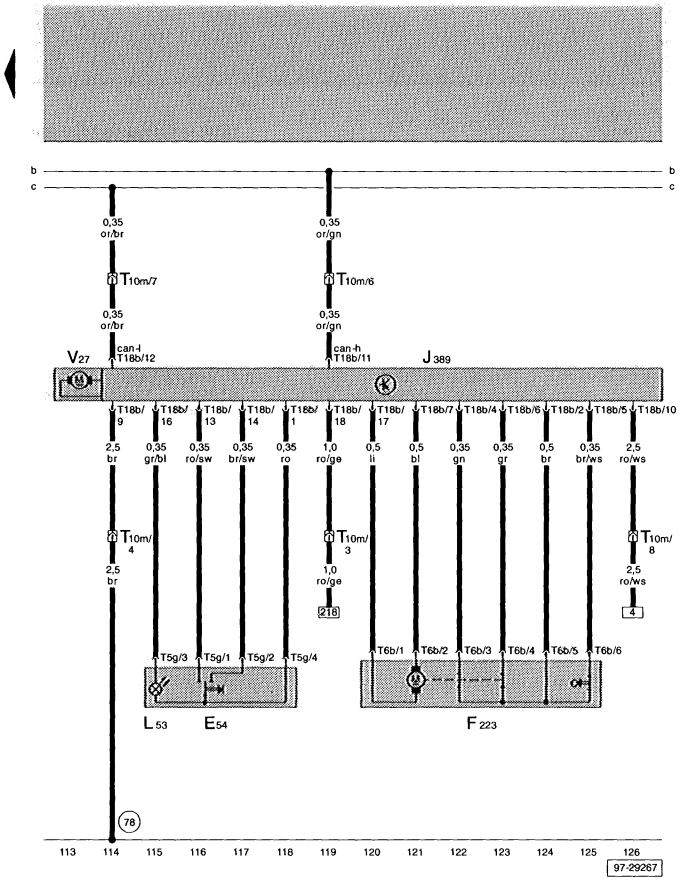


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E52 - Left Rear Window Switch, (In LR Door)
F222 - Lock unit for central locking, rear, left
J388 - Door control module, rear, left
L53 - Power Window Switch Light
T5f - 5-Pin Connector
T6a - 6-Pin Connector
T10l - 10-Pin Connector, black, connector station B-pillar, left
T18a - 18-Pin Connector
V26 - Motor for window regulator, rear, left

(77) - Ground connection, on left B-pillar, lower part

Door control module (rear left), left rear window switch (In LR Door), lock unit for central locking (rear left), motor for window regulator (rear left)

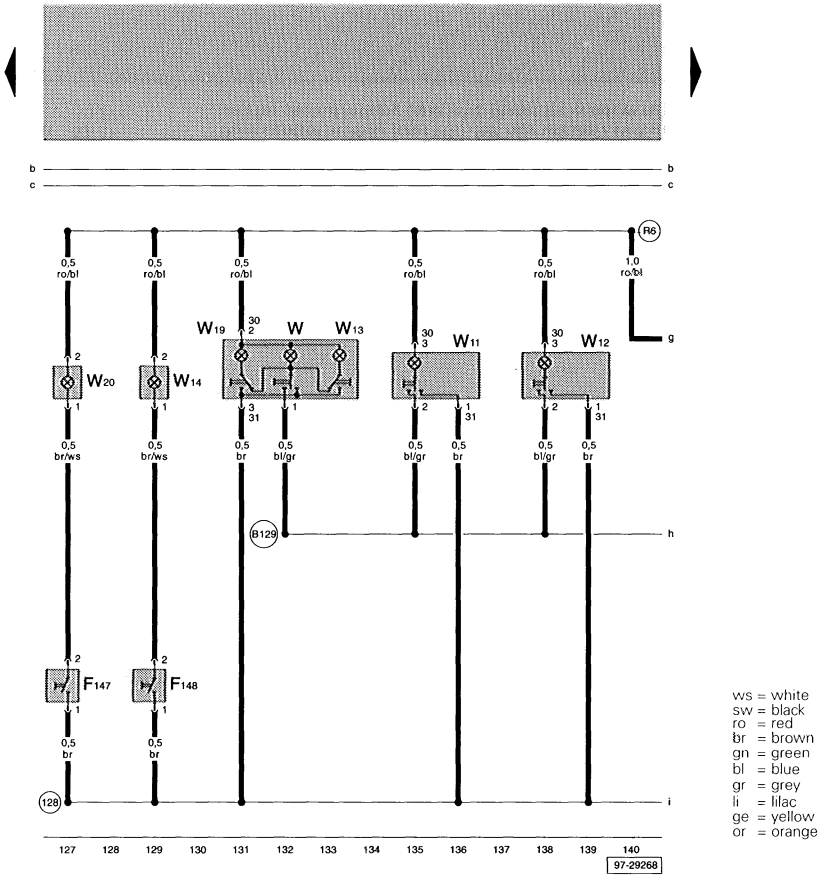


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E54 - Right Rear Window Switch, (In RR Door)
F223 - Lock unit for central locking, rear, right
J389 - Door control module, rear, right
L53 - Power Window Switch Light
T5g - 5-Pin Connector
T6b - 6-Pin Connector
T10m - 10-Pin Connector, black, connector station B-pillar, right
T18b - 18-Pin Connector
V27 - Motor for window regulator, rear, right

(78) - Ground connection, on right B-pillar, lower part

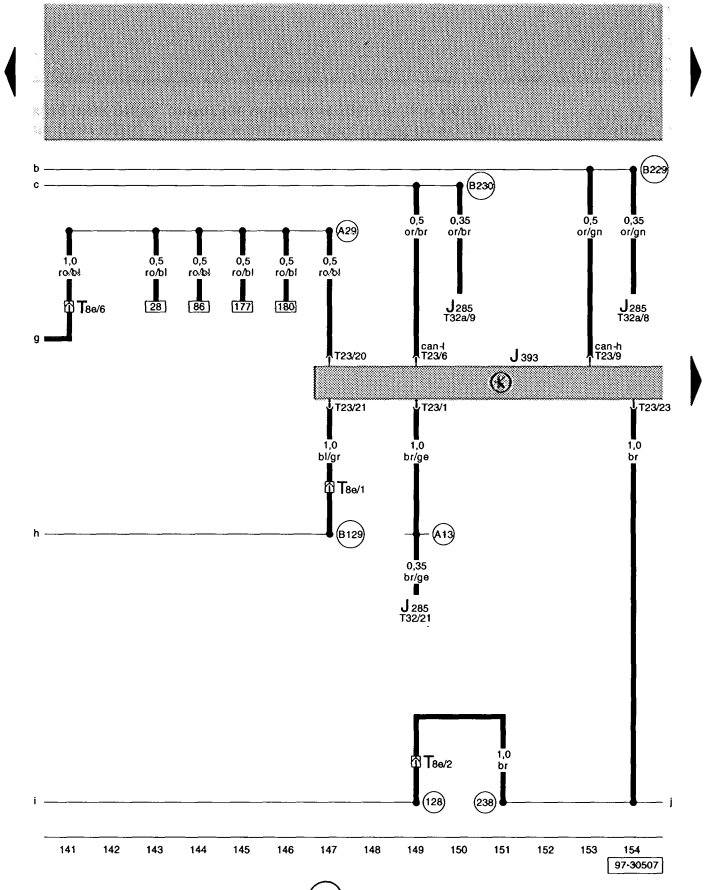
Door control module (rear right), right rear window switch (In RR Door), lock unit for central locking (rear right), motor for window regulator (rear right)



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F147 - Left Make-Up Mirror Light Switch
F148 - Right Make-Up Mirror Light Switch
W - Front Interior Light
W11 - Left Rear Reading Light
W12 - Right Rear Reading Light
W13 - Right Front Map/Reading Light
W14 - Right Make-up Mirror Light
W19 - Left Front Reading Light
W20 - Left Make-up Mirror Light

(128) - Ground connection -1-, in interior light wiring harness
(B129) - Connector (interior light 3/L) in wiring harness interior
(R6) - Plus connection -1-, in interior light wiring harness



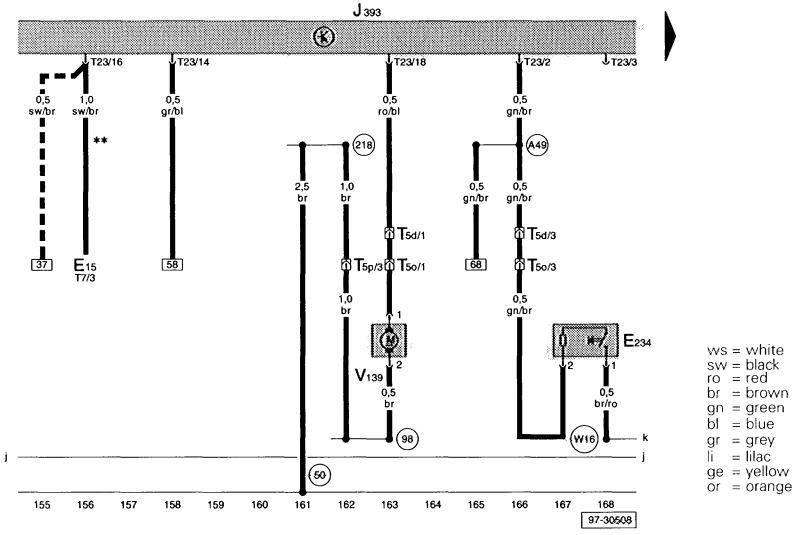
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
T8e - 8-Pin Connector, behind left A-pillar trim, center
T23 - 23-Pin Connector
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(128) - Ground connection -1-, in interior light wiring harness
(238) - Ground connection -1-, in wiring harness interior
(A13) - Wire connection (door contact switch) in instrument panel wiring harness
(A29) - Wire connection (interior light), in instrument panel wiring harness
(B129) - Connector (interior light 3/L) in wiring harness interior
(B229) - Connection (high bus), in instrument panel wiring harness
(B230) - Connection (low bus), in instrument panel wiring harness

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ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

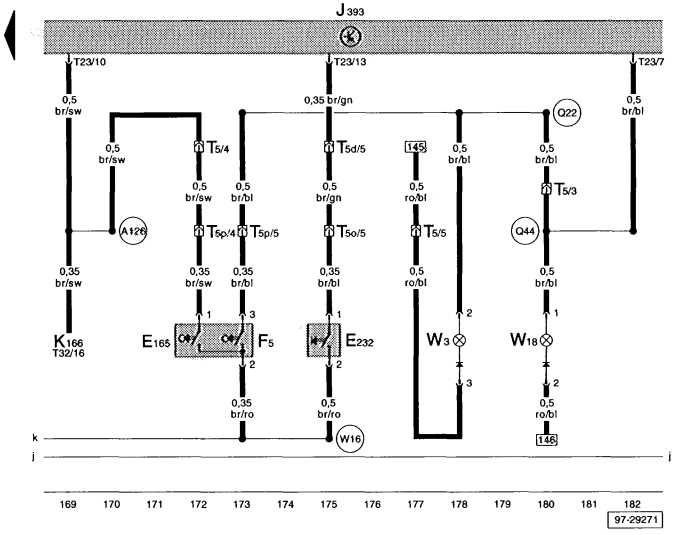
E15 - Rear window defogger switch
E234 - Switch for unlocking, rear lid handle
J393 - Central control module for comfort system, behind instrument panel, left
T5d - 5-Pin Connector, brown, connector station D-pillar, right
T5o - 5-Pin Connector, brown, in rear lid
T5p - 5-Pin Connector, black, in rear lid
T7 - 7-Pin Connector
T23 - 23-Pin Connector
V139 - Motor to unlock rear lid

(50) - Ground connection, in luggage compartment, left
(98) - Ground connection, in rear lid wiring harness
(218) - Ground connection -1-, in rear lid wiring harness
(A49) - Wire connection -1-, in instrument panel wiring harness
(W16) - Connector (contact switch) in lock cylinder for rear hatch central locking), in wiring harness, rear

--- - Vehicles with separate heated outside mirrors only
** - Vehicles without seperate heated outside mirrors only

Edition 09/01
USA.5102.11.21

Central control module for comfort system, switch for unlocking (rear lid handle), motor to unlock rear lid



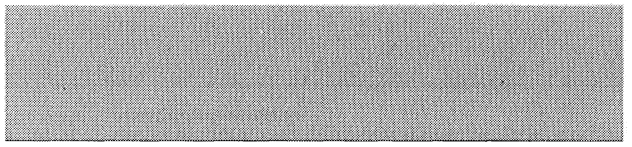
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sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

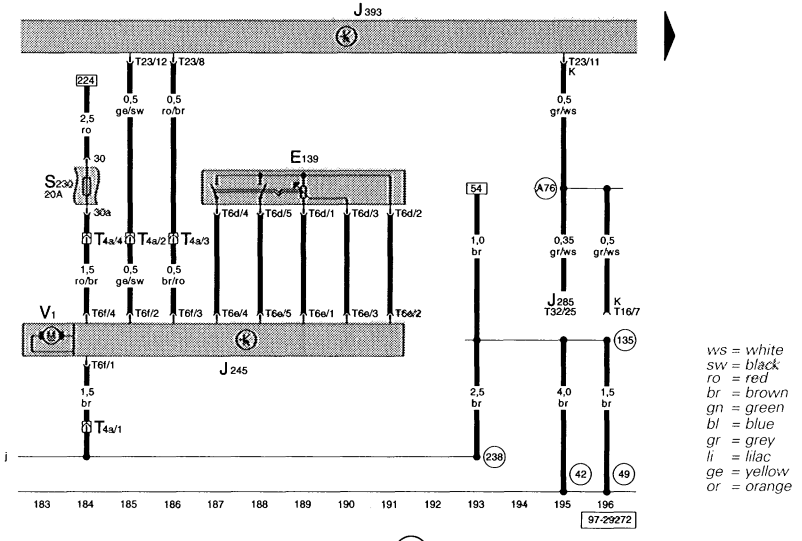
E165 - Trunk Lid Release Switch
E232 - Rear Lid Remote Lock Key Switch
F5 - Luggage Compartment Light Switch
J393 - Central control module for comfort system, behind instrument panel, left
K166 - Door Ajar Indicator Lamp, in instrument cluster
T5 - 5-Pin Connector, black, connector station D-pillar, left
T5d - 5-Pin Connector, brown, connector station D-pillar, right
T5o - 5-Pin Connector, brown, in rear lid
T5p - 5-Pin Connector, black, in rear lid
T23 - 23-Pin Connector
T32 - 32-Pin Connector, blue, on Instrument cluster
W3 - Luggage compartment Light
W18 - Left Luggage Compartment Light

(A126) - Connection (contact switch in rear lid) in instrument panel wiring harness
(Q22) - Wire connection -1-, in rear lid wiring harness
(Q44) - Wire connection -2-, in tailgate wiring harness
(W16) - Connector (contact switch) in lock cylinder for rear hatch central locking), in wiring harness, rear

Central control module for comfort system, trunk lid release switch, luggage compartment light

Edition 09/01
USA.5102.11.21

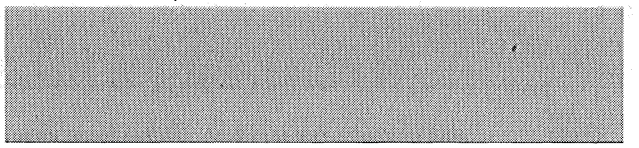


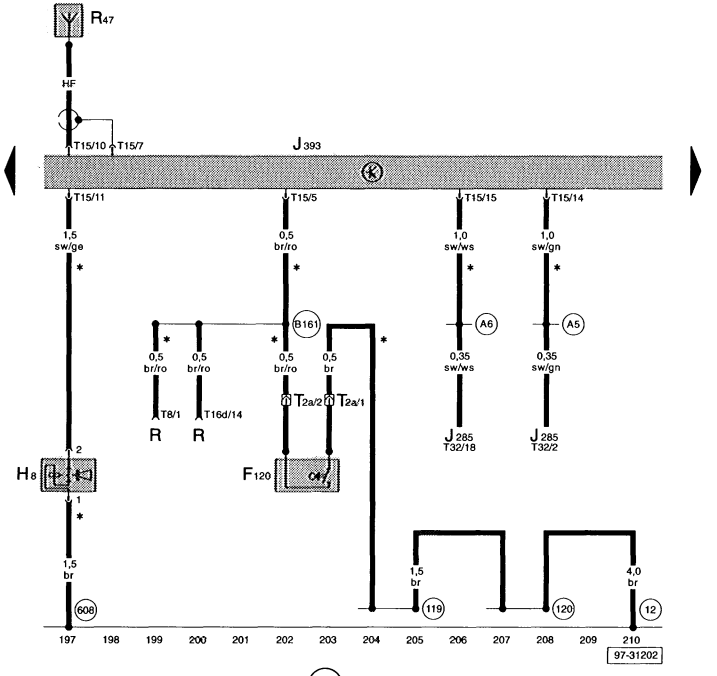


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E139 - *Sunroof Regulator*
J245 - *Power Sunroof Control Module*
J285 - *Control module with indicator unit in instrument panel insert*
J393 - *Central control module for comfort system, behind instrument panel, left*
S230 - *Fuse 30 in fuse holder*
T4a - *4-Pin Connector, behind left A-pillar trim, center*
T6d - *6-Pin Connector*
T6e - *6-Pin Connector*
T6f - *6-Pin Connector*
T16 - *Data Link Connector (DLC), below instrument panel, left*
T23 - *23-Pin Connector*
T32 - *32-Pin Connector, blue, on Instrument cluster*
V1 - *Sunroof Motor*

(42) - *Ground connection, beside steering column*
(49) - *Ground connection, on steering column*
(135) - *Ground connection -2-, in instrument panel wiring harness*
(238) - *Ground connection -1-, in wiring harness interior*
(A76) - *Connector (K-diagnosis wire) in instrument panel wiring harness*



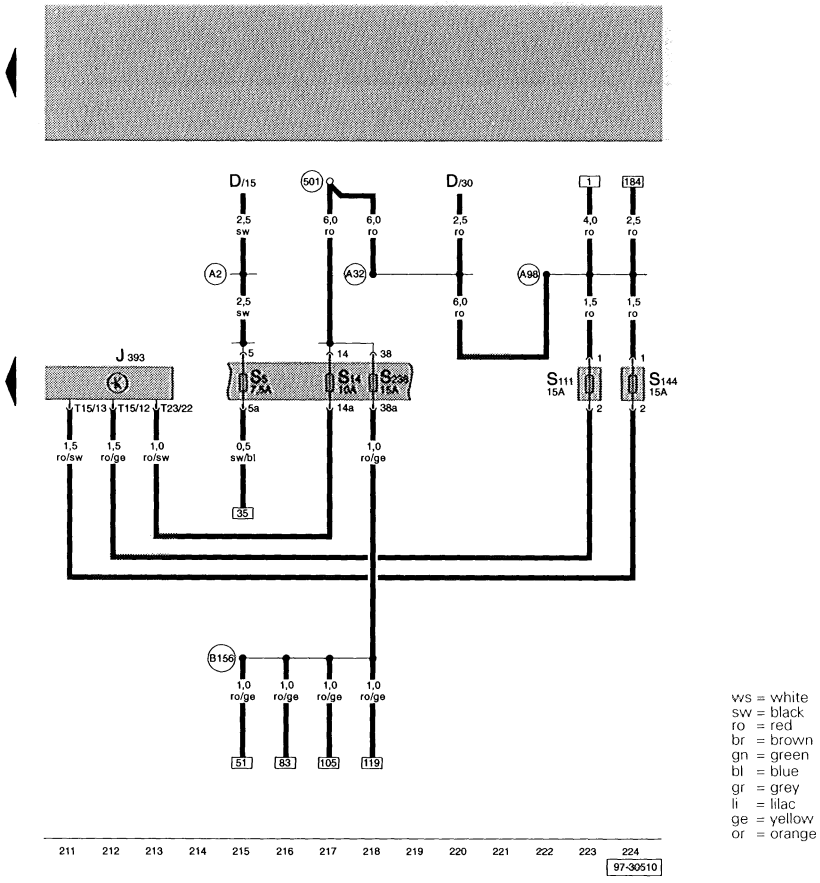


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F120 - *Hood Alarm Switch**
H8 - *Alarm Horn**
J285 - *Control module with indicator unit in instrument panel insert*
J393 - *Central control module for comfort system, behind instrument panel, left*
R - *Radio*
R47 - *Antenna wire for central locking and antitheft warning system*
T2a - *Double Connector, near headlight, right*
T8 - *8-Pin Connector (through July 2001)*
T15 - *15-Pin Connector**
T16d - *16-Pin Connector (beginning August 2001)*
T32 - *32-Pin Connector, blue, on instrument cluster*

(12) - *Ground connection, in engine compartment, left*
(119) - *Ground connection -1-, in headlight wiring harness*
(120) - *Ground connection -2-, in headlight wiring harness*
(608) - *Ground connection (in center plenum chamber)*
(A5) - *Plus connection (right turn signal), in instrument panel wiring harness*
(A6) - *Plus connection (left turn signal), in instrument panel wiring harness*
(B161) - *Connector (anti-theft warning system), in wiring harness interior*

* - *Vehicles with anti-theft warning system only*



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

D - Ignition/Starter Switch
J393 - Central control module for comfort system, behind instrument panel, left
S5 - Fuse 5 in fuse holder
S14 - Fuse 14 in fuse holder
S111 - Alarm System and Anti-Theft Fuse, above the thirteenfold auxiliary relay panel*
S144 - Fuse for central locking/anti-theft warning system, above the thirteenfold auxiliary relay panel*
S238 - Fuse 38 in fuse holder
T15 - 15-Pin Connector*
T23 - 23-Pin Connector

(501) - Threaded connection -2- (30) on the relay plate

(A2) - Plus connection (15), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness
(B156) - Plus connector (30a), in wiring harness interior

* - Vehicles with anti-theft warning system only

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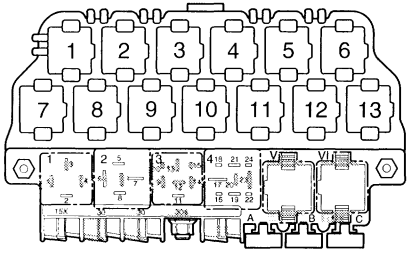
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Comfort system (vehicles without power windows),

from May 2001

- Anti-theft warning system
- Central locking system with remote control
- Fuel tank lid unlock system
- Heated outside mirrors
- Interior lights
- Luggage compartment light
- Power sunroof
- Rear lid unlock system

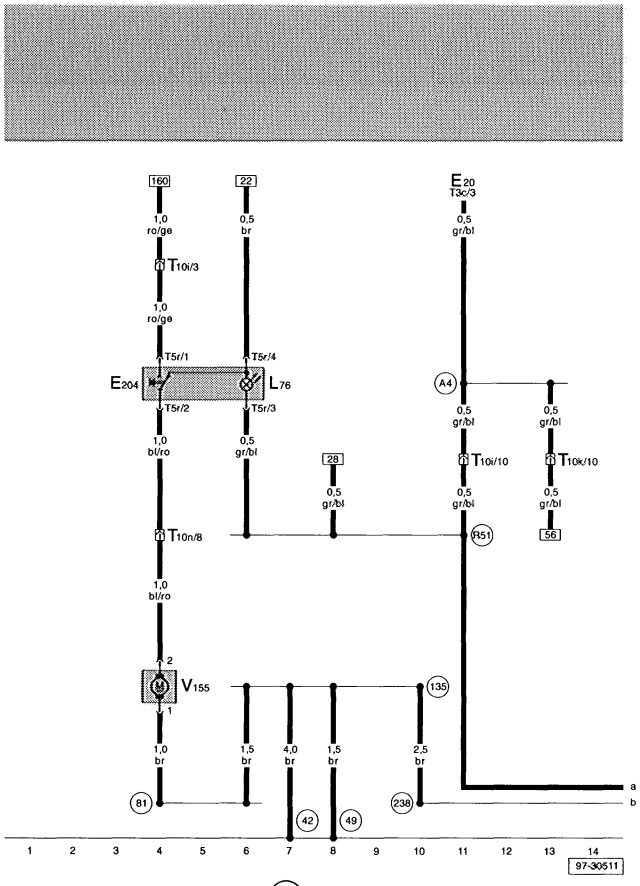
Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

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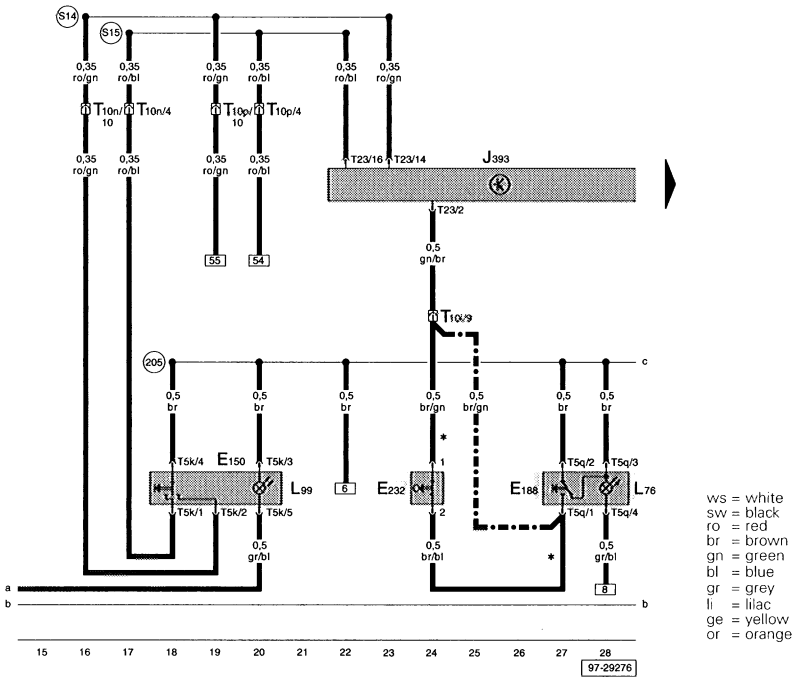
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E20 - Instrument Panel Light Dimmer Switch
E204 - Switch for remote/fuel tank door
L76 - Push Button Light
T3c - 3-Pin Connector
T5r - 5-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10k - 10-Pin Connector, black, connector station A-pillar, right
T10n - 10-Pin Connector, brown, connector station A-pillar, left
V155 - Motor for fuel tank lid unlock

(42) - Ground connection, beside steering column
(49) - Ground connection, on steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(238) - Ground connection -1-, in wiring harness interior
(A4) - Plus connection (58b), in instrument panel wiring harness
(R51) - Connection (58b) in door wiring harness, driver side

Switch for remote/fuel tank door, motor for fuel tank lid unlock

Repair Manual page number 97-579



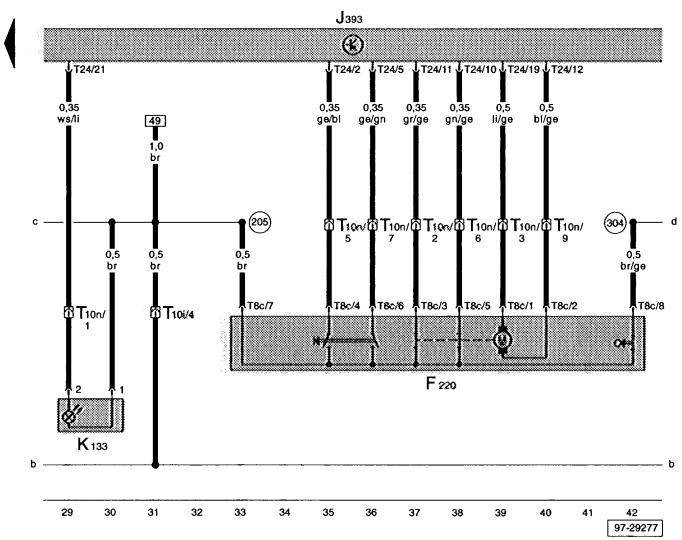
E150 - Switch for interior lock, driver side
E188 - Switch for remote unlock, rear lid, driver side
E232 - Key switch for switching off remote unlock rear lid
J393 - Central control module for comfort system, behind instrument panel, left
L76 - Push Button Light
L99 - Lighting for switch interior lock
T5k - 5-Pin Connector
T5q - 5-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10n - 10-Pin Connector, brown, connector station A-pillar, left
T10p - 10-Pin Connector, brown, connector station A-pillar, right
T23 - 23-Pin Connector

(205) - Ground connection, in driver's door wiring harness
(S14) - Wire connection (open), in central locking system wiring harness
(S15) - Wire connection (closed), in central locking system wiring harness

* - Jetta only
-•-•- Golf only

Edition 03/01
USA.5102.10.21

Central control module for comfort system, switch for interior lock (driver side), switch for remote unlock rear lid

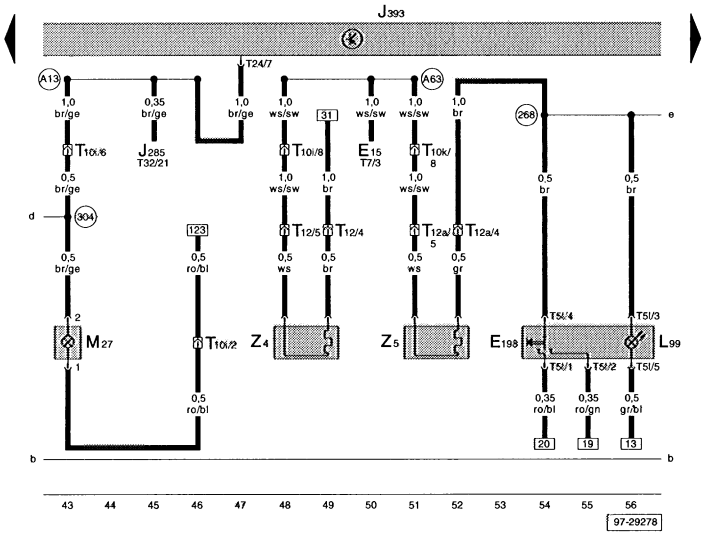


F220 - Lock unit for central locking, driver side
J393 - Central control module for comfort system, behind instrument panel, left
K133 - Warning light for central locking -SAFE-
T8c - 8-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10n - 10-Pin Connector, brown, connector station A-pillar, left
T24 - 24-Pin Connector

(205) - Ground connection, in driver's door wiring harness
(304) - Ground connector -3-, in wiring harness door cable - driver side

Central control module for comfort system, lock unit for central locking, warning light for central locking -SAFE-

Edition 03/01
USA.5102.10.21



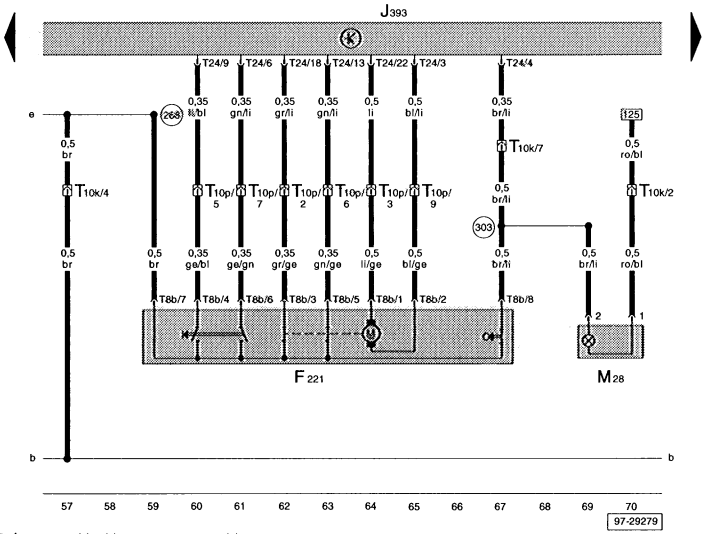
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E15 - Rear window defogger switch
E198 - Switch for interior lock, passenger side
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
L99 - Lighting for switch interior lock
M27 - Left Door Warning Light
T5l - 5-Pin Connector
T7 - 7-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10k - 10-Pin Connector, black, connector station A-pillar, right
T12 - 12-Pin Connector, in driver's door
T12a - 12-Pin Connector, in front passenger's door
T24 - 24-Pin Connector
T32 - 32-Pin Connector, blue
Z4 - Heated outside mirror, driver side
Z5 - Heated outside mirror, passenger side

(268) - Ground connector -2-, in wiring harness door cable - passenger side
(304) - Ground connector -3-, in wiring harness door cable - driver side
(A13) - Wire connection (door contact switch) in instrument panel wiring harness
(A63) - Connector (mirror adjustment/-heated) in instrument panel wiring harness

Edition 03/01
USA.5102.10.21

Central control module for comfort system, switch for interior lock (passenger side), left door warning light, heated outside mirrors



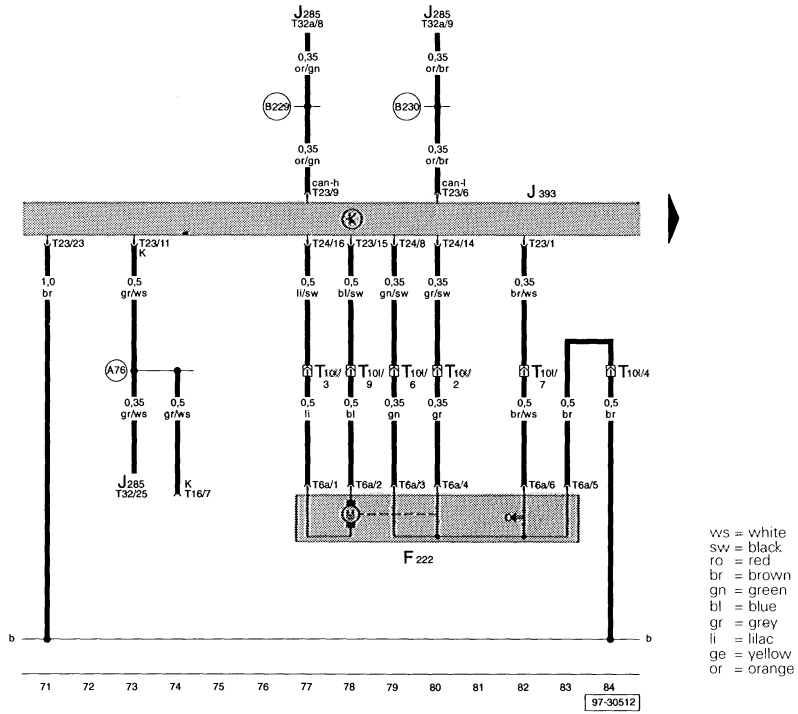
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F221 - Lock unit for central locking, passenger side
J393 - Central control module for comfort system, behind instrument panel, left
M28 - Right Door Warning Light
T8b - 8-Pin Connector
T10k - 10-Pin Connector, black, connector station A-pillar, right
T10p - 10-Pin Connector, brown, connector station A-pillar, right
T24 - 24-Pin Connector

(268) - Ground connector -2-, in wiring harness door cable - passenger side
(303) - Ground connector -3-, in wiring harness door cable - passenger side

Central control module for comfort system, lock unit for central locking (passenger side), right door warning light

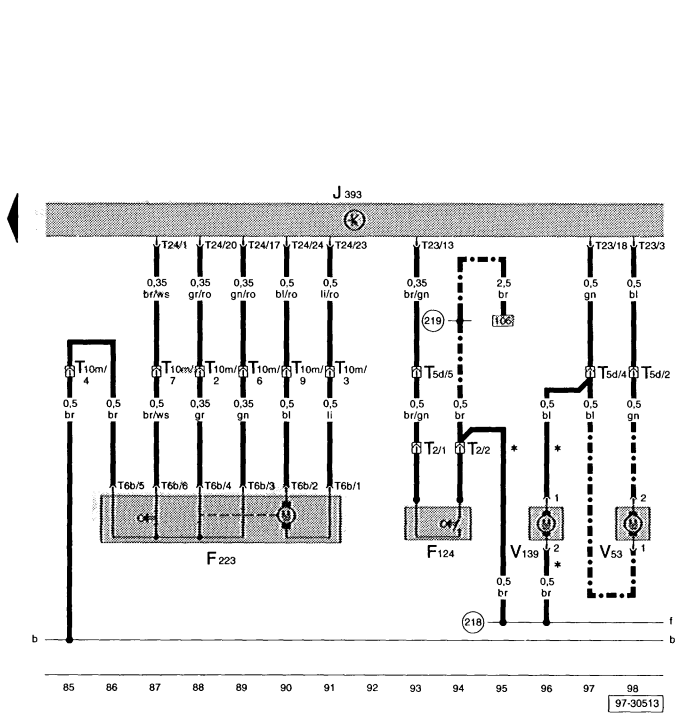
Edition 03/01
USA.5102.10.21



F222 - Lock unit for central locking, rear, left
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
T6a - 6-Pin Connector
T10l - 10-Pin Connector, black, connector station B-pillar, left
T16 - Data Link Connector (DLC), below instrument panel, left
T23 - 23-Pin Connector
T24 - 24-Pin Connector
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

A76 - Connector (K-diagnosis wire) in instrument panel wiring harness
B229 - Connection (high bus), in instrument panel wiring harness
B230 - Connection (low bus), in instrument panel wiring harness

Edition 09/01 **Central control module for comfort system, lock unit for central locking (rear left)**
USA.5102.11.21

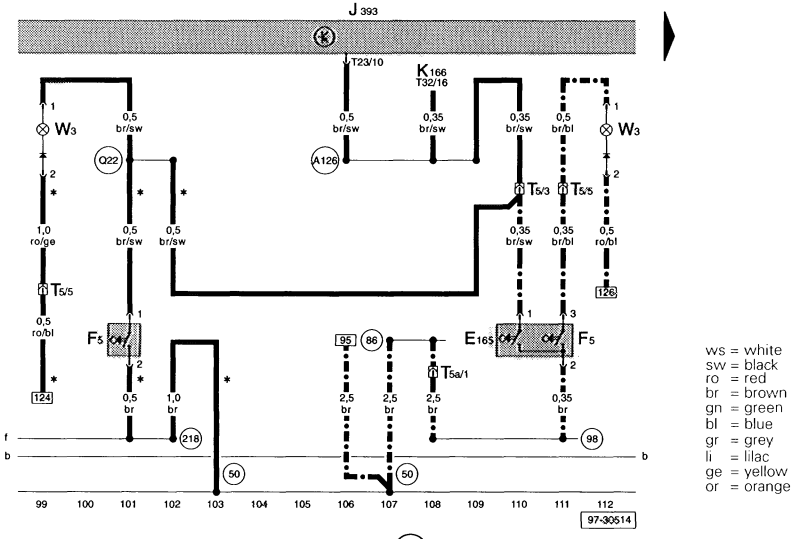


F124 - Trunk Lock Alarm/Central Locking Switch
F223 - Lock unit for central locking, rear, right
J393 - Central control module for comfort system, behind instrument panel, left
T2 - Double Connector, in rear lid
T5d - 5-Pin Connector, brown, connector station C-pillar, left
T6b - 6-Pin Connector
T10m - 10-Pin Connector, black, connector station B-pillar, right
T23 - 23-Pin Connector
T24 - 24-Pin Connector
V53 - Decklid Central Locking System Motor (Golf only)
V139 - Motor to unlock rear lid*

218 - Ground connection -1-, in rear lid wiring harness
219 - Ground connection -2-, in rear lid wiring harness

* - Jetta only
-•-•- Golf only

Central control module for comfort system, lock unit for central locking (rear right), trunk lock alarm/central locking switch, decklid central locking system motor **Edition 09/01**
USA.5102.11.21



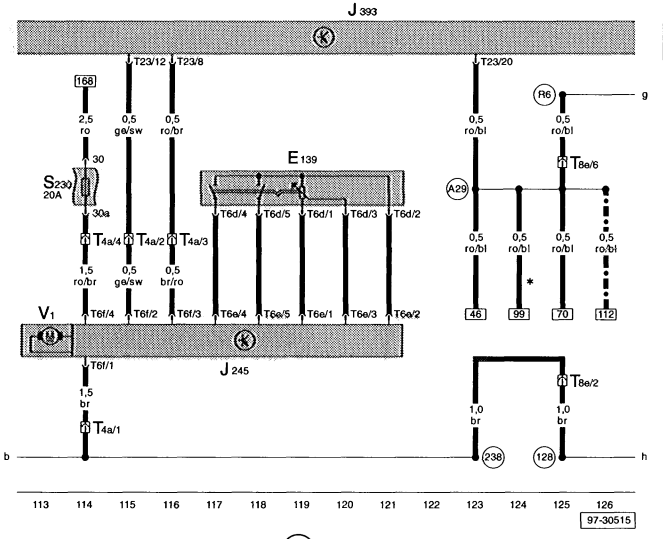
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E165 - Trunk Lid Release Switch
F5 - Luggage Compartment Light Switch
J393 - Central control module for comfort system, behind instrument panel, left
K166 - Door Ajar Indicator Lamp, in instrument cluster
T5 - 5-Pin Connector, black, connector station C-pillar, left
T5a - 5-Pin Connector, pink, connector station C-pillar, left (Golf only)
T23 - 23-Pin Connector
T32 - 32-Pin Connector, blue, on Instrument cluster
W3 - Luggage compartment Light

(50) - Ground connection, in luggage compartment, left
(86) - Ground connection -1-, in rear wiring harness
(98) - Ground connection, in rear lid wiring harness
(218) - Ground connection -1-, in rear lid wiring harness
(A126) - Connection (contact switch in rear lid) in instrument panel wiring harness
(Q22) - Wire connection -1-, in rear lid wiring harness

* - Jetta only
-•-•- Golf only

Central control module for comfort system, trunk lid release switch, luggage compartment light switch



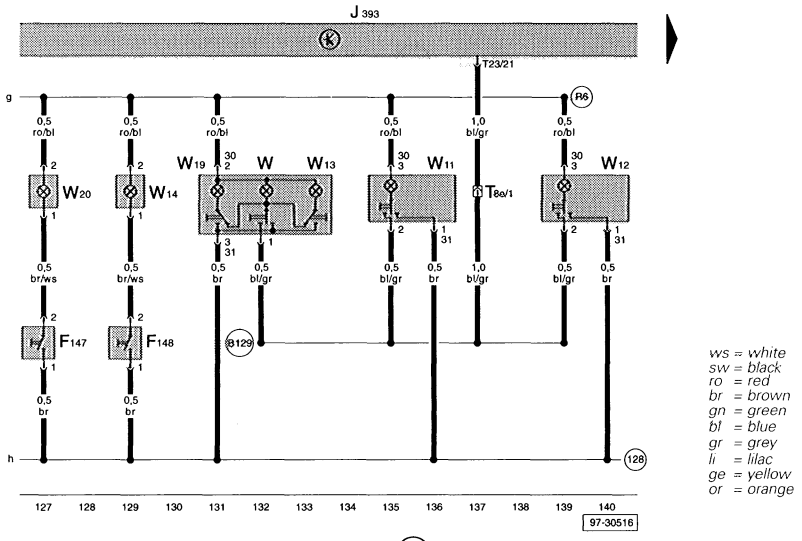
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E139 - Sunroof Regulator
J245 - Power Sunroof Control Module
J393 - Central control module for comfort system, behind instrument panel, left
S230 - Fuse 30 in fuse holder
T4a - 4-Pin Connector, behind left A-pillar trim, center
T6d - 6-Pin Connector
T6e - 6-Pin Connector
T6f - 6-Pin Connector
T8e - 8-Pin Connector, behind left A-pillar trim, center
T23 - 23-Pin Connector
V1 - Sunroof Motor

(128) - Ground connection -1-, in interior light wiring harness
(238) - Ground connection -1-, in wiring harness interior
(A29) - Wire connection (interior light), in instrument panel wiring harness
(R6) - Plus connection -1-, in interior light wiring harness

* - Jetta only
-•-•- Golf only

Central control module for comfort system, power sunroof control module, sunroof regulator, sunroof motor

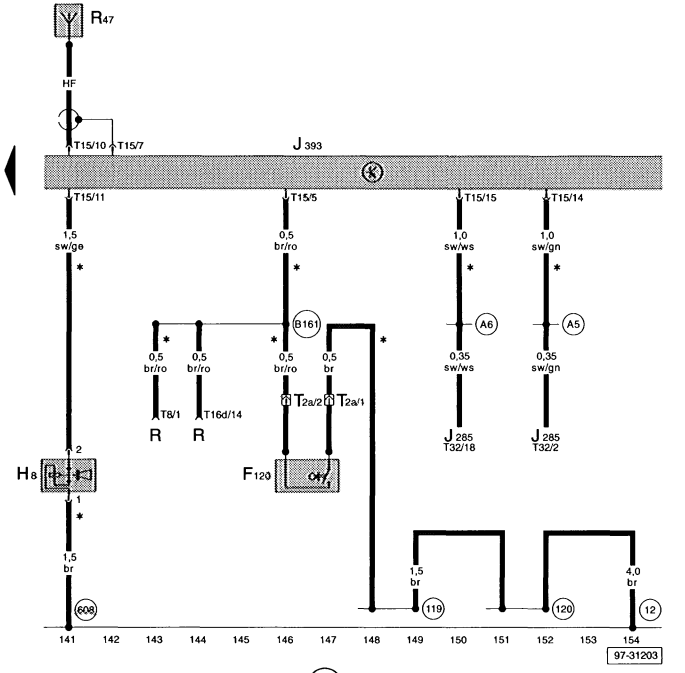


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F147 - Left Make-Up Mirror Light Switch
F148 - Right Make-Up Mirror Light Switch
J393 - Central control module for comfort system, behind instrument panel, left
W - Front Interior Light
W11 - Left Rear Reading Light
W12 - Right Rear Reading Light
W13 - Right Front Map/Reading Light
W14 - Right Make-up Mirror Light
W19 - Left Front Reading Light
W20 - Left Make-up Mirror Light
T8e - 8-Pin Connector, behind left A-pillar trim, center
T23 - 23-Pin Connector

(128) - Ground connection -1-, in interior light wiring harness

(B129) - Connector (interior light 3/L) in wiring harness interior
(R6) - Plus connection -1-, in interior light wiring harness

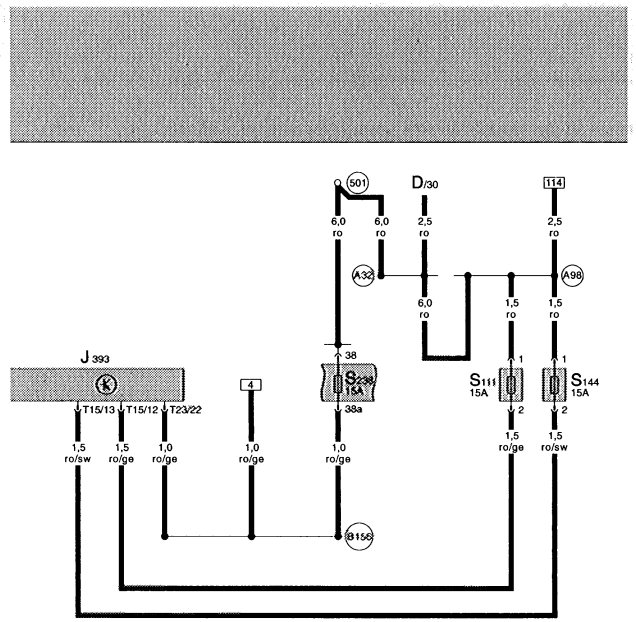


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F120 - Hood Alarm Switch*
H8 - Alarm Horn*
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
R - Radio
R47 - Antenna wire for central locking and antitheft warning system
T2a - Double Connector, near headlight, right
T8 - 8-Pin Connector (through July 2001)
T15 - 15-Pin Connector
T16d - 16-Pin Connector (beginning August 2001)
T32 - 32-Pin Connector, blue, on instrument cluster

(12) - Ground connection, in engine compartment, left
(119) - Ground connection -1-, in headlight wiring harness
(120) - Ground connection -2-, in headlight wiring harness
(608) - Ground connection (in center plenum chamber)
(A5) - Plus connection (right turn signal), in instrument panel wiring harness
(A6) - Plus connection (left turn signal), in instrument panel wiring harness
(B161) - Connector (anti-theft warning system), in wiring harness interior

* - Vehicles with anti-theft warning system only



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

D - Ignition/Starter Switch
J393 - Central control module for comfort system, behind instrument panel, left
S111 - Alarm System and Anti-Theft Fuse, above the thirteenfold auxiliary relay panel
S144 - Fuse for central locking/anti-theft warning system, above the thirteenfold auxiliary relay panel
S238 - Fuse 38 in fuse holder
T15 - 15-Pin Connector
T23 - 23-Pin Connector

(501) - Threaded connection -2- (30) on the relay plate
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness
(B156) - Plus connector (30a), in wiring harness interior

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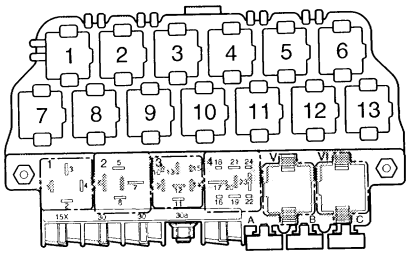
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Comfort System (vehicles with power windows),

from May 2001

- Anti-theft warning system
- Central locking system with remote control
- Fuel tank lid unlock system
- Heated power mirrors
- Interior lights
- Luggage compartment light
- Power sunroof
- Power windows
- Rear lid unlock system

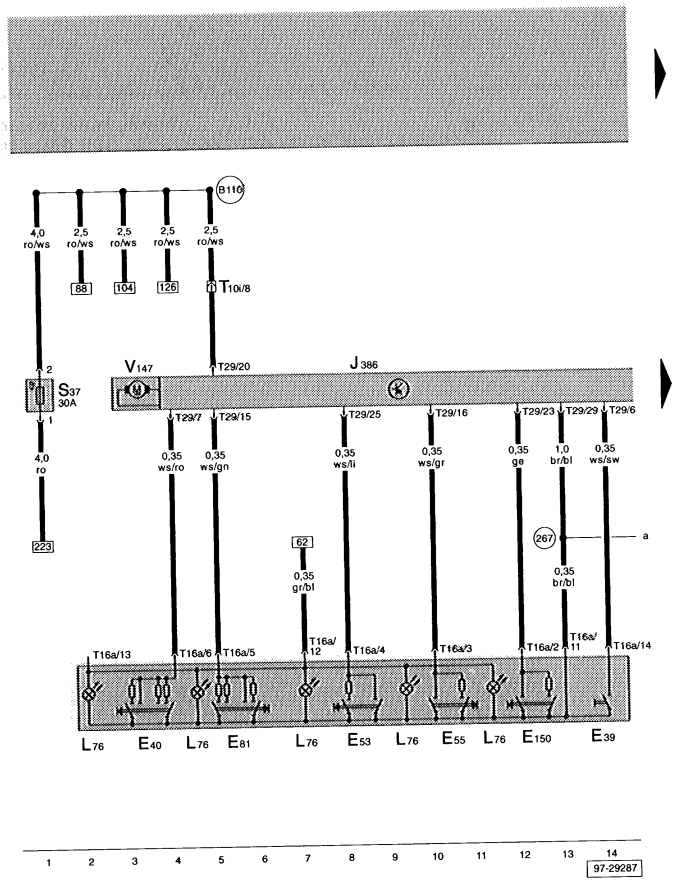
Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97-14163

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

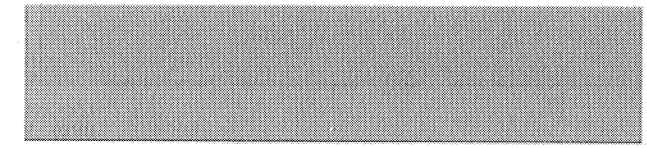


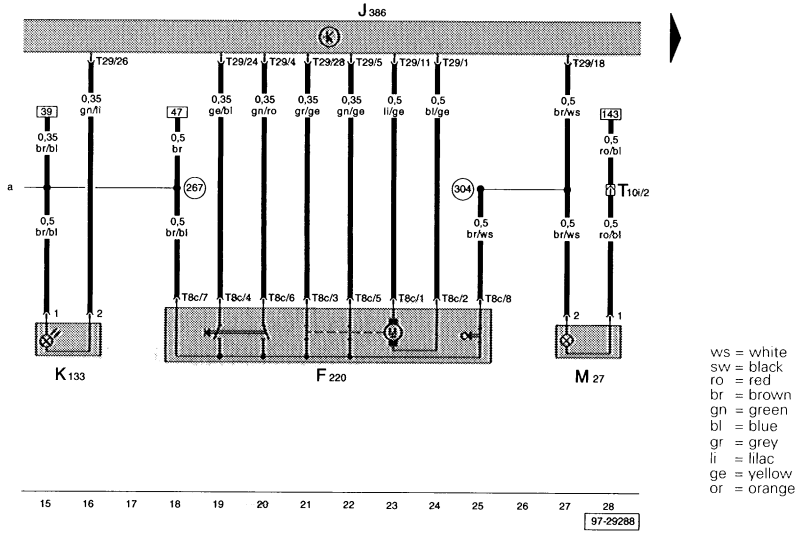
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E39 - Safety switch for window regulator rear
E40 - Switch for window regulator front left
E53 - Switch for window regulator rear left, driver
E55 - Switch for window regulator rear right, driver
E81 - Switch for window regulator front right, driver
E150 - Switch for interior lock, driver side
J386 - Door control module, driver side
L76 - Push Button Light
S37 - Fuse for window regulator (circuit breaker), on thirteen position auxiliary relay panel
T10i - 10-Pin Connector, black, connector station A-pillar, left
T16a - 16-Pin Connector
T29 - 29-Pin Connector
V147 - Motor for window regulator, driver side

(267) - Ground connector -2-, in wiring harness door cable - driver side
(B110) - Connection (30), window regulator) in wiring harness interior

Door control module (driver side), switch for window regulator, safety switch for window regulator rear, switch for interior lock (driver side)





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

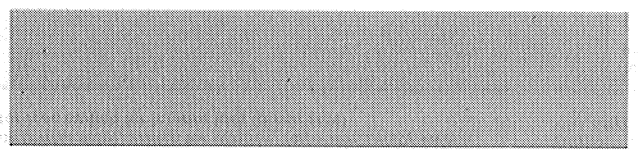
F220 - Lock unit for central locking, driver side
J386 - Door control module, driver side
K133 - Warning light for central locking -SAFE-
M27 - Left Door Warning Light
T8c - 8-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T29 - 29-Pin Connector

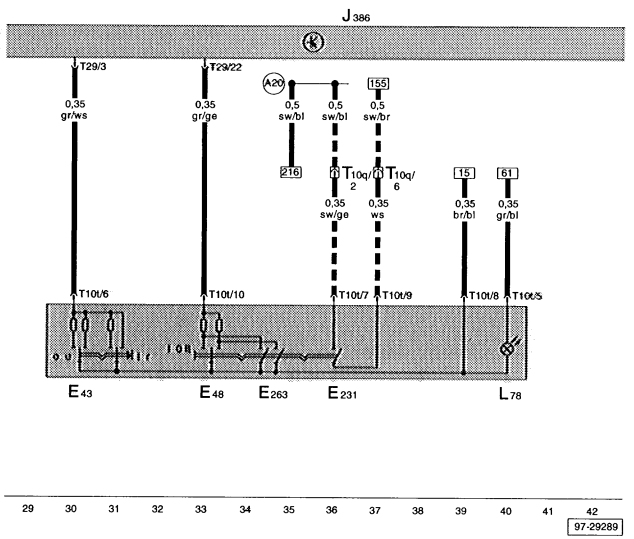
(267) - Ground connector -2-, in wiring harness door cable - driver side
(304) - Ground connector -3-, in wiring harness door cable - driver side

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Door control module (driver side), lock unit for central locking (driver side), warning light for central locking -SAFE-, left door warning light

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ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E43 - Mirror Adjustment Switch
E48 - Mirror Selector Switch
E231 - Switch for outside mirror heating
E263 - Mirror fold-away Switch*
J386 - Door control module, driver side
L78 - Mirror Adjusting Switch Light
T10q - 10-Pin Connector, blue, connector station A-pillar, left
T10t - 10-Pin Connector
T29 - 29-Pin Connector

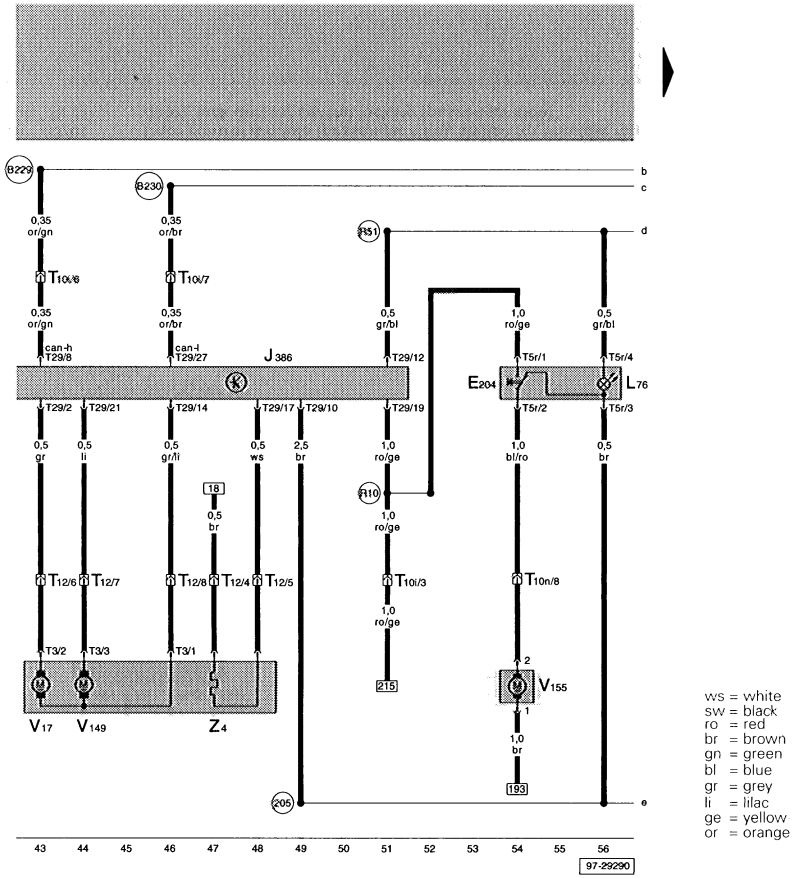
(A20) - Wire connection (15a), in instrument panel wiring harness

* - Mirror fold-away function for some export countrys only
--- Vehicles with seperate heated outside mirrors only

Door control module (driver side), mirror adjustment switch, mirror selector switch, switch for outside mirror heating

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Repair Manual page number **97-595**



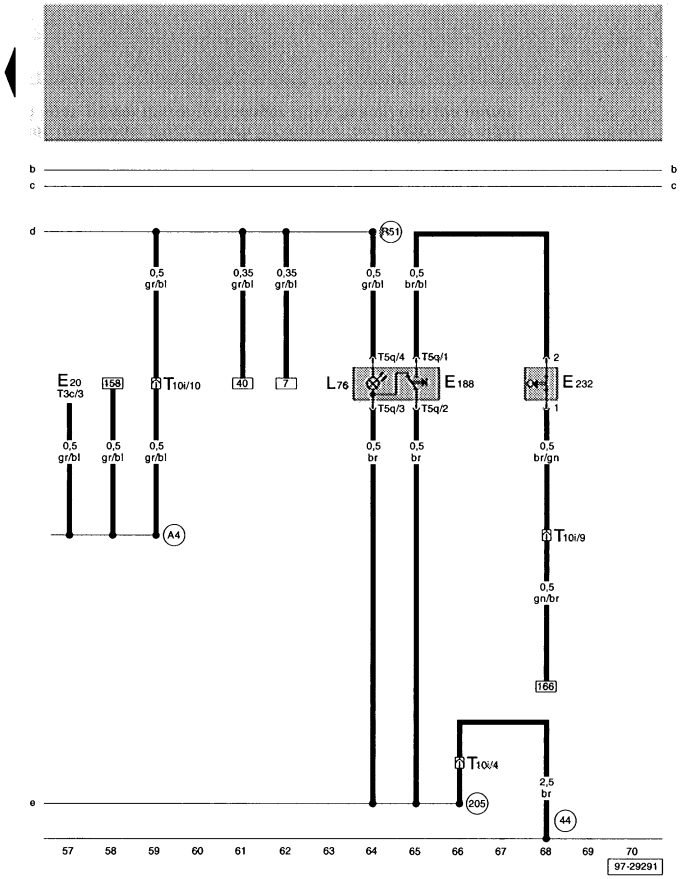
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E204 - Switch for remote/fuel tank door
J386 - Door control module, driver side
L76 - Push Button Light
T3 - 3-Pin Connector
T5r - 5-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10n - 10-Pin Connector, brown, connector station A-pillar, left
T12 - 12-Pin Connector
T29 - 29-Pin Connector
V17 - Driver's Side Mirror Adjustment Motor
V149 - Motor for mirror adjustment, driver side
V155 - Motor for fuel tank lid unlock
Z4 - Heated outside mirror, driver side

(205) - Ground connection, in driver's door wiring harness
(B229) - Connection (high bus), in instrument panel wiring harness
(B230) - Connection (low bus), in instrument panel wiring harness
(R10) - Plus connection -1- (30a), in driver's door wiring harness
(R51) - Connection (58b), in driver's door wiring harness

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Door control module (driver side), switch for remote/fuel tank door, motor for fuel tank lid unlock, power mirror (driver side), heated outside mirror (driver side)



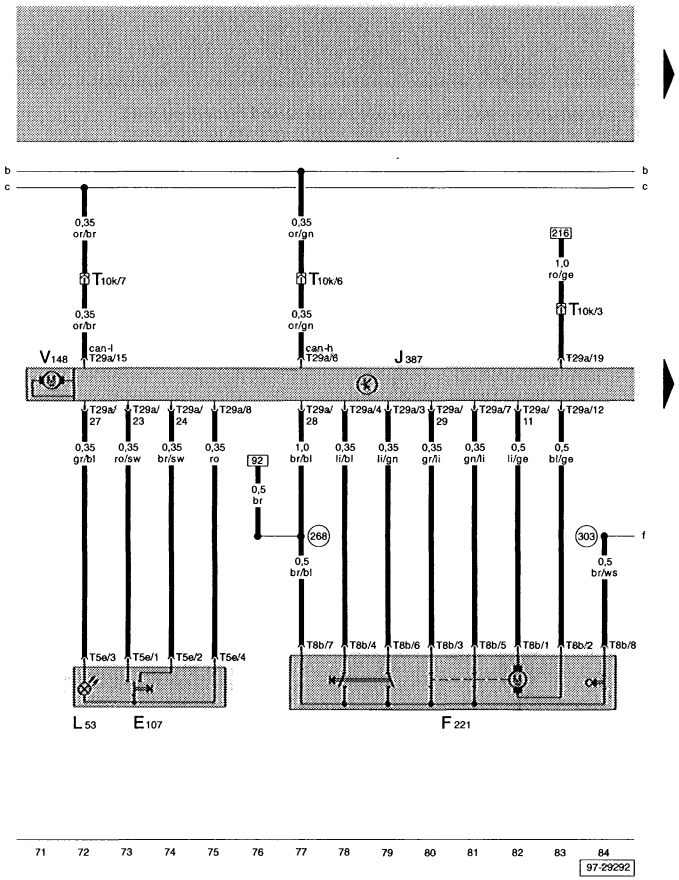
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E20 - Instrument Panel Light Dimmer Switch
E188 - Switch for remote unlock, rear lid, driver side
E232 - Key switch for switching off remote unlock rear lid
L76 - Push Button Light
T3c - 3-Pin Connector
T5q - 5-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left

(44) - Ground connection, on left A-pillar, lower part
(205) - Ground connection, in driver's door wiring harness
(A4) - Plus connection (58b), in instrument panel wiring harness
(R51) - Connection (58b), in driver's door wiring harness

Switch for remote unlock rear lid (driver side), key switch for switching off remote unlock rear lid

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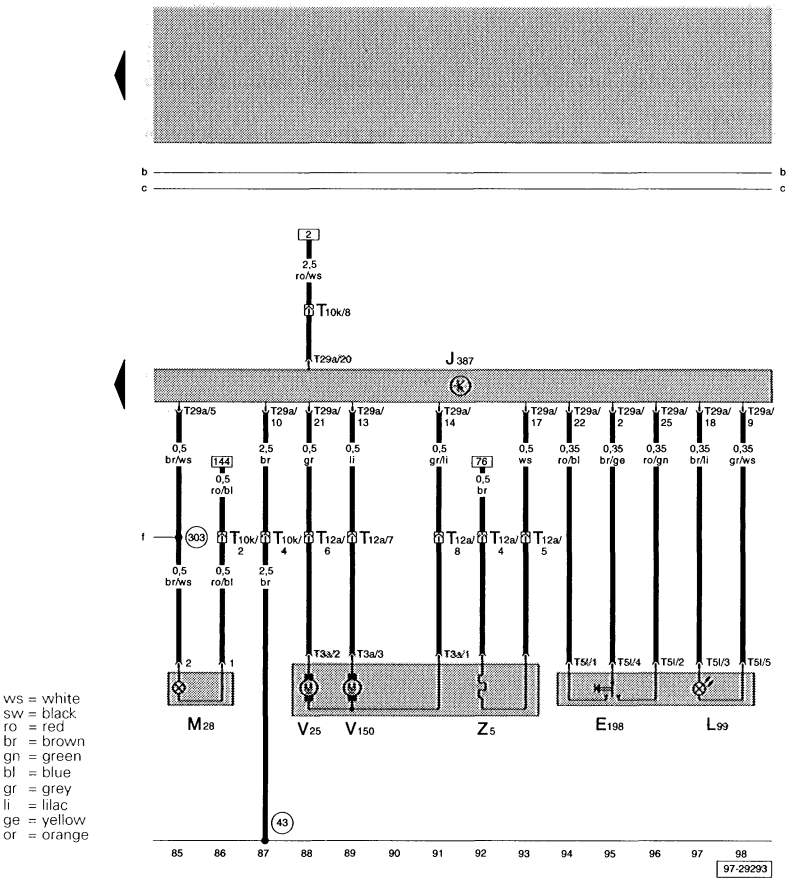
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E107 - Switch for window regulator, in passenger door
F221 - Lock unit for central locking, passenger side
J387 - Door control module, passenger side
L53 - Power Window Switch Light
T5e - 5-Pin Connector
T8b - 8-Pin Connector
T10k - 10-Pin Connector, black, connector station A-pillar, right
T29a - 29-Pin Connector
V148 - Motor for window regulator, passenger side

(268) - Ground connector -2-, in wiring harness door cable - passenger side
(303) - Ground connector -3-, in wiring harness door cable - passenger side

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Door control module (passenger side), switch for window regulator (passenger door), lock unit for central locking (passenger side)



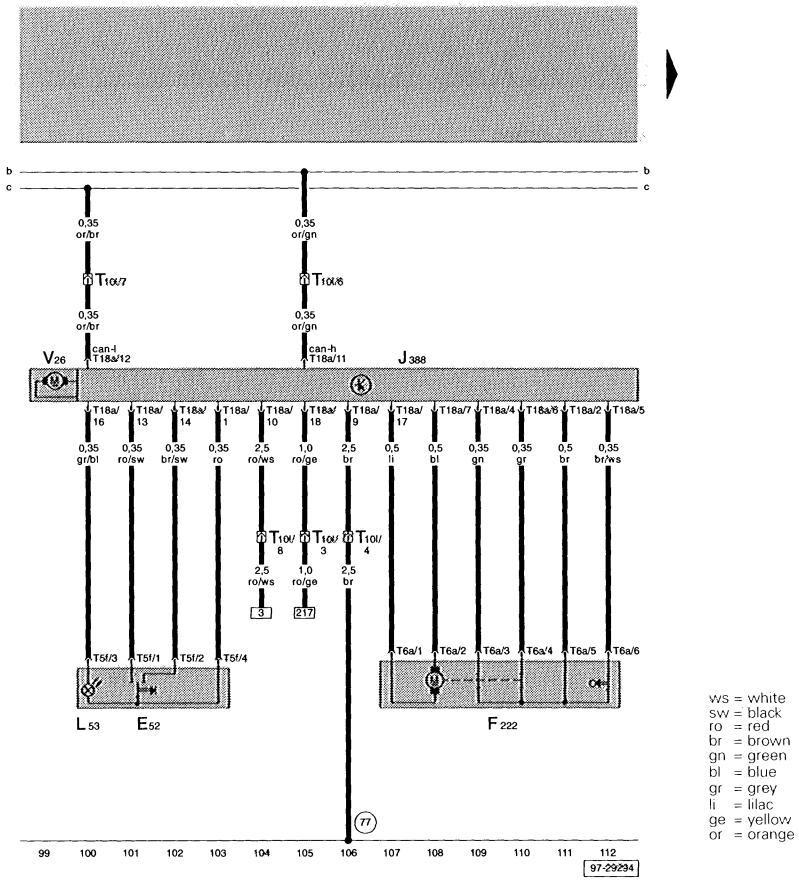
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E198 - Switch for interior lock, passenger side
J387 - Door control module, passenger side
L99 - Lighting for switch interior lock
M28 - Right Door Warning Light
T3a - 3-Pin Connector
T5f - 5-Pin Connector
T10k - 10-Pin Connector, black, connector station A-pillar, right
T12a - 12-Pin Connector
T29a - 29-Pin Connector
V25 - Passenger's Side Mirror Adjustment Motor
V150 - Motor for mirror adjustment, passenger side
Z5 - Heated outside mirror, passenger side

(43) - Ground connection, on right A-pillar, lower part
(303) - Ground connector -3-, in wiring harness door cable - passenger side

Door control module (passenger side), switch for interior lock (passenger side), right door warning light, power mirror (passenger side), heated outside mirror

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USA.5102.10.21

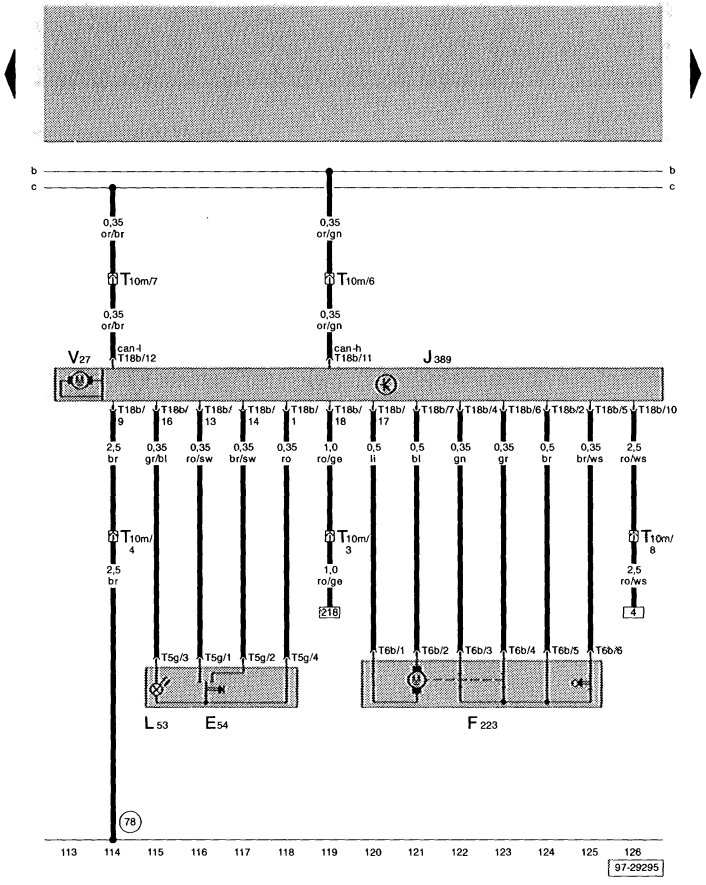


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E52 - Left Rear Window Switch, (In LR Door)
F222 - Lock unit for central locking, rear, left
J388 - Door control module, rear, left
L53 - Power Window Switch Light
T5f - 5-Pin Connector
T6a - 6-Pin Connector
T10l - 10-Pin Connector, black, connector station B-pillar, left
T18a - 18-Pin Connector
V26 - Motor for window regulator, rear, left

(77) - Ground connection, on left B-pillar, lower part

Door control module (rear left), left rear window switch (In LR Door), lock unit for central locking (rear left), motor for window regulator (rear left)

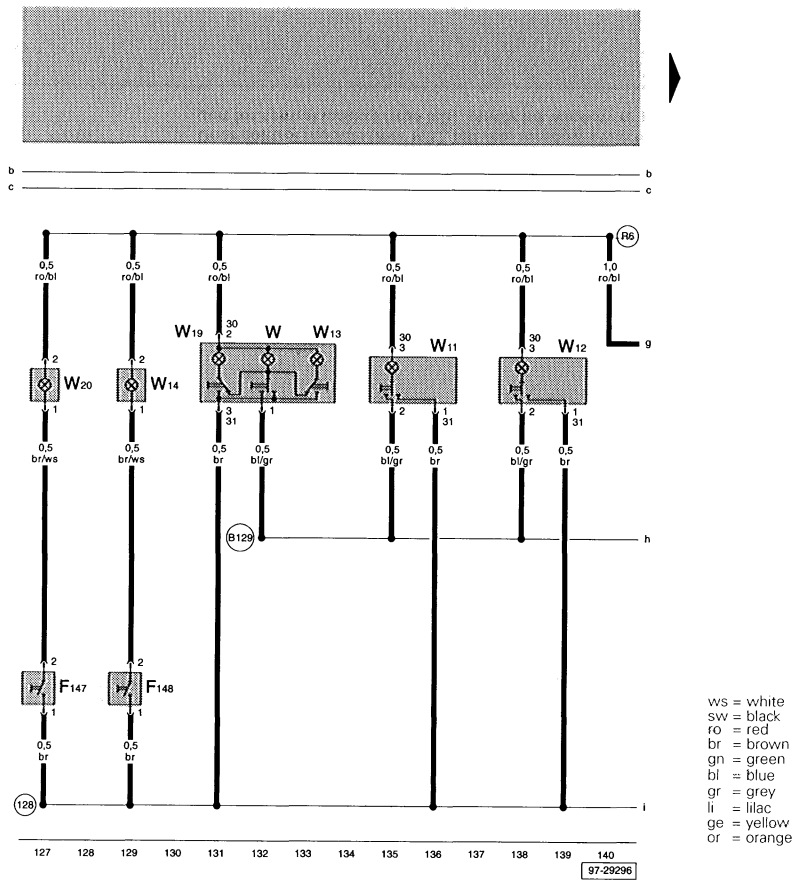


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E54 - Right Rear Window Switch, (In RR Door)
F223 - Lock unit for central locking, rear, right
J389 - Door control module, rear, right
L53 - Power Window Switch Light
T5g - 5-Pin Connector
T6b - 6-Pin Connector
T10m - 10-Pin Connector, black, connector station B-pillar, right
T18b - 18-Pin Connector
V27 - Motor for window regulator, rear, right

(78) - Ground connection, on right B-pillar, lower part

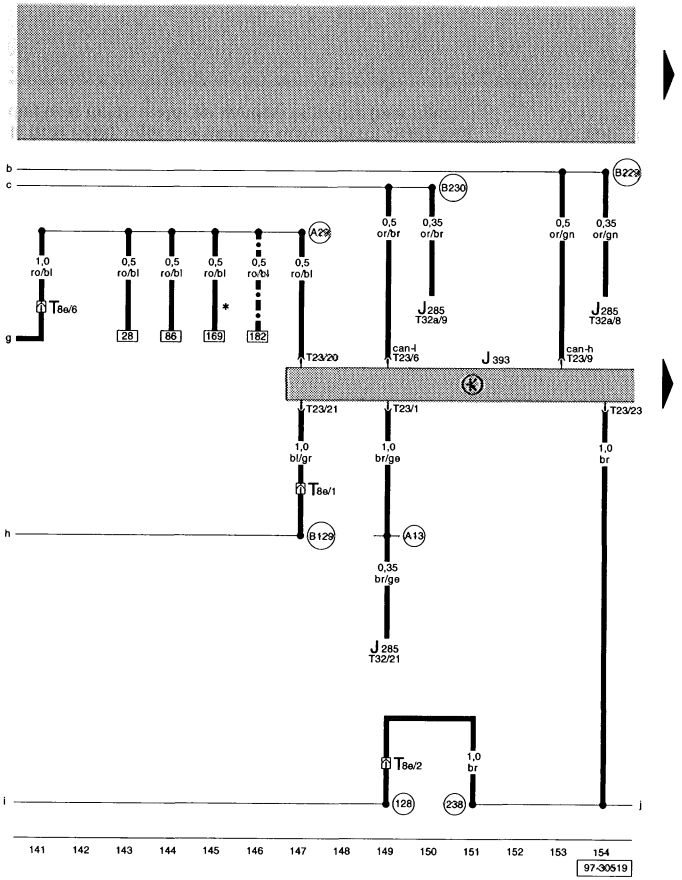
Door control module (rear right), right rear window switch (In RR Door), lock unit for central locking (rear right), motor for window regulator (rear right)



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F147 - Left Make-Up Mirror Light Switch
F148 - Right Make-Up Mirror Light Switch
W - Front Interior Light
W11 - Left Rear Reading Light
W12 - Right Rear Reading Light
W13 - Right Front Map/Reading Light
W14 - Right Make-up Mirror Light
W19 - Left Front Reading Light
W20 - Left Make-up Mirror Light

(128) - Ground connection -1-, in interior light wiring harness
(B129) - Connector (interior light 3/L) in wiring harness interior
(R6) - Plus connection -1-, in interior light wiring harness

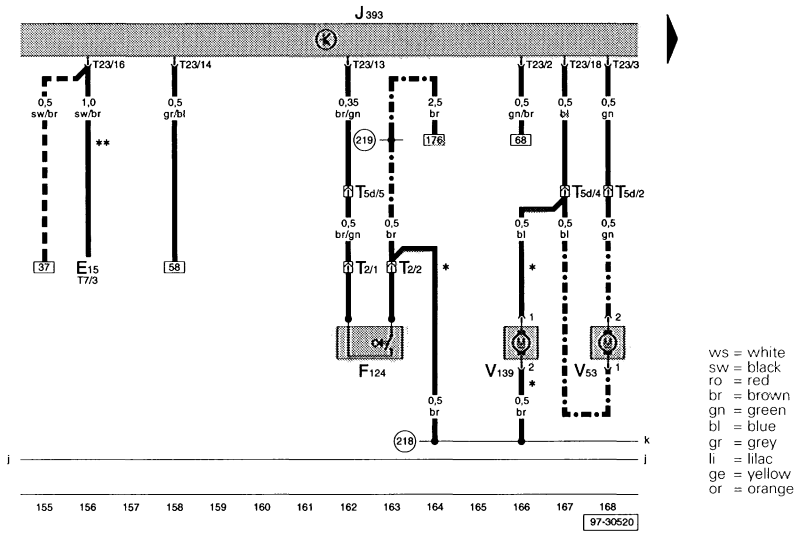


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
T8e - 8-Pin Connector, behind left A-pillar trim, center
T23 - 23-Pin Connector
T32 - 32-Pin Connector, blue, on instrument cluster
T32a - 32-Pin Connector, green

(128) - Ground connection -1-, in interior light wiring harness
(238) - Ground connection -1-, in wiring harness interior
(A13) - Wire connection (door contact switch) in instrument panel wiring harness
(A29) - Wire connection (interior light), in instrument panel wiring harness
(B129) - Connector (interior light 3/L) in wiring harness interior
(B229) - Connection (high bus), in instrument panel wiring harness
(B230) - Connection (low bus), in instrument panel wiring harness

* - Jetta only
-•-•- Golf only



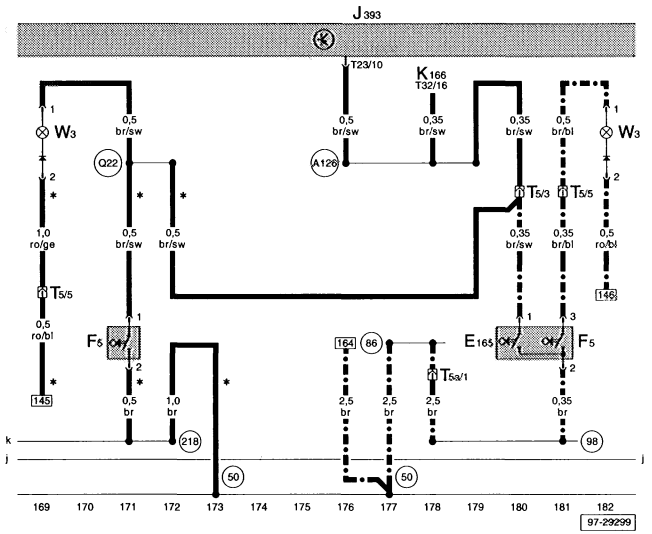
E15 - Rear window defogger switch
F124 - Trunk Lock Alarm/Central Locking Switch
J393 - Central control module for comfort system, behind instrument panel, left
T2 - Double Connector, in rear lid
T5d - 5-Pin Connector, brown, connector station C-pillar, left
T7 - 7-Pin Connector
T23 - 23-Pin Connector
V53 - Decklid Central Locking System Motor (Golf only)
V139 - Motor to unlock rear lid*

(218) - Ground connection -1-, in rear lid wiring harness
(219) - Ground connection -2-, in rear lid wiring harness

* - Jetta only
- - - - Vehicles with seperate heated outside mirrors only
** - Vehicles without seperate heated outside mirrors only
-•-•- Golf only

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Central control module for comfort system, switch for unlocking (rear lid handle), motor to unlock rear lid



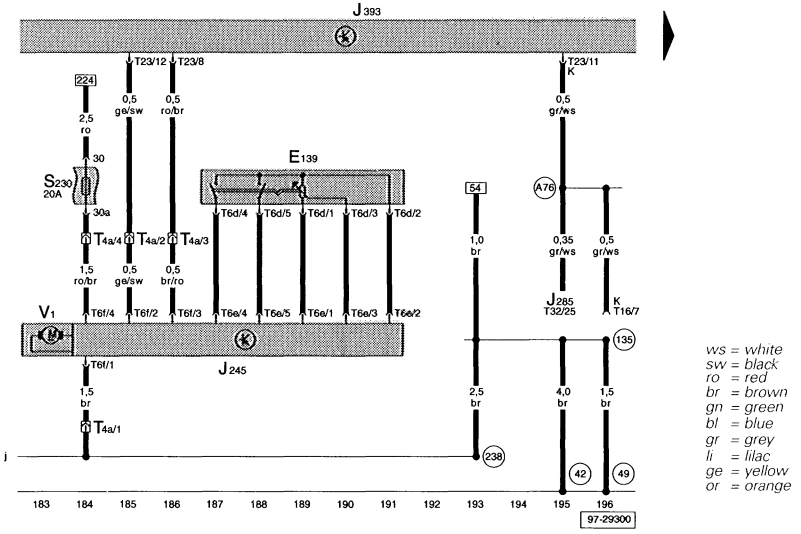
E165 - Trunk Lid Release Switch
F5 - Luggage Compartment Light Switch
J393 - Central control module for comfort system, behind instrument panel, left
K166 - Door Ajar Indicator Lamp, in instrument cluster
T5 - 5-Pin Connector, black, connector station C-pillar, left
T5a - 5-Pin Connector, pink, connector station C-pillar, left (Golf only)
T23 - 23-Pin Connector
T32 - 32-Pin Connector, blue, on Instrument cluster
W3 - Luggage compartment Light

(50) - Ground connection, in luggage compartment, left
(86) - Ground connection -1-, in rear wiring harness
(98) - Ground connection, in rear lid wiring harness
(218) - Ground connection -1-, in rear lid wiring harness
(A126) - Connection (contact switch in rear lid) in instrument panel wiring harness
(Q22) - Wire connection -1-, in rear lid wiring harness

* - Jetta only
-•-•- Golf only

Central control module for comfort system, trunk lid release switch, luggage compartment light switch

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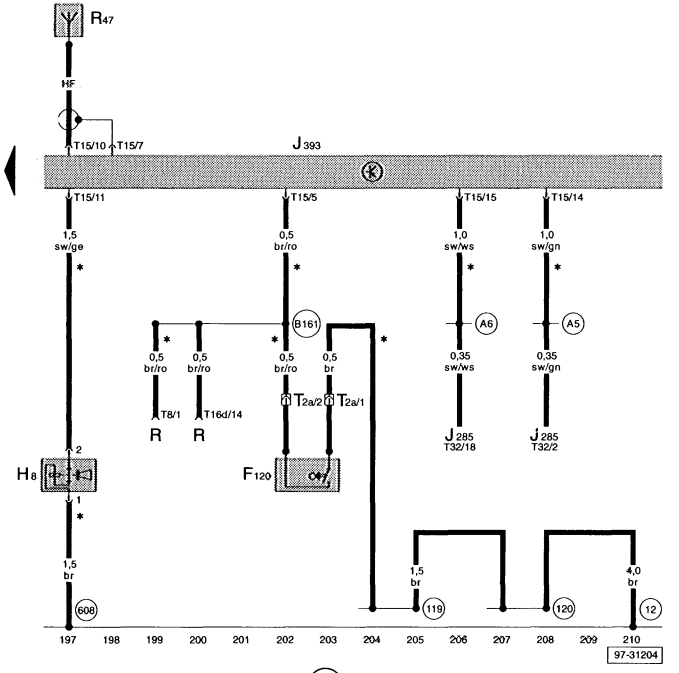


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E139 - *Sunroof Regulator*
J245 - *Power Sunroof Control Module*
J285 - *Control module with indicator unit in instrument panel insert*
J393 - *Central control module for comfort system, behind instrument panel, left*
S230 - *Fuse 30 in fuse holder*
T4a - *4-Pin Connector, behind left A-pillar trim, center*
T6d - *6-Pin Connector*
T6e - *6-Pin Connector*
T6f - *6-Pin Connector*
T16 - *Data Link Connector (DLC), below instrument panel, left*
T23 - *23-Pin Connector*
T32 - *32-Pin Connector, blue, on Instrument cluster*
V1 - *Sunroof Motor*

(42) - *Ground connection, beside steering column*
(49) - *Ground connection, on steering column*
(135) - *Ground connection -2-, in instrument panel wiring harness*
(238) - *Ground connection -1-, in wiring harness interior*
(A76) - *Connector (K-diagnosis wire) in instrument panel wiring harness*

Central control module for comfort system, power sunroof control module, sunroof regulator, sunroof motor



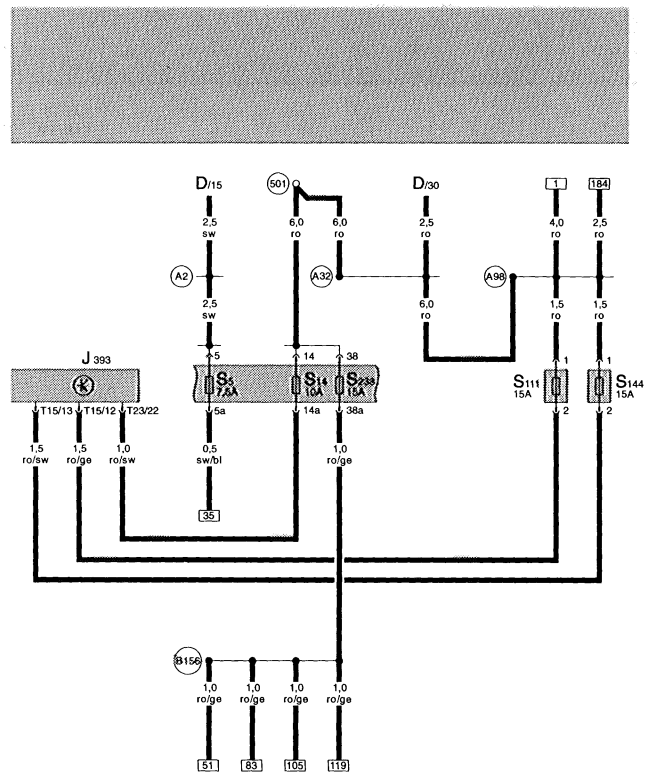
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F120 - Hood Alarm Switch*
H8 - Alarm Horn*
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system, behind instrument panel, left
R - Radio
R47 - Antenna wire for central locking and antitheft warning system
T2a - Double Connector, rear headlight, right
T8 - 8-Pin Connector (through July 2001)
T15 - 15-Pin Connector*
T16d - 16-Pin Connector (beginning August 2001)
T32 - 32-Pin Connector, blue, on instrument cluster

(12) - Ground connection, in engine compartment, left
(119) - Ground connection -1-, in headlight wiring harness
(120) - Ground connection -2-, in headlight wiring harness
(608) - Ground connection (in center plenum chamber)
(A5) - Plus connection (right turn signal), in instrument panel wiring harness
(A6) - Plus connection (left turn signal), in instrument panel wiring harness
(B161) - Connector (anti-theft warning system), in wiring harness interior

* - Vehicles with anti-theft warning system only

Central control module for comfort system, antitheft warning system, antenna wire for central locking and antitheft warning system



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

D - Ignition/Starter Switch
J393 - Central control module for comfort system, behind instrument panel, left
S5 - Fuse 5 in fuse holder
S14 - Fuse 14 in fuse holder *
S111 - Alarm System and Anti-Theft Fuse, above the thirteenfold auxiliary relay panel*
S144 - Fuse for central locking/anti-theft warning system, above the thirteenfold auxiliary relay panel*
S238 - Fuse 38 in fuse holder
T15 - 15-Pin Connector*
T23 - 23-Pin Connector

(501) - Threaded connection -2- (30) on the relay plate

(A2) - Plus connection (15), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness
(B156) - Plus connector (30a), in wiring harness interior

* - Vehicles with anti-theft warning system only

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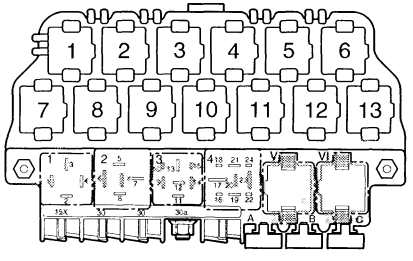
Central control module for comfort system

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Headlight washer,

from May 2000

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

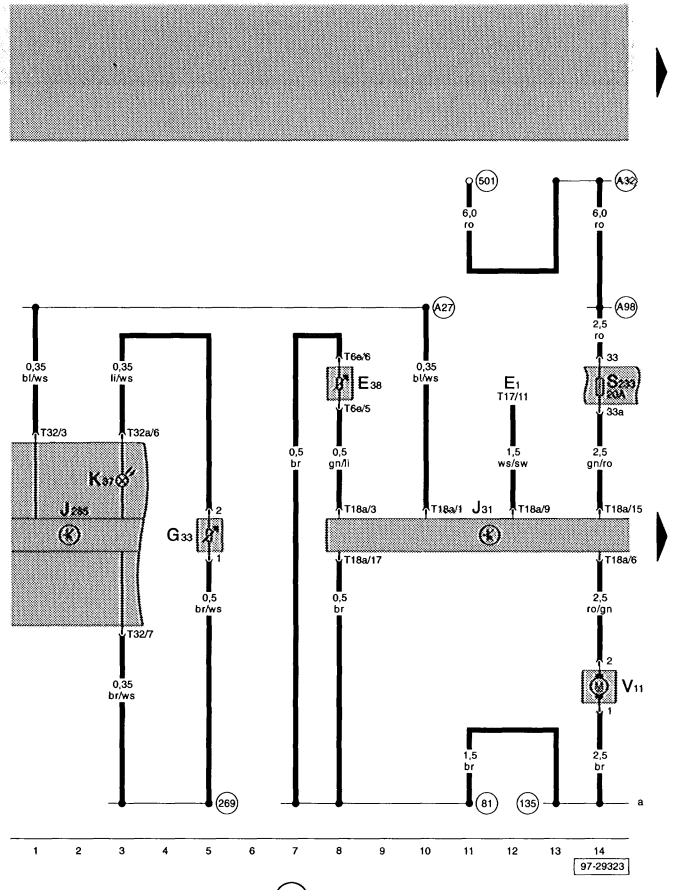
V Wiper/Washer Intermittent Relay (389)

VI

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

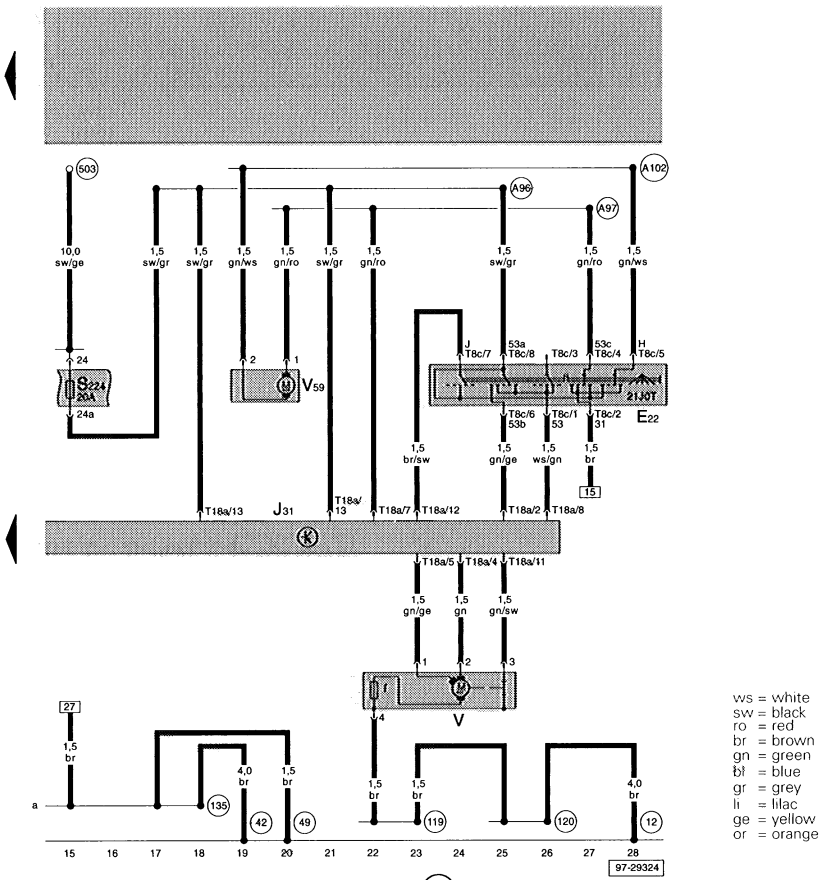
E1 - Light switch
E38 - Windshield Wiper Intermittent Regulator
G33 - Windshield Washer Fluid Level Sensor
J31 - Wiper/Washer Intermittent Relay, on relais panel
J285 - Control module with indicator unit in instrument panel insert
K37 - Low Windshield Washer Fluid Level Indicator Light
S233 - Fuse 33 in fuse holder
T6e - 6-Pin Connector
T17 - 17-Pin Connector
T18a - 18-Pin Connector
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green
V11 - Headlight Washer Pump

(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(269) - Ground connector (sensor ground) -1-, in instrument panel wiring harness
(501) - Threaded connection -2- (30) on the relay plate
(A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness

Wiper/washer intermittent relay, windshield wiper intermittent regulator, windshield washer fluid level sensor, headlight washer pump, instrument cluster

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Repair Manual page number 97-611



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E22 - Windshield Wiper/Washer Switch
J31 - Wiper/Washer Intermittent Relay, on relais panel
S224 - Fuse 24 in fuse holder
T8c - 8-Pin Connector
T18a - 18-Pin Connector
V - Windshield Wiper Motor
V59 - Windshield and Rear Window Washer Pump

(12) - Ground connection, in engine compartment, left
(42) - Ground connection, beside steering column
(49) - Ground connection, on steering column
(119) - Ground connection -1-, in headlight wiring harness
(120) - Ground connection -2-, in headlight wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(503) - Threaded connection -2- (75x) on the relay plate
(A96) - Connector (53a), in instrument panel wiring harness
(A97) - Connector (53), in instrument panel wiring harness
(A102) - Connector (windshield wiper), in instrument panel wiring harness

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Wiper/washer intermittent relay, windshield wiper/washer switch, windshield wiper motor, windshield and rear window washer pump

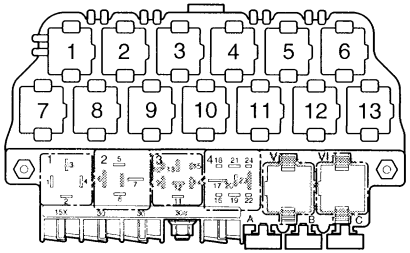
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Fog lights,

from May 2000

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

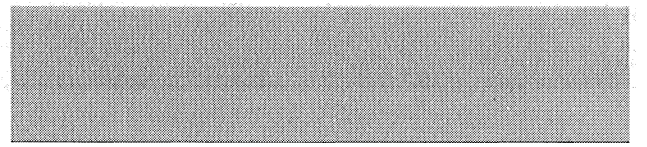
4 Fog Light Relay (53)

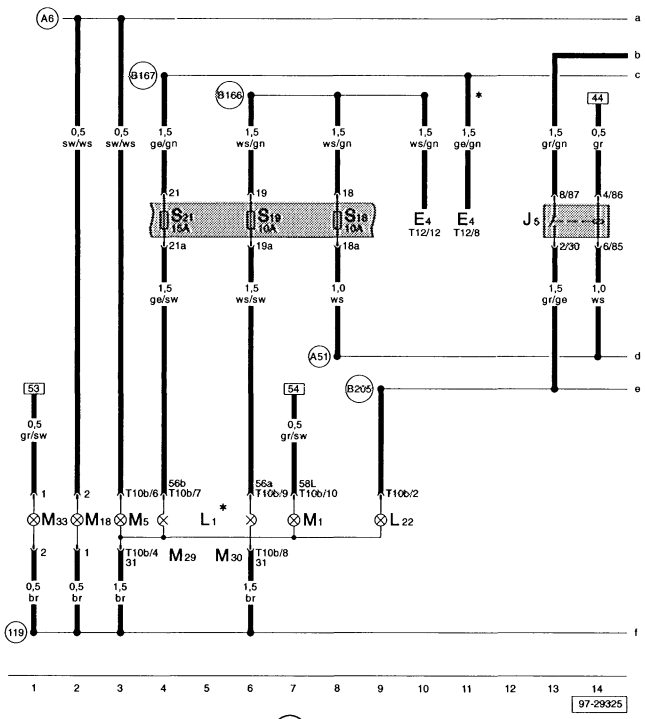
Relay panel:

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet





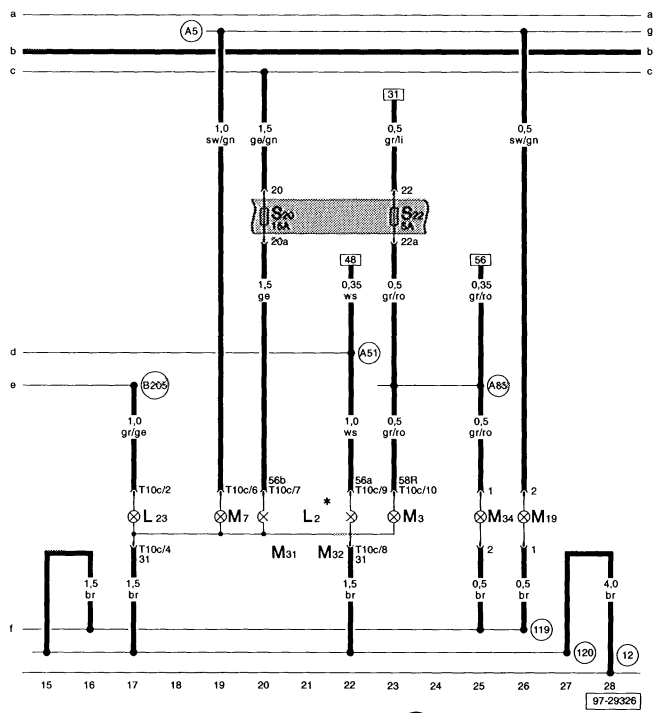
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E4 - Headlight Dimmer/Flasher Switch
J5 - Fog Light Relay
L1 - Left Headlight*
L22 - Left Front Fog Light
M1 - Left Parking Light
M5 - Left Front Turn Signal Light
M18 - Left, Side Turn Signal Light
M29 - Left Low Beam Headlight (Golf only)
M30 - Left High Beam Headlight (Golf only)
M33 - Light for side marker front left
S18 - Fuse 18 in fuse holder
S19 - Fuse 19 in fuse holder
S21 - Fuse 21 in fuse holder
T10b - 10-Pin Connector
T12 - 12-Pin Connector

(119) - Ground connection -1-, in headlight wiring harness
(A6) - Plus connection (left turn signal), in instrument panel wiring harness
(A51) - Wire connection (56), in instrument panel wiring harness
(B166) - Connection (56a), in passenger compartment wiring harness
(B167) - Connection (56b), in passenger compartment wiring harness
(B205) - Connection (fog light), in passenger compartment wiring harness

* - Jetta only

Left headlight light, light for side marker front left, fog light relay, left front fog light, left parking light



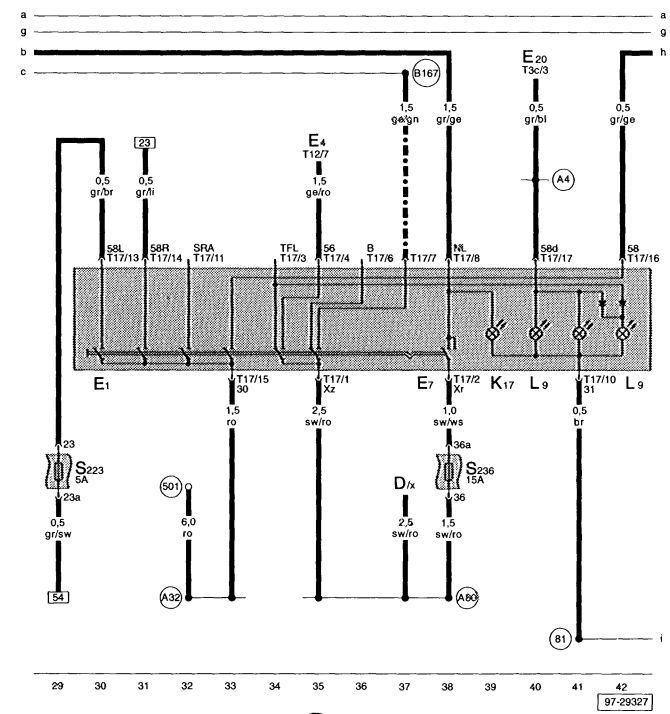
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

L2 - Right Headlight*
L23 - Right Front Fog Light
M3 - Right Parking Light
M7 - Right Front Turn Signal Light
M19 - Right, Side Turn Signal Light
M31 - Right Low Beam Headlight (Golf only)
M32 - Right High Beam Headlight (Golf only)
M34 - Light for side marker front right
S20 - Fuse 20 in fuse holder
S22 - Fuse 22 in fuse holder
T10c - 10-Pin Connector

(12) - Ground connection, in engine compartment, left
(119) - Ground connection -1-, in headlight wiring harness
(120) - Ground connection -2-, in headlight wiring harness
(A5) - Plus connection (right turn signal), in instrument panel wiring harness
(A51) - Wire connection (56), in instrument panel wiring harness
(A85) - Connection (58R) in instrument panel wiring harness
(B205) - Connection (fog light), in passenger compartment wiring harness

* - Jetta only

Right front turn signal light, light for side marker front right, right headlight, right front fog light, right parking light



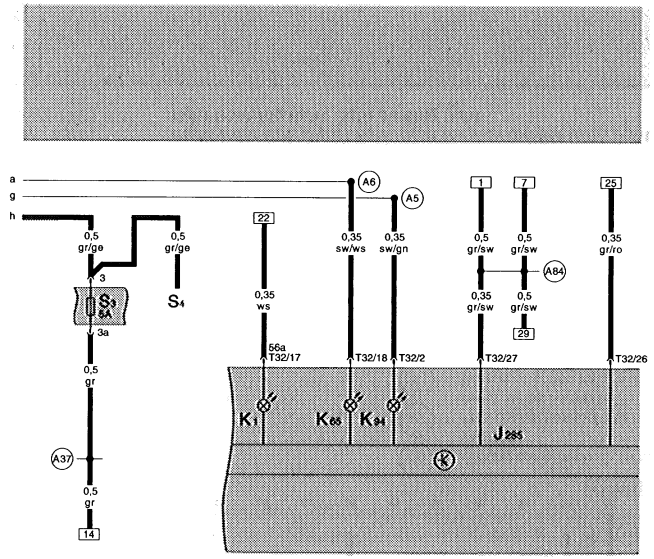
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

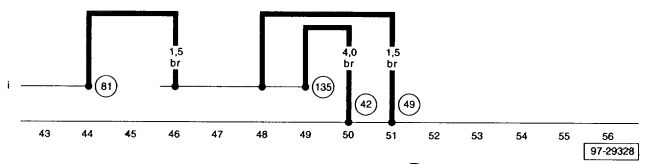
D - Ignition/Starter Switch
E1 - Light switch
E4 - Headlight Dimmer/Flasher Switch
E7 - Fog Light Switch
E20 - Instrument Panel Light Dimmer Switch
K17 - Fog Light Indicator Light
L9 - Headlight Switch Light
S223 - Fuse 23 in fuse holder
S236 - Fuse 36 in fuse holder
T3c - 3-Pin Connector
T12 - 12-Pin Connector
T17 - 17-Pin Connector

(81) - Ground connection -1-, in instrument panel wiring harness
(501) - Threaded connection -2- (30) on the relay plate
(A4) - Plus connection (58b), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A80) - Connector -1- (X) in instrument panel wiring harness
(B167) - Connection (56b), in passenger compartment wiring harness

-•-•- Golf only

Light switch, fog light switch





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

J285 - Control module with indicator unit in instrument panel insert
K1 - Headlight High Beam Indicator Light
K65 - Left Turn Signal Indicator Light
K94 - Right Turn Signal Indicator Light
S3 - Fuse 3 in fuse holder
S4 - Fuse 4 in fuse holder
T32 - 32-Pin Connector, blue

(42) - Ground connection, beside steering column
(49) - Ground connection, on steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(A5) - Plus connection (right turn signal), in instrument panel wiring harness
(A6) - Plus connection (left turn signal), in instrument panel wiring harness
(A37) - Wire connection (58a), in instrument panel wiring harness
(A84) - Connector (58L), in instrument panel wiring harness

Edition 03/01 Instrument cluster, headlight high beam indicator light, turn signal indicator lights
USA.5102.10.21

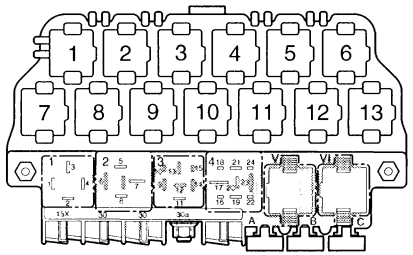
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Daytime running lights,

from May 2000

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



97-14163

Relay location on the thirteenfold auxiliary relay panel, above relay panel:

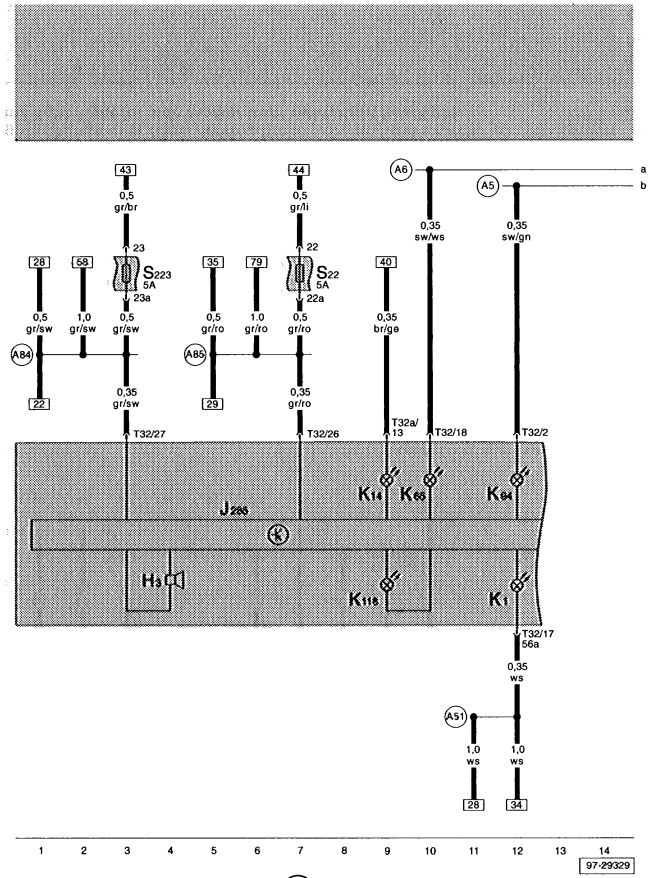
7 Daytime Running Lights Change-over Relay (173)

Relay panel:

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



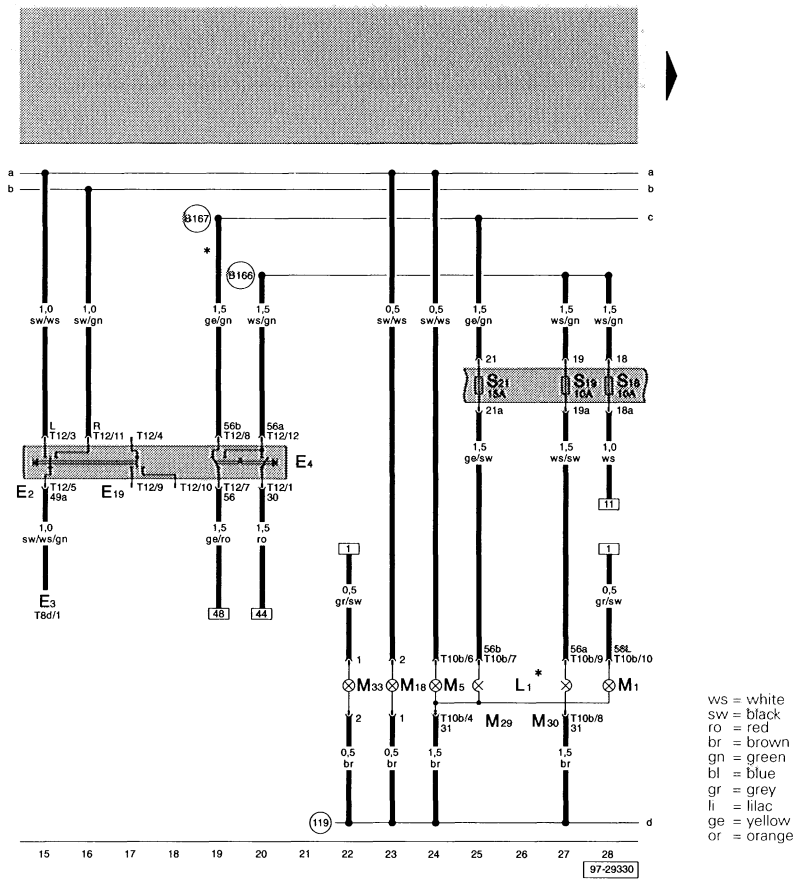
97-29329

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

H3 - Warning buzzer
J285 - Control module with indicator unit in instrument panel insert
K1 - Headlight High Beam Indicator Light
K14 - Parking Brake Indicator Light
K65 - Left Turn Signal Indicator Light
K94 - Right Turn Signal Indicator Light
K118 - Warning light for brake system
S22 - Fuse 22 in fuse holder
S223 - Fuse 23 in fuse holder
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(A5) - Plus connection (right turn signal), in instrument panel wiring harness
(A6) - Plus connection (left turn signal), in instrument panel wiring harness
(A51) - Wire connection (56), in instrument panel wiring harness
(A84) - Connector (58L) in instrument panel wiring harness
(A85) - Connector (58R) in instrument panel wiring harness

Instrument cluster, left and right turn signal indicator lights, parking brake indicator light, warning light for brake system, headlight high beam indicator light



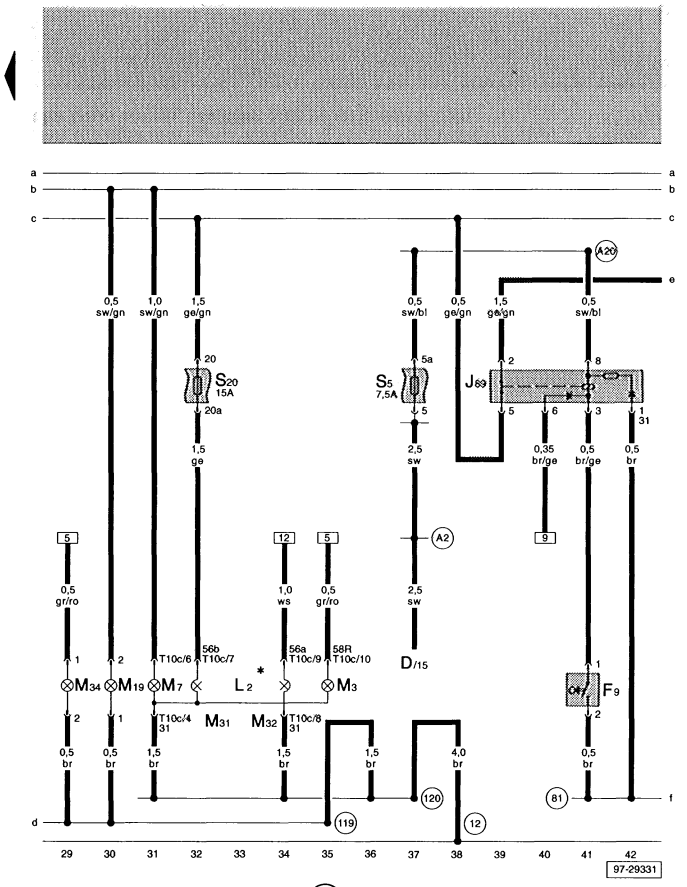
E2 - Turn signal switch
E3 - Emergency Flasher Switch
E4 - Headlight Dimmer/Flasher Switch
E19 - Park Light Switch
L1 - Left Headlight*
M1 - Left Parking Light
M5 - Left Front Turn Signal Light
M18 - Left, Side Turn Signal Light
M29 - Left Low Beam Headlight (Golf only)
M30 - Left High Beam Headlight (Golf only)
M33 - Light for side marker front left
S18 - Fuse 18 in fuse holder
S19 - Fuse 19 in fuse holder
S21 - Fuse 21 in fuse holder
T8d - 8-Pin Connector
T10b - 10-Pin Connector
T12 - 12-Pin Connector

(119) - Ground connection -1-, in headlight wiring harness
(B166) - Connection (56a) in passenger compartment wiring harness
(B167) - Connection (56b) in passenger compartment wiring harness

* - Jetta only

Edition 03/01 USA.5102.10.21

Turn signal switch, headlight dimmer/flasher switch, left front turn signal light, light for side marker front left, left headlight



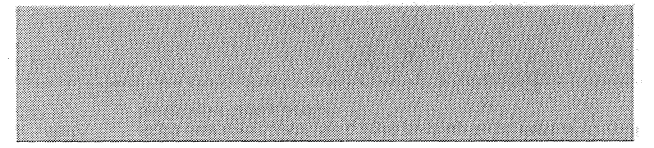
D - Ignition/Starter Switch
F9 - Parking Brake Warning Light Switch
J89 - Daytime Running Lights Change-over Relay, on the thirteenfold auxiliary relay panel, above relay panel
L2 - Right Headlight*
M3 - Right Parking Light
M7 - Right Front Turn Signal Light
M19 - Right, Side Turn Signal Light
M31 - Right Low Beam Headlight (Golf only)
M32 - Right High Beam Headlight (Golf only)
M34 - Light for side marker front right
S5 - Fuse 5 in fuse holder
S20 - Fuse 20 in fuse holder
T10c - 10-Pin Connector

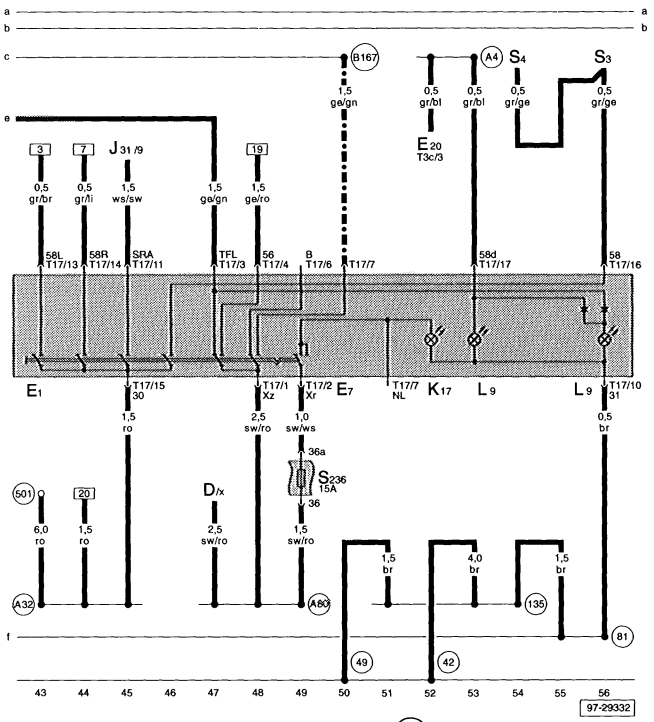
(12) - Ground connection, in engine compartment, left
(81) - Ground connection -1-, in instrument panel wiring harness
(119) - Ground connection -1-, in headlight wiring harness
(120) - Ground connection -2-, in headlight wiring harness
(A2) - Plus connection (15), in instrument panel wiring harness
(A20) - Wire connection (15a), in instrument panel wiring harness

* - Jetta only

Daytime running lights change-over relay, parking brake warning light switch, right front turn signal light, light for side marker front right, right headlight

Edition 03/01 USA.5102.10.21



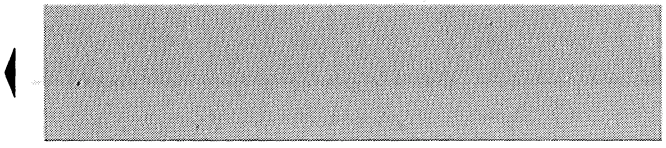


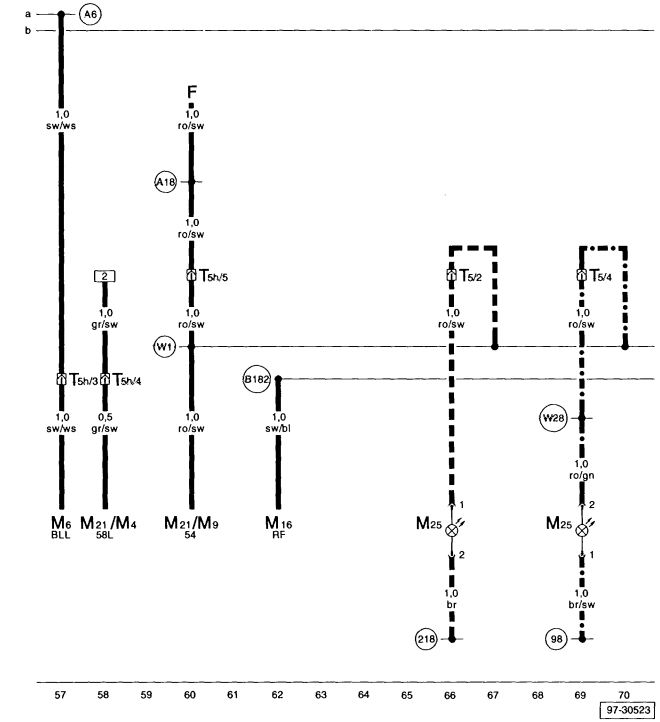
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

D - Ignition/Starter Switch
E1 - Light switch
E7 - Fog Light Switch
E20 - Instrument Panel Light Dimmer Switch
J31 - Wiper/Washer Intermittent Relay
K17 - Fog Light Indicator Light
L9 - Headlight Switch Light
S3 - Fuse 3 in fuse holder
S4 - Fuse 4 in fuse holder
S236 - Fuse 36 in fuse holder
T3c - 3-Pin Connector
T17 - 17-Pin Connector

(42) - Ground connection, beside steering column
(49) - Ground connection, on steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(501) - Threaded connection -2- (30) on the relay plate
(A4) - Plus connection (58b), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A80) - Connector -1- (X) in instrument panel wiring harness
(B167) - Connection (56b) in passenger compartment wiring harness

-•-•- Golf only





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F - Brake Light Switch
M4 - Left Tail Light (Golf/Jetta Sedan only)
M6 - Left Rear Turn Signal Light
M9 - Left Brake Light (Golf/Jetta Sedan only)
M16 - Left Back-Up Light
M21 - Left Brake/Tail Light (Jetta Wagon only)
M25 - High-mount Brake Light
T5 - 5-Pin Connector, black, connector station C-pillar, left (Golf/Jetta Sedan), connector station D-pillar, left (Jetta Wagon)
T5h - 5-Pin Connector, near left A-pillar, lower part, in harness

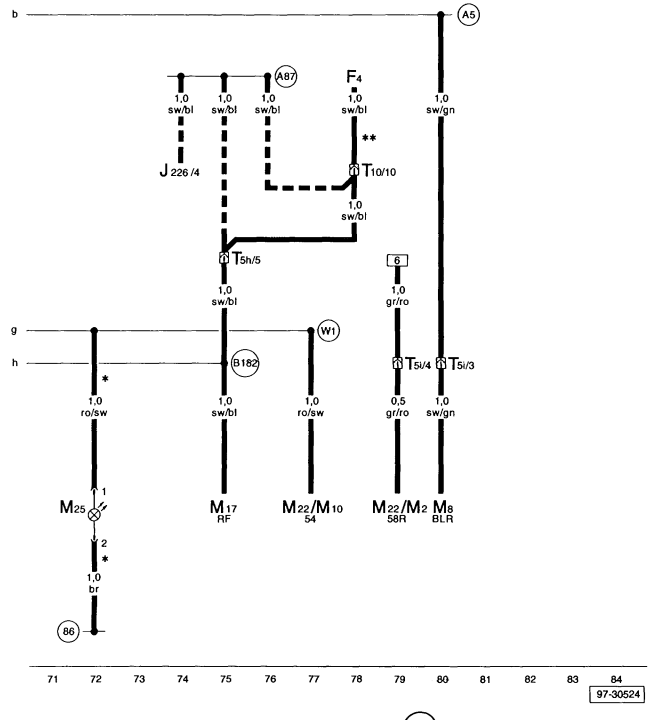
(98) - Ground connection, in rear lid wiring harness
(218) - Ground connection -1-, in rear lid wiring harness
(A6) - Plus connection (left turn signal), in instrument panel wiring harness
(A18) - Wire connection (54), in instrument panel wiring harness
(B182) - Connection (RF), in passenger compartment wiring harness
(W1) - Plus connection (54), in rear wiring harness
(W28) - Plus connector -2- (54), in wiring harness taillight assembly

* - Jetta Sedan only
-•-•- Golf only
- - - Jetta Wagon only

Left rear turn signal light, left back-up light, left brake/tail light, high-mount brake light (Jetta Wagon/Golf)

Repair Manual page number 97-624

Repair Manual page number 97-625



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

F4 - Back-Up Light Switch
J226 - Park/Neutral Position (PNP) Relay
M2 - Right Tail Light (Golf/Jetta Sedan only)
M8 - Right Rear Turn Signal Light
M10 - Right Brake Light (Golf/Jetta Sedan only)
M17 - Right Back-Up Light
M22 - Right Brake/Tail Light (Jetta Wagon only)
M25 - High-mount Brake Light (18 light emitting diodes)*
T5h - 5-Pin Connector, near left A-pillar, lower part, in harness
T5i - 5-Pin Connector, near left A-pillar, lower part, in harness
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left

(86) - Ground connection -1-, in rear wiring harness
(A5) - Plus connection (right turn signal), in instrument panel wiring harness
(A87) - Connector (reverse lamp), in instrument panel wiring harness
(B182) - Connection (RF), in passenger compartment wiring harness
(W1) - Plus connection (54), in rear wiring harness

* - Jetta Sedan only
** - Manual transmission only
--- Automatic transmission only

Edition 09/01
USA.5102.11.21

Right rear turn signal light, right back-up light, right brake/tail light, high-mount brake light (Jetta Sedan)

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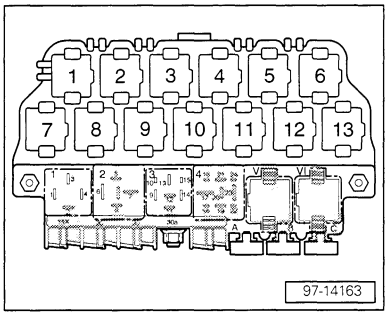
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Repair Manual page number 97-629

1.8L - Engine - Motronic Multiport Fuel Injection (MFI)/132 kW, code AWP,

from June 2001

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations"

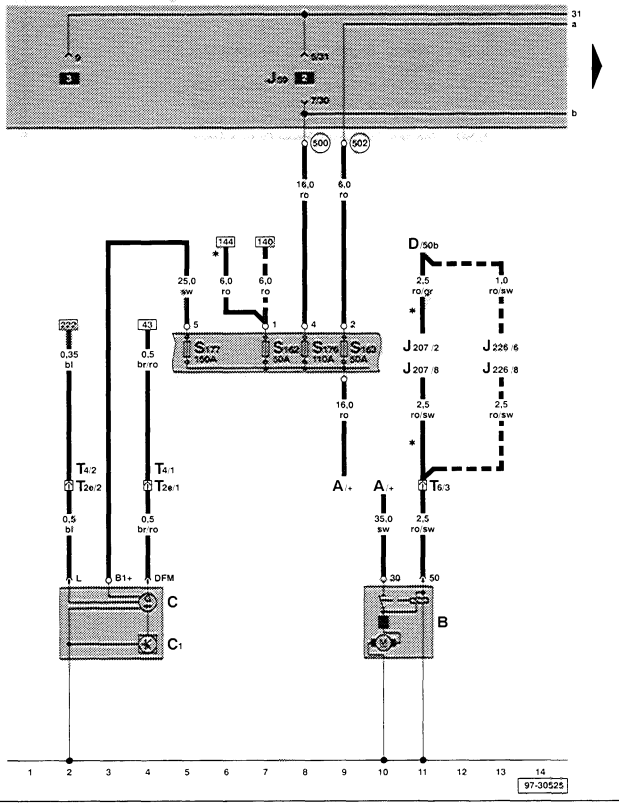


Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

2 J52 - Load Reduction Relay (100)

4 J17 - Fuel Pump (FP) Relay (409)



Generator (GEN), starter

A - Battery
B - Starter
C - Generator (GEN)
C1 - Voltage Regulator (VR)
D - Ignition/Starter Switch
J59 - Load Reduction Relay
J207 - Starting Interlock Relay
J226 - Park/Neutral Position (PNP) Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
T2e - Double Connector, near starter (vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left

(500) - Threaded connection -1- (30) on the relay plate

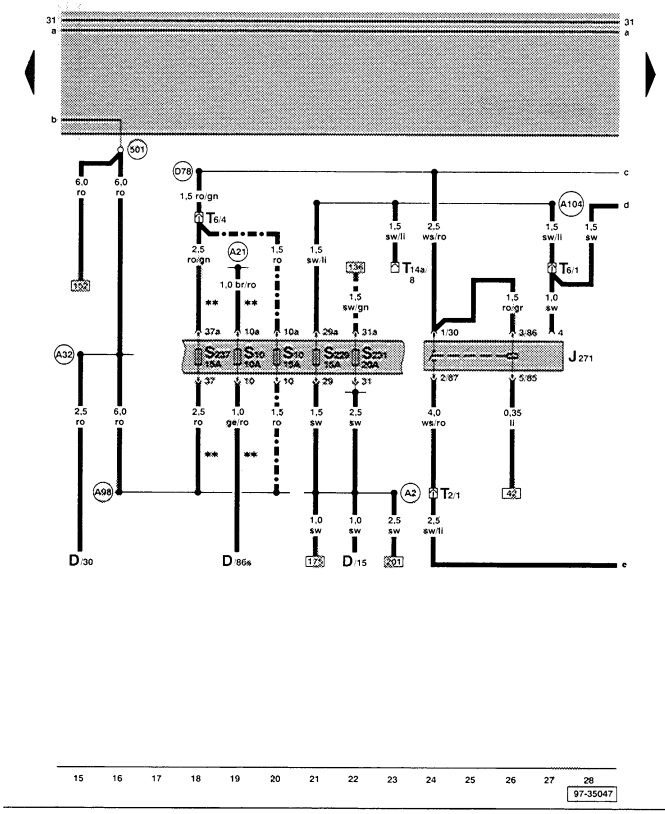
(502) - Threaded connection -1- (30a) on the relay plate

* - Manual transmission only

--- Automatic transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Repair Manual page number 97-628



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

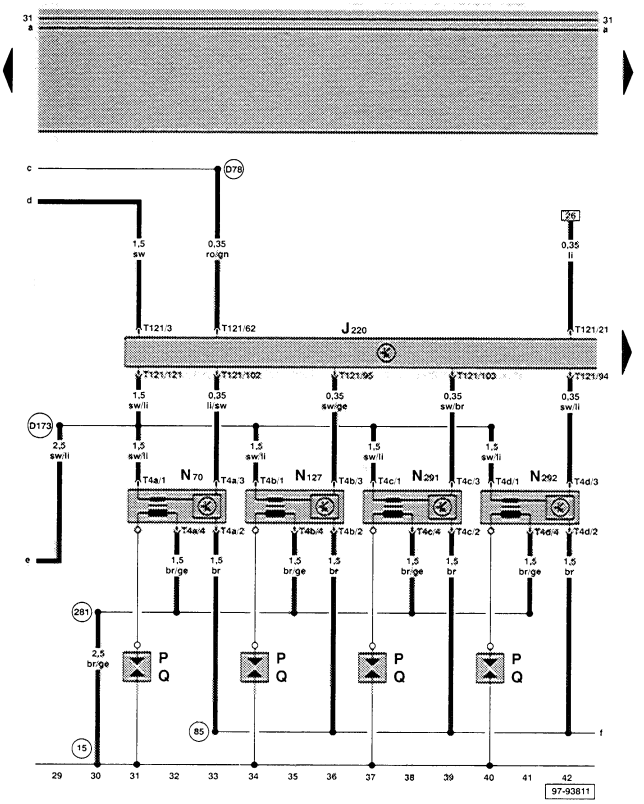
Motronic engine control module (ECM) power supply relay

D - Ignition/Starter Switch
J271 - Motronic engine control module (ECM) power supply relay, in protective housing, in engine compartment, left, production control number (428)
S10 - Fuse 10 in fuse holder
S229 - Fuse 29 in fuse holder
S231 - Fuse 31 in fuse holder
S237 - Fuse 37 in fuse holder
T2 - 2-Pin Connector, in engine compartment, left
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, near battery

(501) - Threaded connection -2- (30) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A21) - Wire connection (86s), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connection -4- (30), in instrument panel wiring harness
(A104) - Plus connection -2- (15), in instrument panel wiring harness
(D78) - Plus connection -1- (30a), in engine compartment wiring harness

--- Automatic transmission only
** - Beginning November 2001
-•-•- Through October 2001

Edition 04.03



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

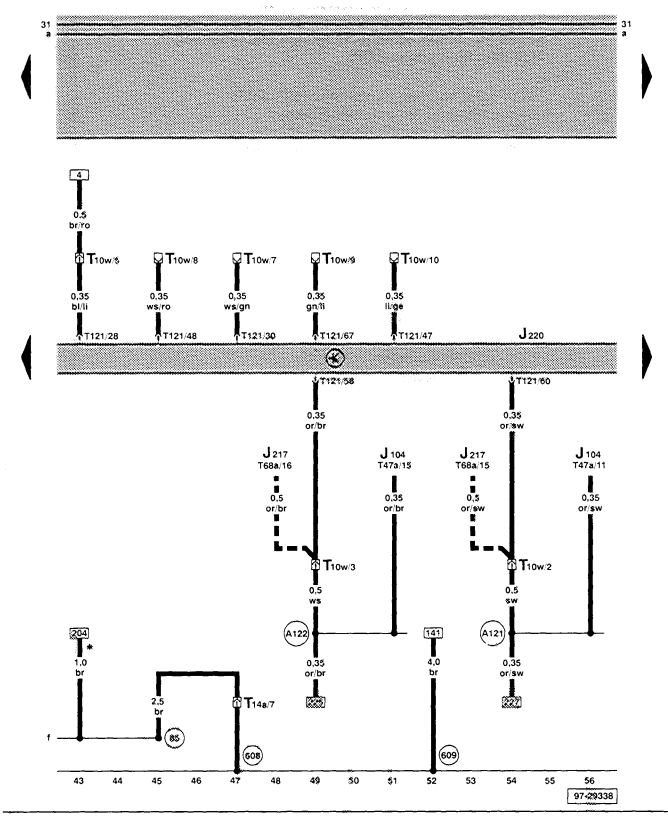
Motronic engine control module (ECM), ignition system

J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N70 - Ignition Coil 1 with Power Output Stage
N127 - Ignition Coil 2 with Power Output Stage
N291 - Ignition Coil 3 with Power Output Stage
N292 - Ignition Coil 4 with Power Output Stage
P - Spark Plug Connectors
Q - Spark Plugs
T4a - 4-Pin Connector
T4b - 4-Pin Connector
T4c - 4-Pin Connector
T4d - 4-Pin Connector
T121 - 121-Pin Connector

(15) - Ground connection, on cylinder head
(85) - Ground connection -1-, in engine compartment wiring harness
(281) - Ground connection -1-, in wiring harness engine pre-wiring
(D78) - Plus connection -1- (30a), in engine compartment wiring harness
(D173) - Connection (87)in engine wiring harness)

Edition 12.04

Repair Manual page number 97-631
Repair Manual page number 97-630



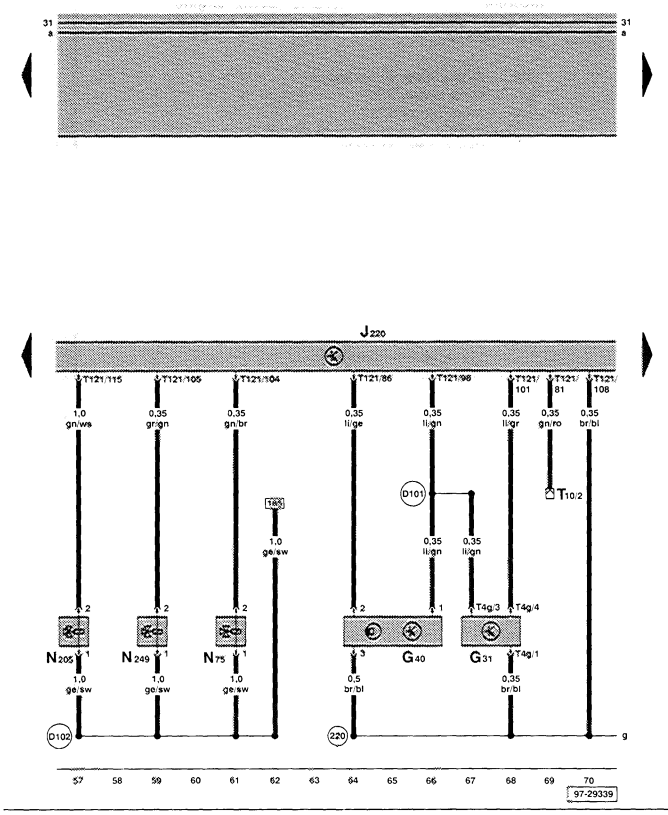
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM)

- J104 - ABS Control Module (w/EDL), in engine compartment, left
- J217 - Transmission Control Module (TCM)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- T47a - 47-Pin Connector, on ABS Control Module
- T68a - 68-Pin Connector, on Transmission Control Module (TCM)
- T121 - 121-Pin Connector

- (85) - Ground connection -1-, in engine compartment wiring harness
- (608) - Ground connection (in center plenum chamber)
- (609) - Ground connection (in right plenum chamber)
- (A121) - Connection (high bus), in instrument panel wiring harness
- (A122) - Connection (low bus), in instrument panel wiring harness

* - Manual transmission only
--- Automatic transmission only

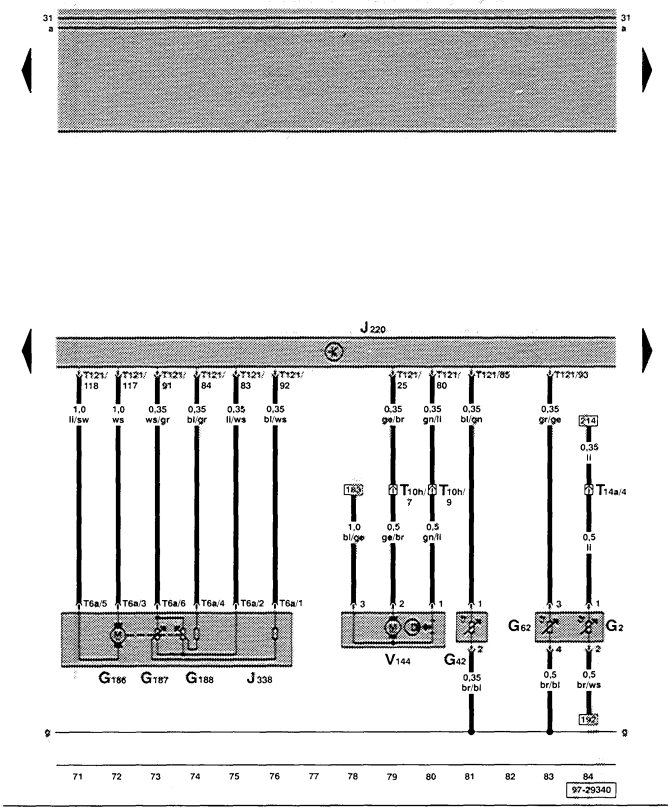


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Charge air pressure sensor, camshaft position (CMP) sensor, wastegate bypass regulator valve, re-circulating valve for turbocharger, valve for camshaft adjustment

- G31 - Charge Air Pressure Sensor
- G40 - Camshaft Position (CMP) Sensor
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- N75 - Wastegate Bypass Regulator Valve
- N205 - Valve -1- for camshaft adjustment
- N249 - Recirculating valve for turbocharger
- T4g - 4-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector

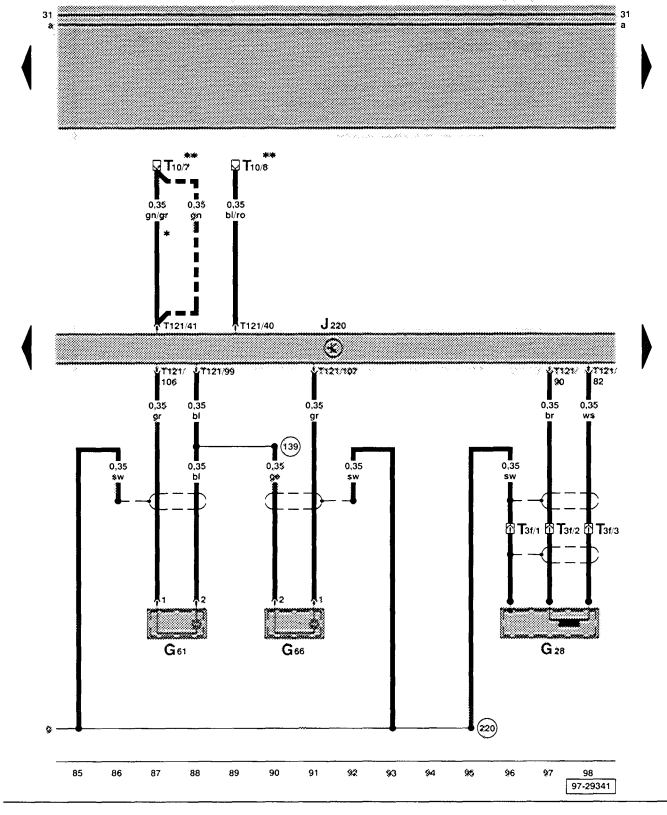
- (220) - Ground connection (sensor ground), in engine compartment wiring harness
- (D101) - Wire connection -1-, in engine compartment wiring harness
- (D102) - Wire connection -2-, in engine compartment wiring harness



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), angle sensor for throttle drive (power accelerator actuation), intake air temperature (IAT) sensor, (ECT) sensor, leak detection pump (LDP)

- G2 - Engine Coolant Temperature (ECT) Sensor
- G42 - Intake Air Temperature (IAT) Sensor
- G62 - Engine Coolant Temperature (ECT) Sensor
- G186 - Throttle drive (power accelerator actuation)
- G187 - Angle sensor -1- for throttle drive (power accelerator actuation)
- G188 - Angle sensor -2- for throttle drive (power accelerator actuation)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J338 - Throttle Valve Control Module
- T6a - 6-Pin Connector
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- T121 - 121-Pin Connector
- V144 - Leak detection pump (LDP)

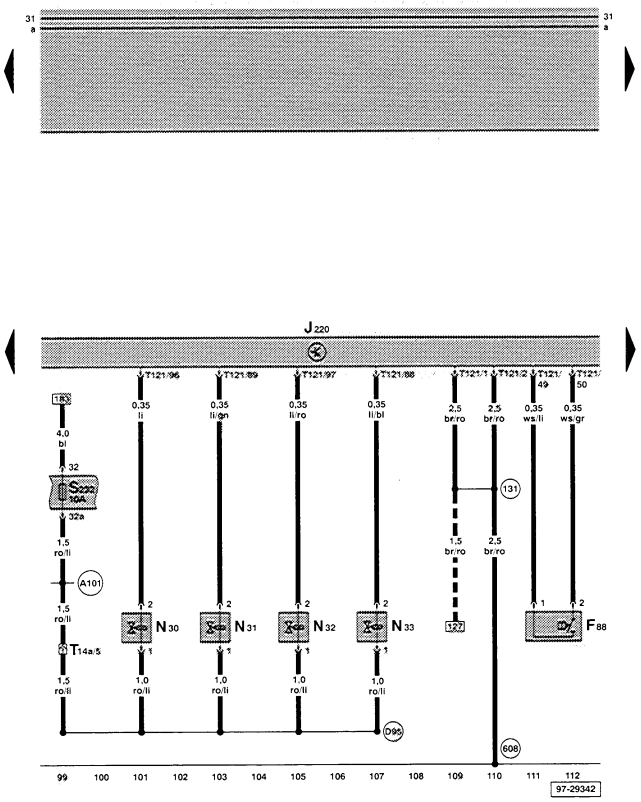


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), engine speed (RPM) sensor, knock sensor (KS) 1, knock sensor (KS) 2

- G28 - Engine Speed (RPM) Sensor
- G61 - Knock Sensor (KS) 1
- G66 - Knock Sensor (KS) 2
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T3f - 3-Pin Connector, in engine compartment, front
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector
- (139) - Ground connection (sensor Ground), in Motronic Multiport Fuel Injection (MFI) wiring harness
- (220) - Ground connection (sensor ground), in engine compartment wiring harness

* - Manual transmission only
** - A/C connection
--- Automatic transmission only



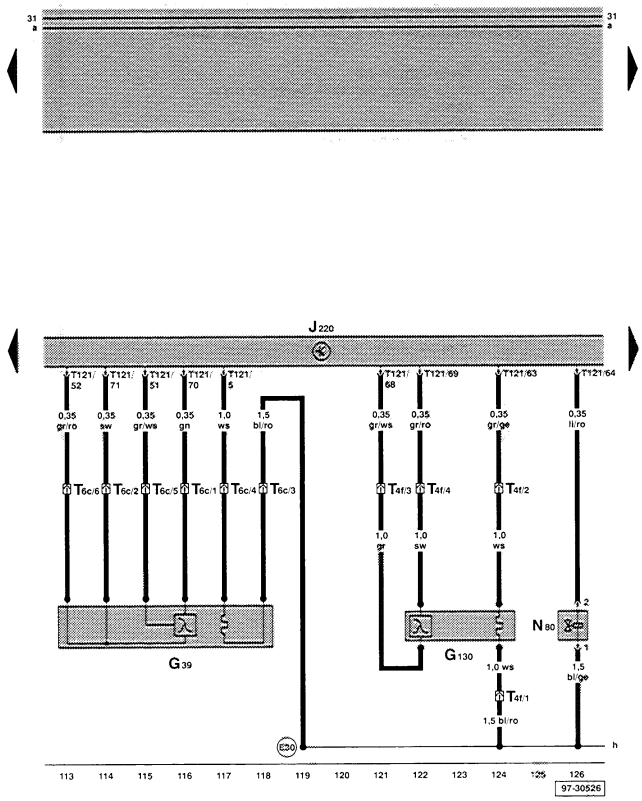
Motronic engine control module (ECM), pressure switch/power steering, injectors

F88 - Pressure switch/power steering
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N30 - Cylinder 1 Fuel Injector
N31 - Cylinder 2 Fuel Injector
N32 - Cylinder 3 Fuel Injector
N33 - Cylinder 4 Fuel Injector
S232 - Fuse 32 in fuse holder
T14a - 14-Pin Connector, near battery
T121 - 121-Pin Connector

(131) - Ground connection -2-, in engine compartment wiring harness
(608) - Ground Connection (in center plenum chamber)
(A101) - Connection -3- (87a), in instrument panel wiring harness
(D95) - Wire connection (injectors), in engine compartment wiring harness

--- Automatic transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Motronic engine control module (ECM), heated oxygen sensor (HO2S), oxygen sensor (O2S) behind three way catalytic converter (TWC), (EVAP) canister purge regulator valve

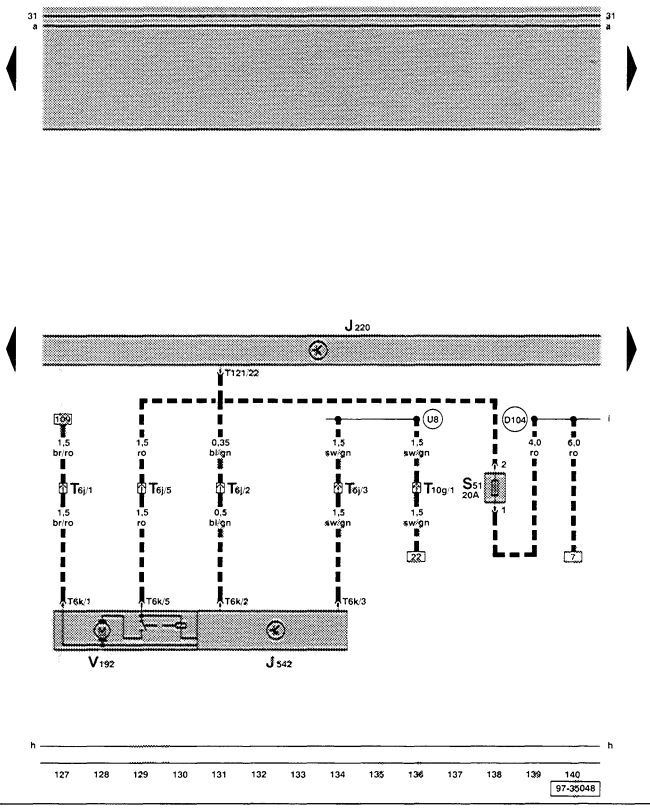
G39 - Heated Oxygen Sensor (HO2S)
G130 - Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC)
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N80 - Evaporative Emission (EVAP) Canister Purge Regulator Valve
T4f - 4-Pin Connector, in protective housing for connectors under right floor
T6c - 6-Pin Connector, in protective housing for connectors under right floor
T121 - 121-Pin Connector

(E30) - Connection (87a), in wiring harness engine

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Repair Manual page number 97-637

Repair Manual page number 97-636



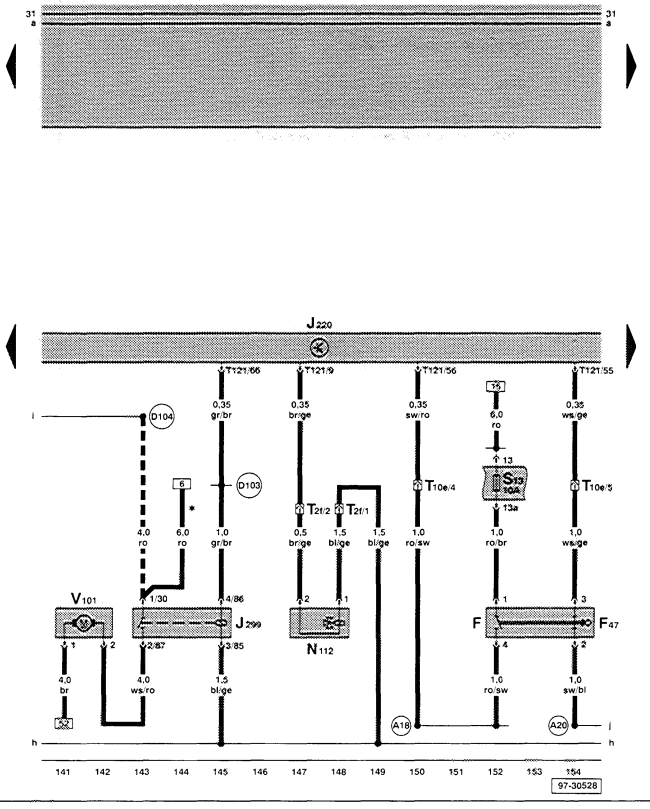
Motronic engine control module (ECM), brake booster control module, brake system vacuum pump

- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J542 - Brake Booster Control Module
- S51 - Fuse, in protective housing, in engine compartment, left
- T6j - 6-Pin Connector, in engine compartment left
- T6k - 6-Pin Connector
- T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector
- V192 - Brake System Vacuum Pump

- (D104) - Plus connection -2- (30a), in engine compartment wiring harness
- (U8) - Plus connection (15a) in automatic transmission wiring harness

--- Automatic transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Motronic engine control module (ECM), secondary air injection (AIR) pump system, brake light switch, brake vacuum vent valve switch for cruise control

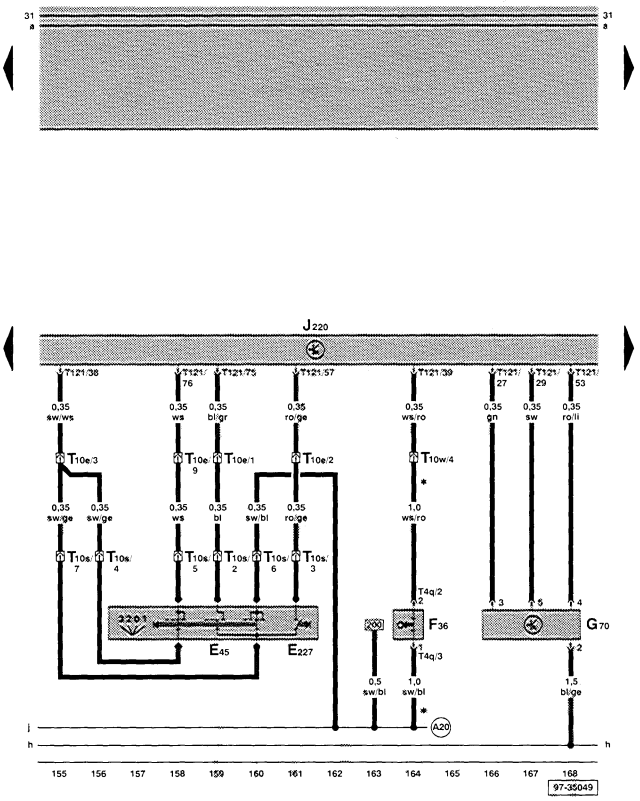
- F - Brake Light Switch
- F47 - Brake Vacuum Vent Valve Switch for cruise control
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J299 - Secondary Air Injection (AIR) Pump Relay, in protective housing, in engine compartment, left, production control number (100)
- N112 - Secondary Air Injection (AIR) Solenoid Valve
- S13 - Fuse 13 in fuse holder
- T2f - Double Connector, in engine compartment left
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector
- V101 - Secondary Air Injection (AIR) Pump Motor

- (A18) - Wire connection (54), in instrument panel
- (A20) - Wire connection (15a), in instrument panel wiring harness
- (D103) - Wire connection -3-, in engine compartment wiring harness
- (D104) - Plus connection -2- (30a), in engine compartment wiring harness

* - Manual transmission only

--- Automatic transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



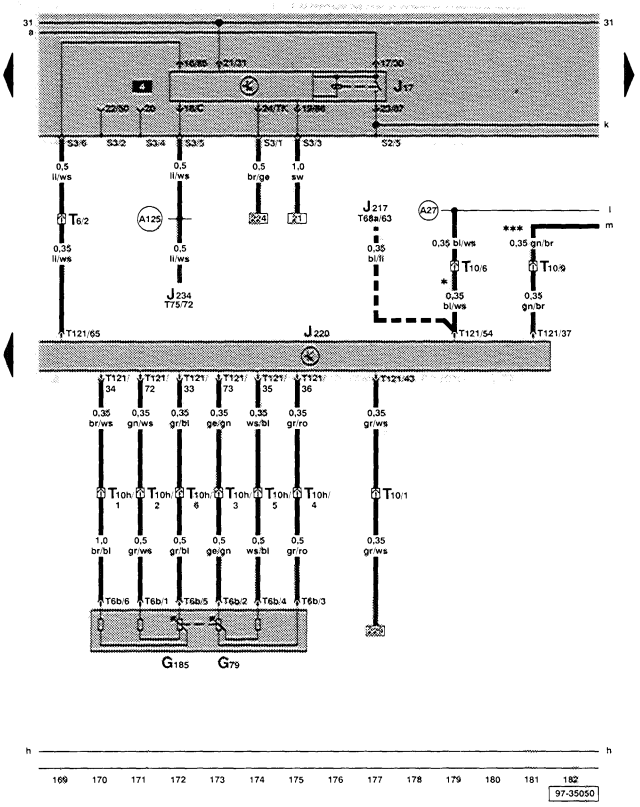
Motronic engine control module (ECM), cruise control switch, mass air flow (MAF) sensor, clutch vacuum vent valve switch

E45 - Cruise Control Switch
E227 - Cruise Control Push Button (SET)
F36 - Clutch Vacuum Vent Valve Switch
G70 - Mass Air Flow (MAF) Sensor
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
T4q - 4-Pin Connector (beginning May 2001)
T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
T10s - 10-Pin Connector, near steering column
T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
T121 - 121-Pin Connector

(A20) - Wire connection (15a), in instrument panel wiring harness

* - Manual transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



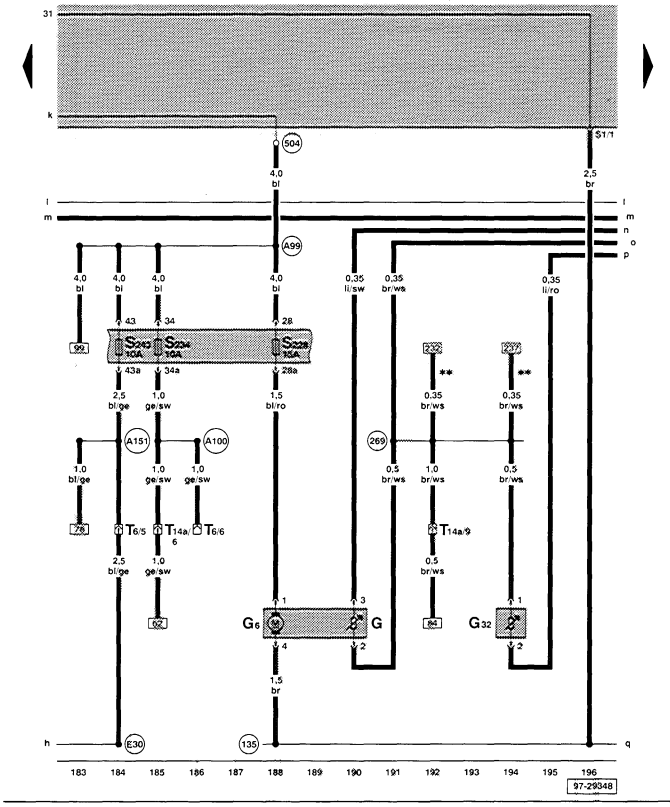
Motronic engine control module (ECM), throttle position (TP) sensor, fuel pump (FP) relay

G79 - Throttle Position (TP) Sensor
G185 - Sender -2- for accelerator pedal position
J17 - Fuel Pump (FP) Relay
J217 - Transmission Control Module (TCM)
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J234 - Airbag Control Module
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T6b - 6-Pin Connector
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T68a - 68-Pin Connector, on Transmission Control Module (TCM)
T75 - 75-Pin Connector
T121 - 121-Pin Connector

(A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness
(A125) - Connection (crash signal) in instrument panel wiring harness

* - Manual transmission only
--- - Automatic transmission only
*** - Through April 2002

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



ws = white
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ge = yellow
or = orange

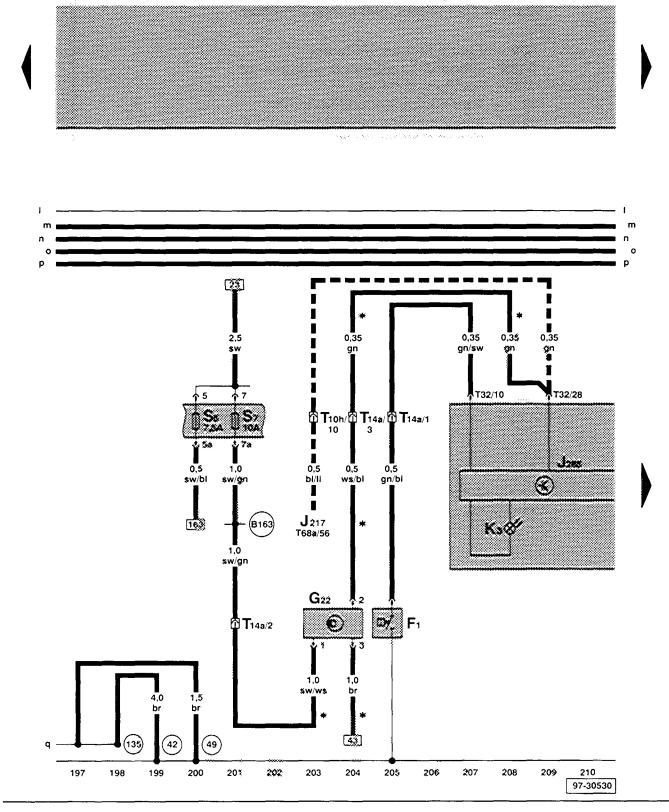
Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor

- G - Fuel Level Sensor
- G6 - Fuel Pump (FP)
- G32 - Engine Coolant Level (ECL) Sensor
- S228 - Fuse 28 in fuse holder
- S234 - Fuse 34 in fuse holder
- S243 - Fuse 43 in fuse holder
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery

- (135) - Ground connection -2-, in instrument panel wiring harnes
- (269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
- (504) - Threaded connection -1- (87) on the relay plate
- (A99) - Connection -1- (87), in instrument panel wiring harness
- (A100) - Connection -2- (87), in instrument panel wiring harness
- (A151) - Connection -4- (87), in instrument panel wiring harness
- (E30) - Connection (87a), in wiring harness engine

** - Vehicles with Multi-Function Indicator (MFI) only

--- Automatic transmission only



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light

- F1 - Oil Pressure Switch
- G22 - Speedometer Vehicle Speed Sensor (VSS)
- J217 - Transmission Control Module (TCM)
- J285 - Control module with indicator unit in instrument panel insert
- K3 - Oil Pressure Warning Light
- S5 - Fuse 5 in fuse holder
- S7 - Fuse 7 in fuse holder
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- T32 - 32-Pin Connector, blue
- T68a - 68-Pin Connector, on Transmission Control Module (TCM)

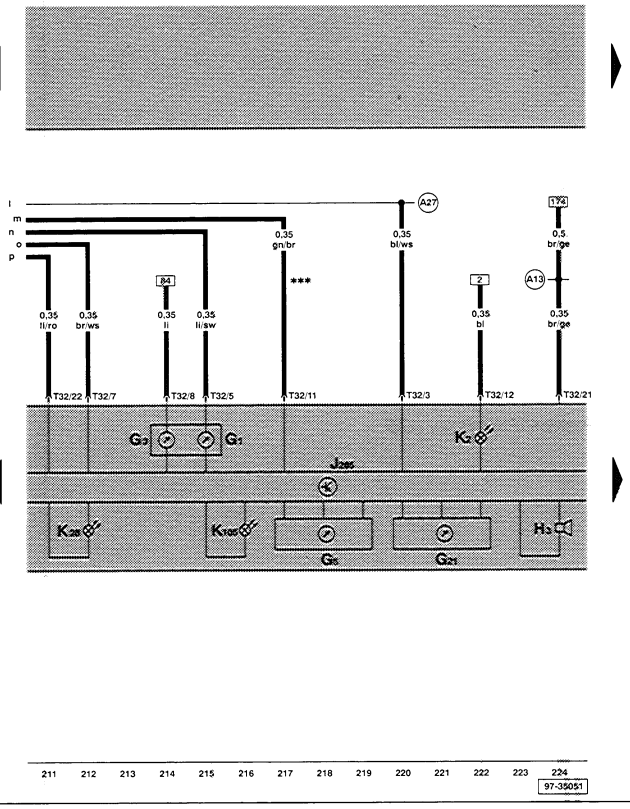
- (42) - Ground connection, beside steering column
- (49) - Ground connection, on steering column
- (135) - Ground connection -2-, in instrument panel wiring harness
- (B163) - Plus connection -1- (15) in wiring harness interior

* - Manual transmission only

--- Automatic transmission only

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Repair Manual page number 97-642



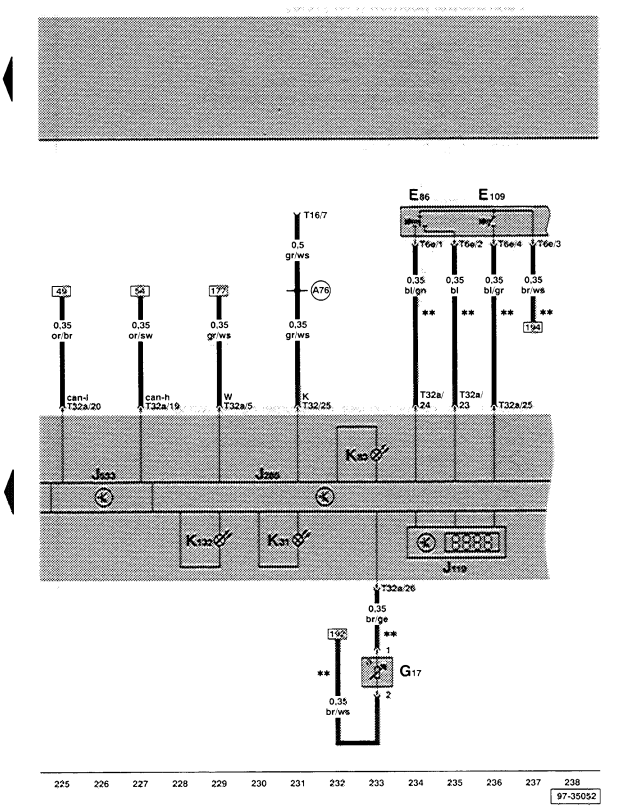
Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light

- G1 - Fuel gauge
- G3 - Engine Coolant Temperature (ECT) Gauge
- G5 - Tachometer
- G21 - Speedometer
- H3 - Warning Buzzer
- J285 - Control module with indicator unit in instrument panel insert
- K2 - Generator (GEN) Warning Light
- K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
- K105 - Low Fuel Level Warning Light
- T32 - 32-Pin Connector, blue

- (A13) - Wire connection (door contact switch), in instrument panel wiring harness
- (A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness

*** - Through April 2002

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp

- E86 - Multi-Function Indicator Mode Select Switch
- E109 - Multi-Function Indicator Memory Switch
- G17 - Outside Air Temperature Sensor
- J119 - Multi-function Indicator (MFI)
- J285 - Control module with indicator unit in instrument panel insert
- J533 - Data Bus On Board Diagnostic Interface
- K31 - Cruise Control Indicator Light
- K83 - Malfunction Indicator Lamp (MIL)
- K132 - Electronic Power Control (EPC) Warning Lamp
- T6e - 6-Pin Connector
- T16 - Data Link Connector (DLC), below instrument panel, left
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green

- (A76) - Connection (K-diagnosis wire), in instrument panel wiring harness

** - Vehicles with Multi-Function Indicator (MFI) only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Repair Manual page number 97-647

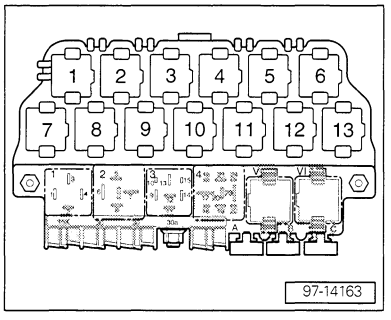
Automatic transmission, 5 speed automatic with Tiptronic,

from June 2001

- **1.8L - Engine - Motronic Multiport Fuel Injection (MFI)/132 kW, code AWP**
- **2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/147 kW, code BDF**

Additional Fuse, Relay, Control Module and Connector locations ⇒ Compontent Locations

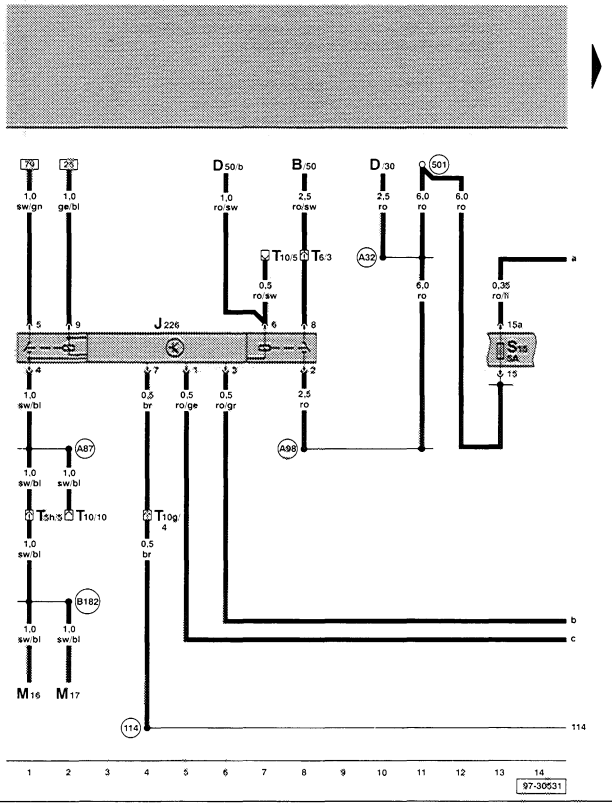
Troubleshooting Procedures ⇒ Guided Fault Finding using VAS 5051/5052



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

11 J317 - Park/Neutral Position (PNP) Relay (175)

Relay panel:



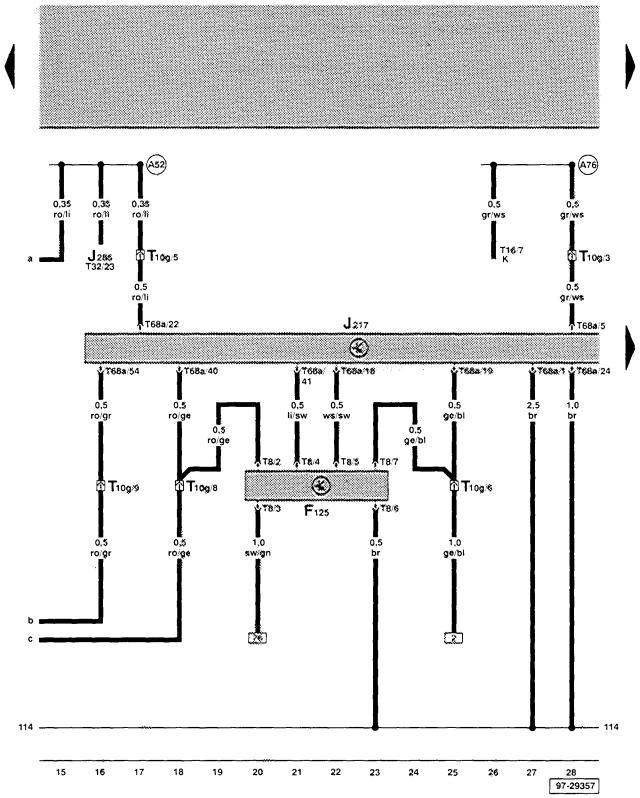
Park/neutral position (PNP) relay

B - Starter
D - Ignition/Starter Switch
J226 - Park/Neutral Position (PNP) Relay, on the thirteenfold auxiliary relay panel, above relay panel
M16 - Left Back-Up Light
M17 - Right Back-Up Light
S15 - Fuse 15 in fuse holder
T5h - 5-Pin Connector, near left A-pillar, lower part, in harness
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left

(114) - Ground connection, in automatic transmission wiring harness
(501) - Threaded connection -2- (30) on the relay plate
(A32) - Plus connection (30), in instrument panel wiring harness
(A87) - Connection (RF), in instrument panel wiring harness
(A98) - Plus connection -4- (30), in instrument panel wiring harness
(B182) - Connection (RF), in passenger compartment wiring harness

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ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Repair Manual page number 97-646

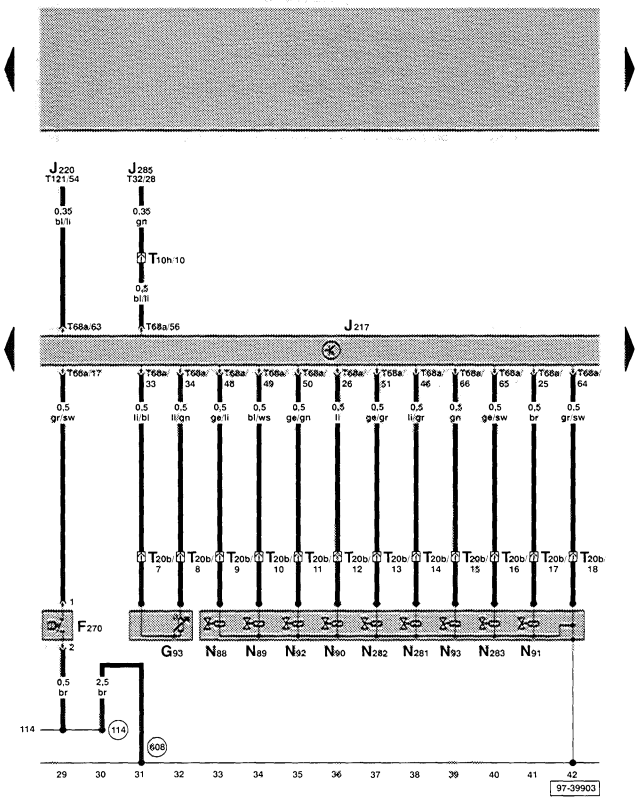


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Transmission control module (TCM), multi-function transmission range (TR) switch

- F125 - Multi-Function Transmission Range (TR) Switch
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- J285 - Control module with indicator unit in instrument panel insert
- T8 - 8-Pin Connector
- T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
- T16 - Data Link Connector (DLC), below instrument panel, left
- T32 - 32-Pin Connector, blue
- T68a - 68-Pin Connector

- (A52) - Plus connection (30a), in instrument panel wiring harness
- (A76) - Connection (K-diagnosis wire) in instrument panel wiring harness

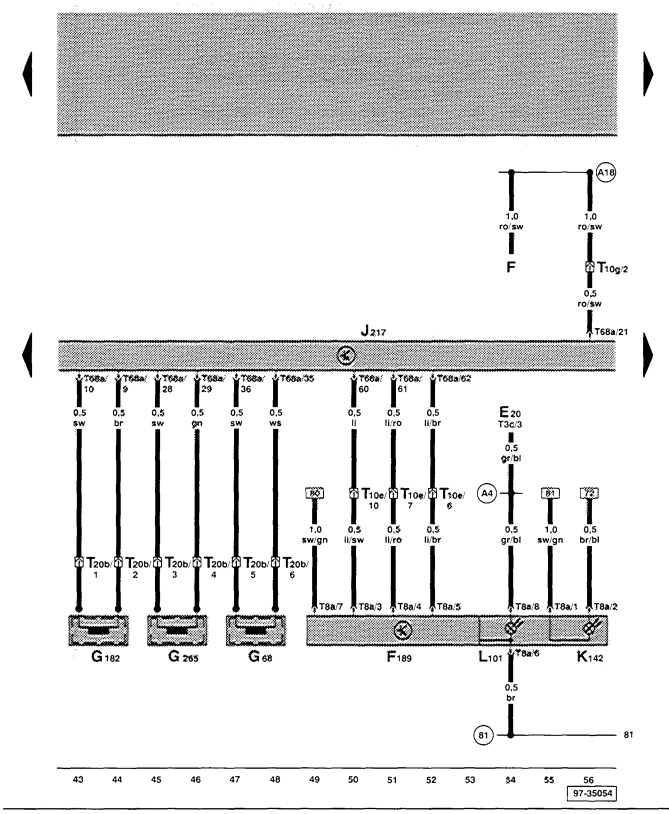


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Transmission control module (TCM), solenoid valves, transmission fluid temperature sensor, brake pressure switch

- F270 - Brake Pressure Switch
- G93 - Transmission Fluid Temperature Sensor
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J285 - Control module with indicator unit in instrument panel insert
- N88 - Solenoid Valve 1
- N89 - Solenoid Valve 2
- N90 - Solenoid Valve 3
- N91 - Solenoid Valve 4
- N92 - Solenoid Valve 5
- N93 - Solenoid Valve 6
- N281 - Solenoid Valve 8
- N282 - Solenoid Valve 9
- N283 - Solenoid Valve 10
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T20b - 20-Pin Connector, on transmission
- T32 - 32-Pin Connector, blue
- T68a - 68-Pin Connector
- T121 - 121-Pin Connector

- (114) - Ground connection, in automatic transmission wiring harness
- (608) - Ground connection (in center plenum chamber)

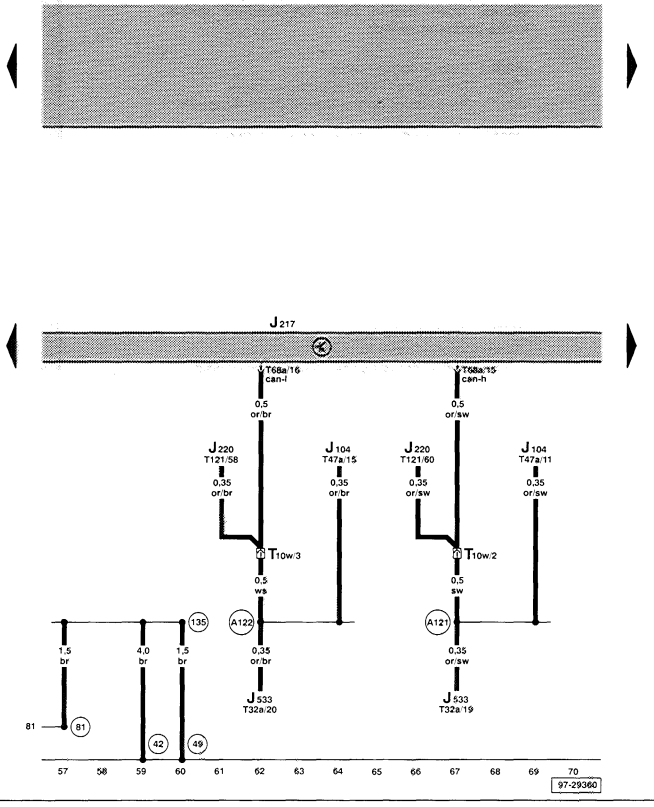


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
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Transmission control module (TCM), vehicle speed sensor (VSS), sensor for transmission RPM, intermediate shaft speed sensor, tiptronic switch

- E20 - Instrument Panel Light Dimmer Switch
- F - Brake Light Switch
- F189 - Tiptronic Switch
- G68 - Vehicle Speed Sensor (VSS)
- G182 - Sensor for transmission RPM
- G265 - Intermediate Shaft Speed Sensor
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- K142 - Warning light for selector lever position P/N
- L101 - Illumination for selector lever scale
- T3c - 3-Pin Connector
- T8a - 8-Pin Connector
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
- T20b - 20-Pin Connector, on transmission
- T68a - 68-Pin Connector

- (81) - Ground connection -1-, in instrument panel wiring harness
- (A4) - Plus connection (58b), in instrument panel wiring harness
- (A18) - Wire connection (54), in instrument panel wiring harness

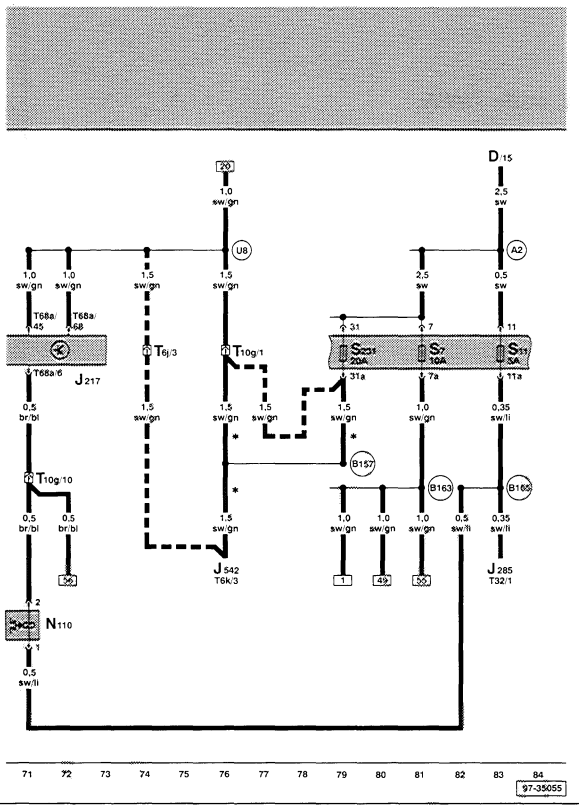


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Transmission control module (TCM)

- J104 - ABS Control Module (w/EDL)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- J533 - Data Bus On Board Diagnostic Interface
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T32a - 32-Pin Connector, green, on Instrument cluster
- T47a - 47-Pin Connector, on ABS Control Module
- T68a - 68-Pin Connector
- T121 - 121-Pin Connector

- (42) - Ground connection, beside steering column
- (49) - Ground connection, on steering column
- (81) - Ground connection -1-, in instrument panel wiring harness
- (135) - Ground connection -2-, in instrument panel wiring harness
- (A121) - Connection (high bus), in instrument panel wiring harness
- (A122) - Connection (low bus), in instrument panel wiring harness



Transmission control module (TCM), shift lock solenoid

- D - Ignition/Starter Switch
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- J285 - Control module with indicator unit in instrument panel insert
- J542 - Brake Booster Control Module
- N110 - Shift Lock Solenoid
- S7 - Fuse 7 in fuse holder
- S11 - Fuse 11 in fuse holder
- S231 - Fuse 31 in fuse holder
- T6j - 6-Pin Connector, in engine compartment left
- T6k - 6-Pin Connector
- T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
- T32 - 32-Pin Connector, blue
- T68a - 68-Pin Connector

- (A2) - Plus connection (15), in instrument panel wiring harness
- (B157) - Plus connection -3- (15a) in wiring harness interior
- (B163) - Plus connector -1- (15) in wiring harness interior
- (B165) - Plus connection -2- (15) in wiring harness interior
- (U8) - Plus connection (15a) in automatic transmission wiring harness

* - Beginning May 2002

--- Through April 2002

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03

Repair Manual page number 97-653

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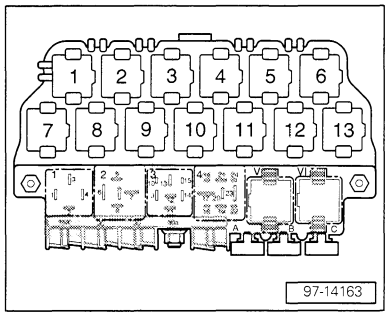
Repair Manual page number 97-652

Repair Manual page number 97-655

1.8L - Engine - Motronic Multiport Fuel Injection (MFI)/110 kW, code AWW,

from February 2001

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations"



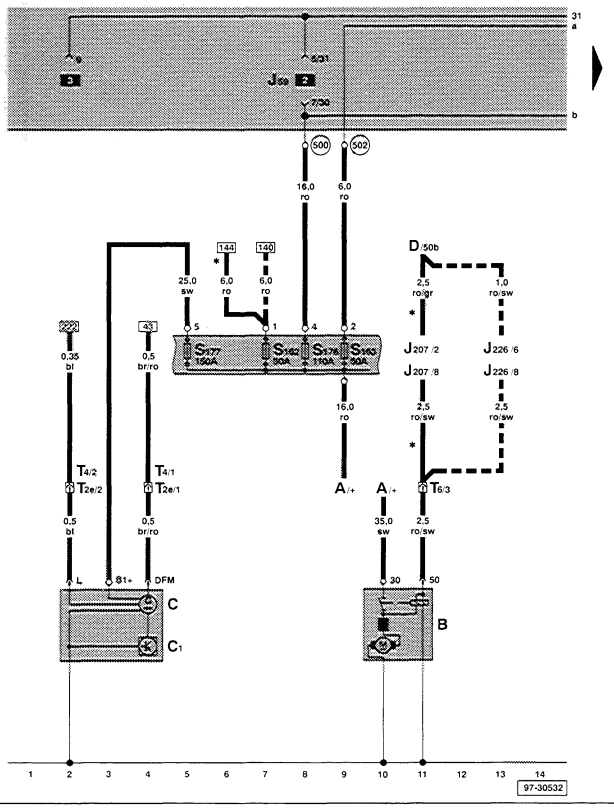
Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

2 J52 - Load Reduction Relay (100)

4 J17 - Fuel Pump (FP) Relay (409)

Repair Manual page number 97-654



Generator (GEN), starter

A - Battery
B - Starter
C - Generator (GEN)
C1 - Voltage Regulator (VR)
D - Ignition/Starter Switch
J59 - Load Reduction Relay
J207 - Starting Interlock Relay
J226 - Park/Neutral Position (PNP) Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
T2e - Double Connector, near starter (vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left

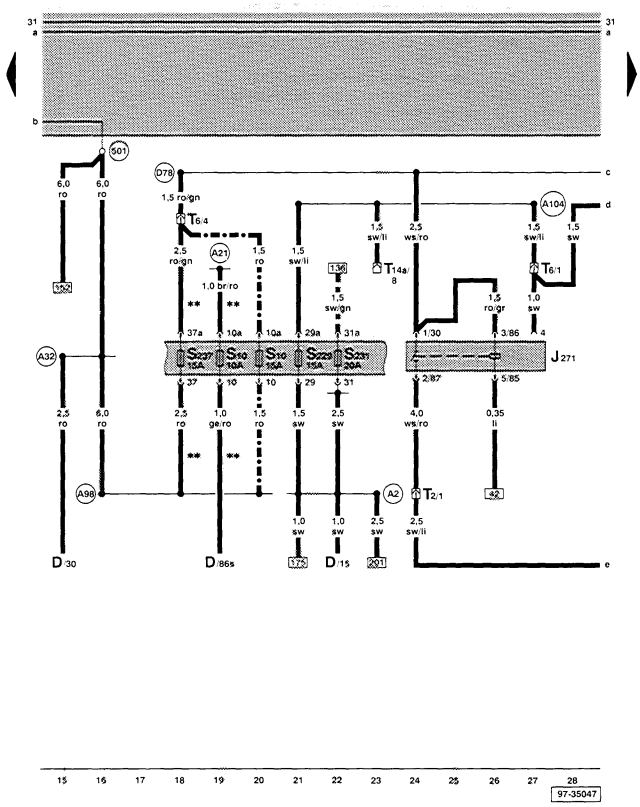
(500) - Threaded connection -1- (30) on the relay plate

(502) - Threaded connection -1- (30a) on the relay plate

* - Manual transmission only

--- Automatic transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Motronic engine control module (ECM) power supply relay

D - Ignition/Starter Switch
J271 - Motronic engine control module (ECM) power supply relay, in protective housing, in engine compartment, left, production control number (428)
S10 - Fuse 10 in fuse holder
S229 - Fuse 29 in fuse holder
S231 - Fuse 31 in fuse holder
S237 - Fuse 37 in fuse holder
T2 - 2-Pin Connector, in engine compartment, left
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, near battery

(501) - Threaded connection -2- (30) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A21) - Wire connection (86s), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connection -4- (30), in instrument panel wiring harness
(A104) - Plus connection -2- (15), in instrument panel wiring harness
(D78) - Plus connection -1- (30a), in engine compartment wiring harness

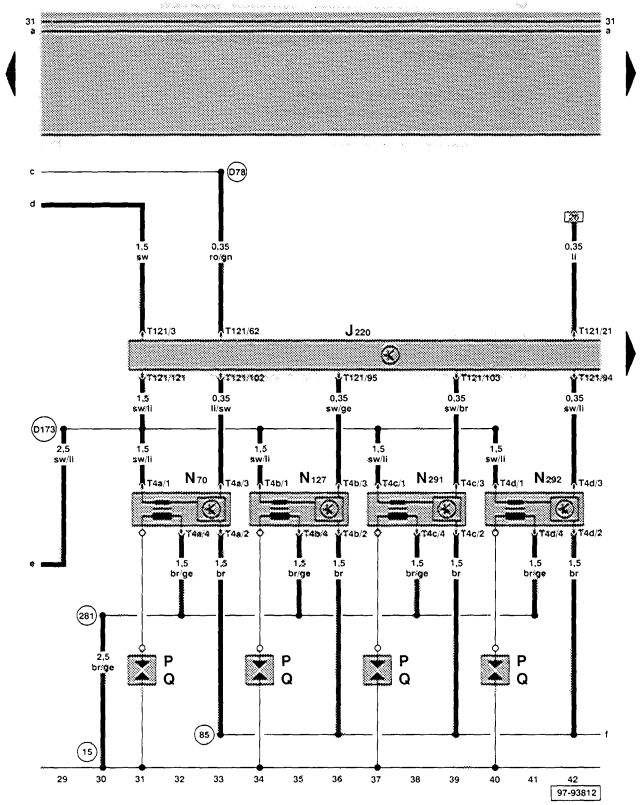
--- Automatic transmission only
** - Beginning November 2001
--•-•- Through October 2001

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

97-35047

Edition 04.03

Repair Manual page number 97-657



Motronic engine control module (ECM), ignition system

J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N70 - Ignition Coil 1 with Power Output Stage
N127 - Ignition Coil 2 with Power Output Stage
N291 - Ignition Coil 3 with Power Output Stage
N292 - Ignition Coil 4 with Power Output Stage
P - Spark Plug Connectors
Q - Spark Plugs
T4a - 4-Pin Connector
T4b - 4-Pin Connector
T4c - 4-Pin Connector
T4d - 4-Pin Connector
T121 - 121-Pin Connector

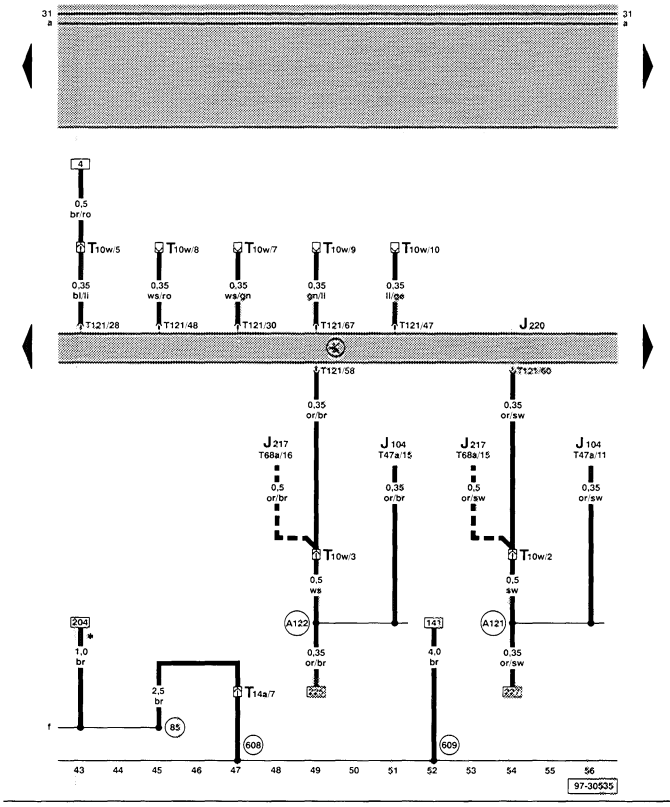
(15) - Ground connection, on cylinder head
(85) - Ground connection -1-, in engine compartment wiring harness
(281) - Ground connection -1-, in wiring harness engine pre-wiring
(D78) - Plus connection -1- (30a), in engine compartment wiring harness
(D173) - Connection (87)(in engine wiring harness)

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

97-93812

Edition 12.04

Repair Manual page number 97-656



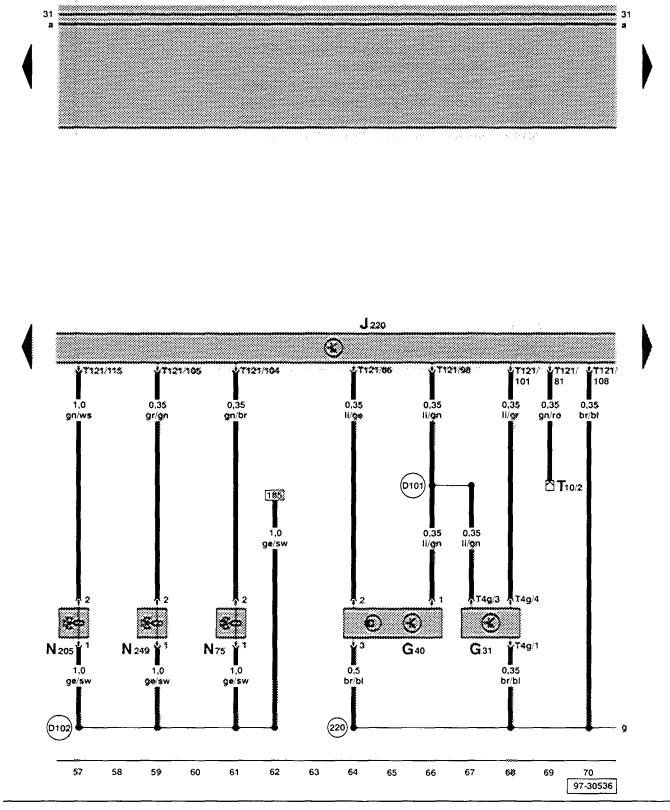
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM)

- J104 - ABS Control Module (w/EDL), in engine compartment, left
- J217 - Transmission Control Module (TCM)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- T47a - 47-Pin Connector, on ABS Control Module
- T68a - 68-Pin Connector, on Transmission Control Module (TCM)
- T121 - 121-Pin Connector

- (85) - Ground connection -1-, in engine compartment wiring harness
- (608) - Ground connection (in center plenum chamber)
- (609) - Ground connection (in right plenum chamber)
- (A121) - Connection (high bus), in instrument panel wiring harness
- (A122) - Connection (low bus), in instrument panel wiring harness

* - Manual transmission only
--- Automatic transmission only



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

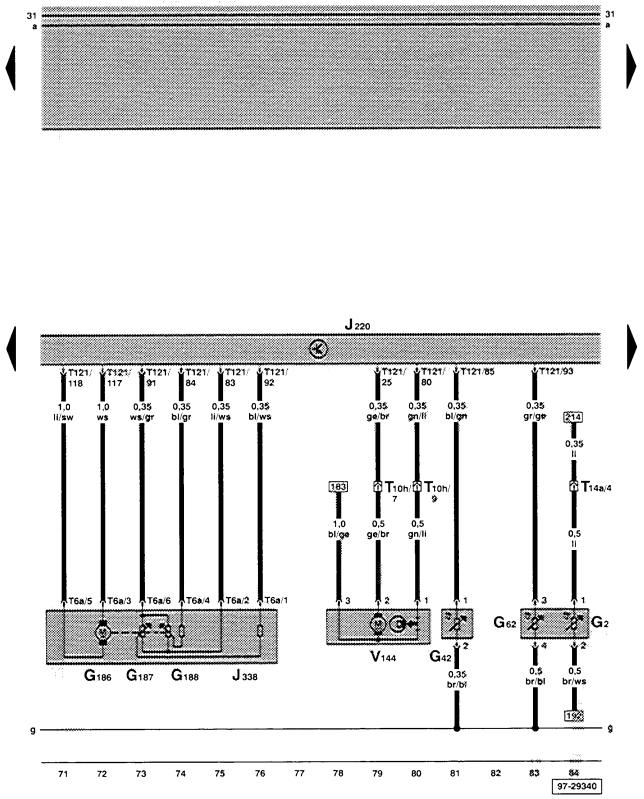
Charge air pressure sensor, camshaft position (CMP) sensor, wastegate bypass regulator valve, re-circulating valve for turbocharger, valve for camshaft adjustment

- G31 - Charge Air Pressure Sensor
- G40 - Camshaft Position (CMP) Sensor
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- N75 - Wastegate Bypass Regulator Valve
- N205 - Valve -1- for camshaft adjustment
- N249 - Recirculating valve for turbocharger
- T4g - 4-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector

- (220) - Ground connection (sensor ground), in engine compartment wiring harness
- (D101) - Wire connection -1-, in engine compartment wiring harness
- (D102) - Wire connection -2-, in engine compartment wiring harness

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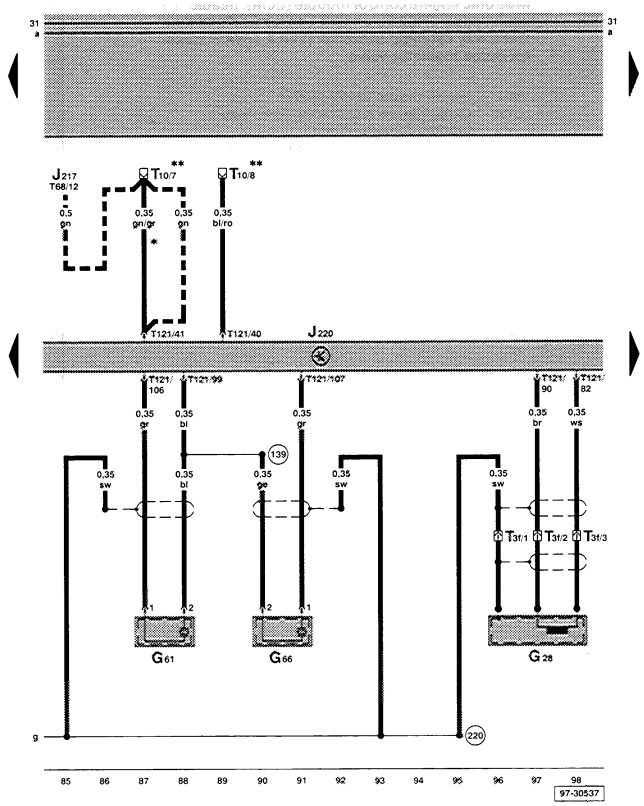
Repair Manual page number 97-658



Motronic engine control module (ECM), angle sensor for throttle drive (power accelerator actuation), intake air temperature (IAT) sensor, (ECT) sensor, leak detection pump (LDP)

- G2 - Engine Coolant Temperature (ECT) Sensor
- G42 - Intake Air Temperature (IAT) Sensor
- G62 - Engine Coolant Temperature (ECT) Sensor
- G186 - Throttle drive (power accelerator actuation)
- G187 - Angle sensor -1- for throttle drive (power accelerator actuation)
- G188 - Angle sensor -2- for throttle drive (power accelerator actuation)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J338 - Throttle Valve Control Module
- T6a - 6-Pin Connector
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- T121 - 121-Pin Connector
- V144 - Leak detection pump (LDP)

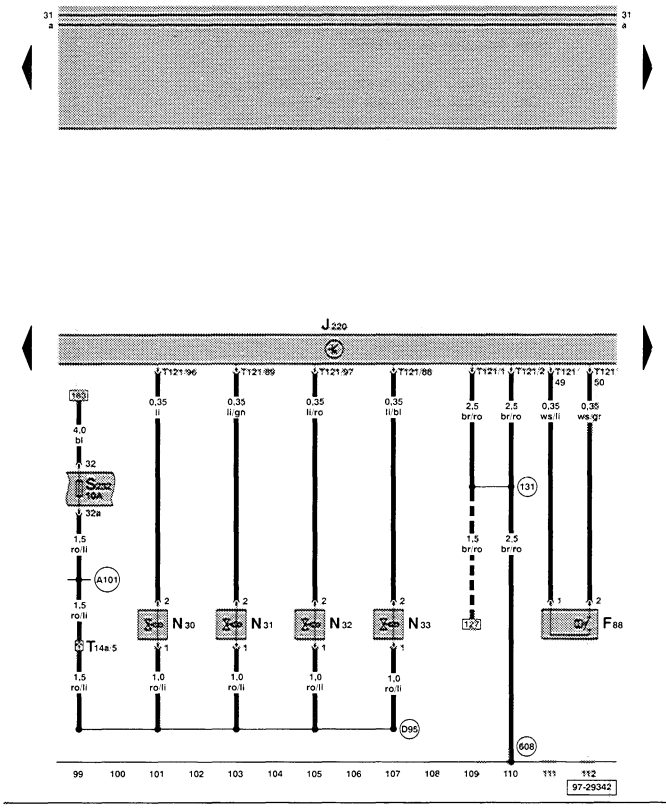
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Motronic engine control module (ECM), engine speed (RPM) sensor, knock sensor (KS) 1, knock sensor (KS) 2

- G28 - Engine Speed (RPM) Sensor
- G61 - Knock Sensor (KS) 1
- G66 - Knock Sensor (KS) 2
- J217 - Transmission Control Module (TCM)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T3f - 3-Pin Connector, in engine compartment, front
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T68 - Connector, 68 point
- T121 - 121-Pin Connector
- (139) - Ground connection (sensor Ground), in Motronic Multiport Fuel Injection (MFI) wiring harness
- (220) - Ground connection (sensor ground), in engine compartment wiring harness
- * - Manual transmission only
- ** - A/C connection
- --- Automatic transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



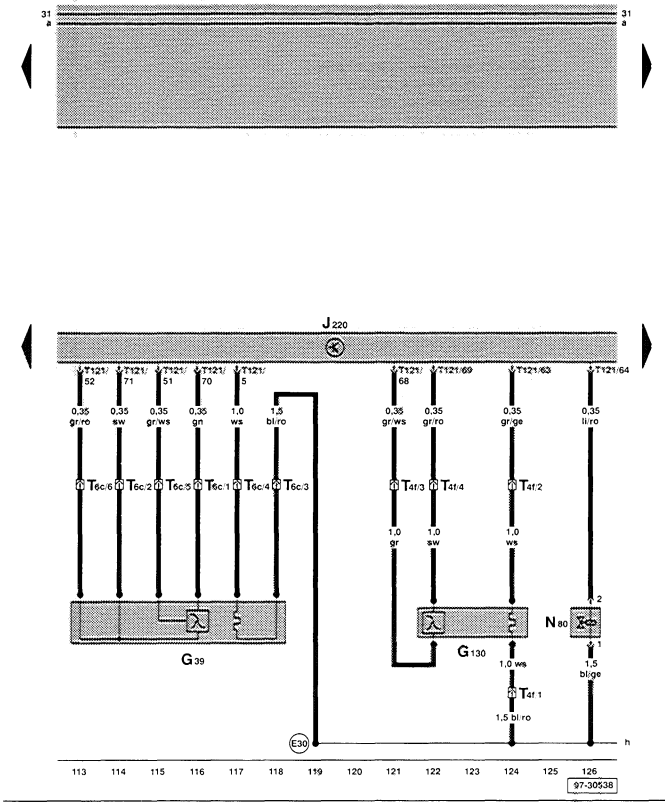
Motronic engine control module (ECM), pressure switch/power steering, injectors

F88 - Pressure switch/power steering
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N30 - Cylinder 1 Fuel Injector
N31 - Cylinder 2 Fuel Injector
N32 - Cylinder 3 Fuel Injector
N33 - Cylinder 4 Fuel Injector
S232 - Fuse 32 in fuse holder
T14a - 14-Pin Connector, near battery
T121 - 121-Pin Connector

(131) - Ground connection -2-, in engine compartment wiring harness
(608) - Ground Connection (in center plenum chamber)
(A101) - Connection -3- (87a), in instrument panel wiring harness
(D95) - Wire connection (injectors), in engine compartment wiring harness

--- Automatic transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Motronic engine control module (ECM), heated oxygen sensor (HO2S), oxygen sensor (O2S) behind three way catalytic converter (TWC), (EVAP) canister purge regulator valve

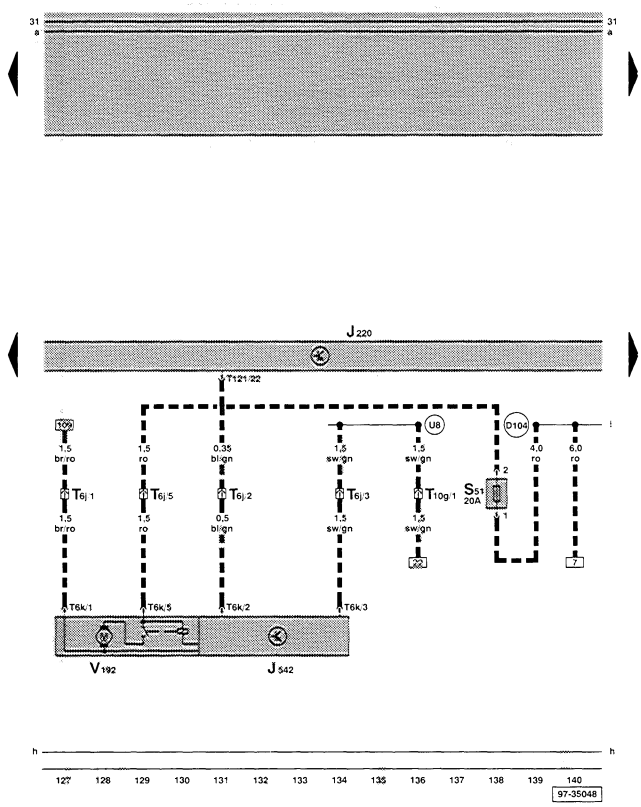
G39 - Heated Oxygen Sensor (HO2S)
G130 - Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC)
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N80 - Evaporative Emission (EVAP) Canister Purge Regulator Valve
T4f - 4-Pin Connector, in protective housing for connectors under right floor
T6c - 6-Pin Connector, in protective housing for connectors under right floor
T121 - 121-Pin Connector

(E30) - Connection (87a), in wiring harness engine

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Repair Manual page number 97-663

Repair Manual page number 97-662



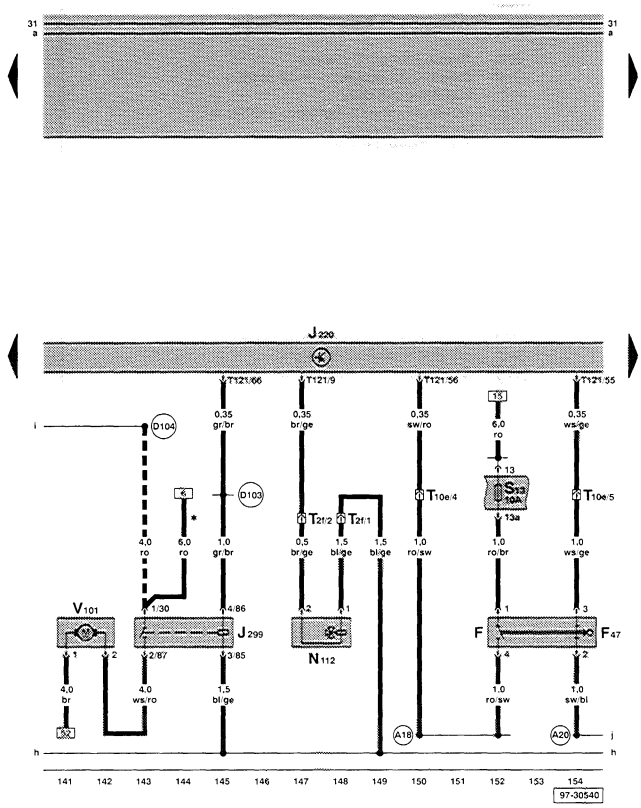
Motronic engine control module (ECM), brake booster control module, brake system vacuum pump

- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J542 - Brake Booster Control Module
- S51 - Fuse, in protective housing, in engine compartment, left
- T6j - 6-Pin Connector, in engine compartment left
- T6k - 6-Pin Connector
- T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector
- V192 - Brake System Vacuum Pump

- (D104) - Plus connection -2- (30a), in engine compartment wiring harness
- (U8) - Plus connection (15a) in automatic transmission wiring harness

--- Automatic transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Motronic engine control module (ECM), secondary air injection (AIR) pump system, brake light switch, brake vacuum vent valve switch for cruise control

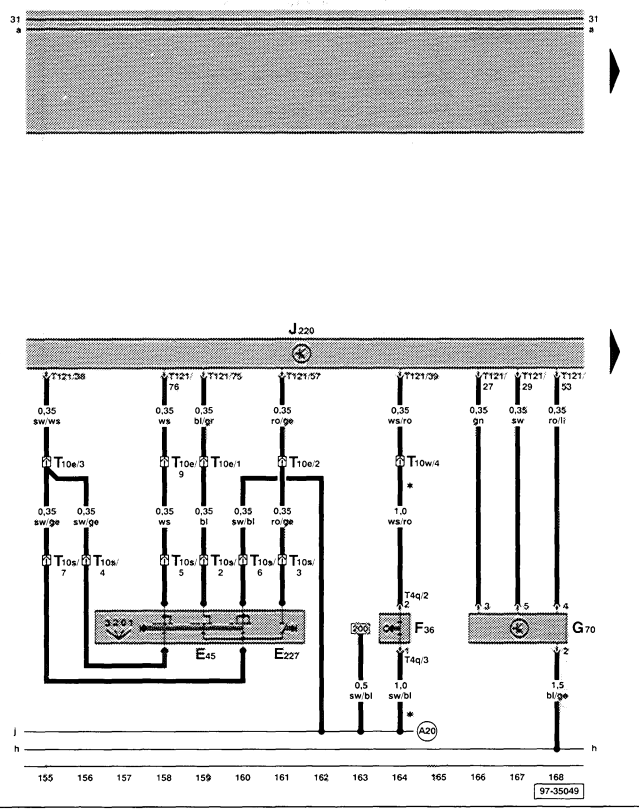
- F - Brake Light Switch
- F47 - Brake Vacuum Vent Valve Switch for cruise control
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J299 - Secondary Air Injection (AIR) Pump Relay, in protective housing, in engine compartment, left, production control number (100)
- N112 - Secondary Air Injection (AIR) Solenoid Valve
- S13 - Fuse 13 in fuse holder
- T2f - Double Connector, in engine compartment left
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector
- V101 - Secondary Air Injection (AIR) Pump Motor

- (A18) - Wire connection (54), in instrument panel
- (A20) - Wire connection (15a), in instrument panel wiring harness
- (D103) - Wire connection -3-, in engine compartment wiring harness
- (D104) - Plus connection -2- (30a), in engine compartment wiring harness

* - Manual transmission only

--- Automatic transmission only

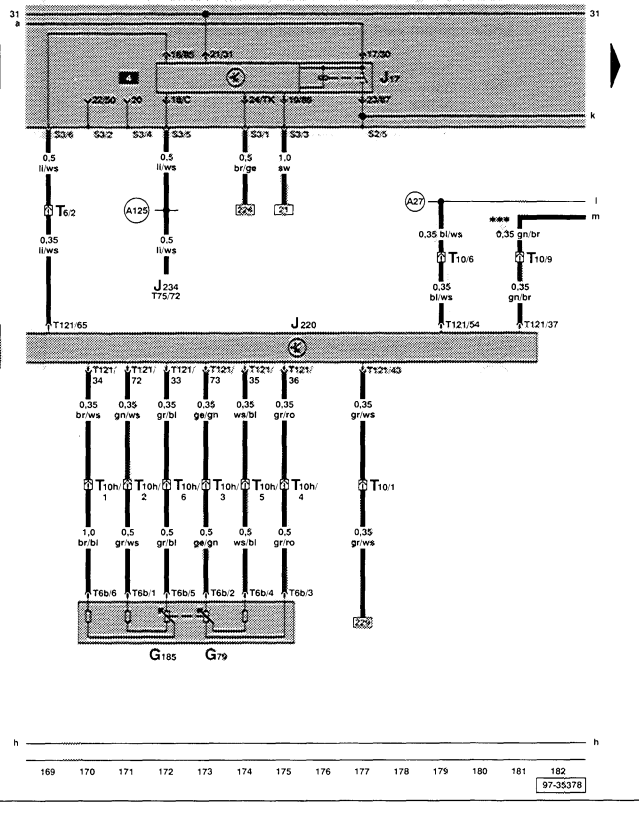
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Motronic engine control module (ECM), cruise control switch, mass air flow (MAF) sensor, clutch vacuum vent valve switch

- E45 - Cruise Control Switch
- E227 - Cruise Control Push Button (SET)
- F36 - Clutch Vacuum Vent Valve Switch
- G70 - Mass Air Flow (MAF) Sensor
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T4q - 4-Pin Connector (beginning May 2001)
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T10s - 10-Pin Connector, near steering column
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector
- (A20) - Wire connection (15a), in instrument panel wiring harness
- * - Manual transmission only

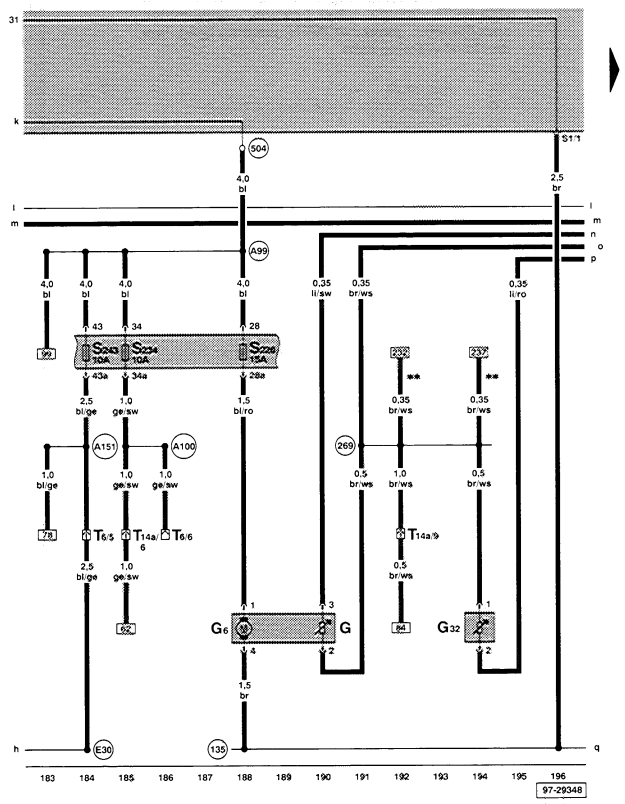
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Motronic engine control module (ECM), throttle position (TP) sensor, fuel pump (FP) relay

- G79 - Throttle Position (TP) Sensor
- G185 - Sender -2- for accelerator pedal position
- J17 - Fuel Pump (FP) Relay
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J234 - Airbag Control Module
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T6b - 6-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T75 - 75-Pin Connector
- T121 - 121-Pin Connector
- (A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness
- (A125) - Connection (crash signal) in instrument panel wiring harness
- *** - Through April 2002

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor

- G - Fuel Level Sensor
- G6 - Fuel Pump (FP)
- G32 - Engine Coolant Level (ECL) Sensor
- S228 - Fuse 28 in fuse holder
- S234 - Fuse 34 in fuse holder
- S243 - Fuse 43 in fuse holder
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery

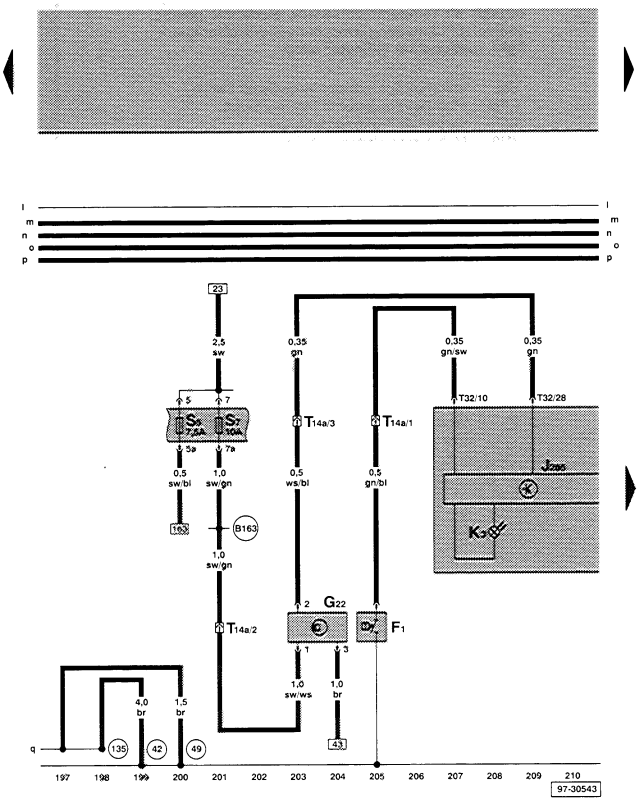
- (135) - Ground connection -2-, in instrument panel wiring harnes
- (269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
- (504) - Threaded connection -1- (87) on the relay plate
- (A99) - Connection -1- (87), in instrument panel wiring harness
- (A100) - Connection -2- (87), in instrument panel wiring harness
- (A151) - Connection -4- (87), in instrument panel wiring harness
- (E30) - Connection (87a), in wiring harness engine

** - Vehicles with Multi-Function Indicator (MFI) only

--- Automatic transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 09.01



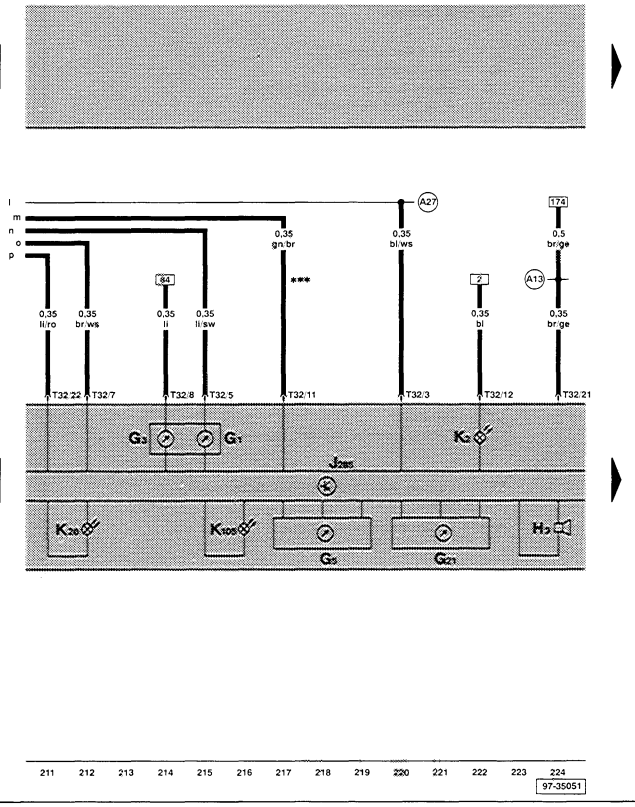
Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light

- F1 - Oil Pressure Switch
- G22 - Speedometer Vehicle Speed Sensor (VSS)
- J285 - Control module with indicator unit in instrument panel insert
- K3 - Oil Pressure Warning Light
- S5 - Fuse 5 in fuse holder
- S7 - Fuse 7 in fuse holder
- T14a - 14-Pin Connector, near battery
- T32 - 32-Pin Connector, blue

- (42) - Ground connection, beside steering column
- (49) - Ground connection, on steering column
- (135) - Ground connection -2-, in instrument panel wiring harness
- (B163) - Plus connection -1- (15) in wiring harness interior

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 09.01



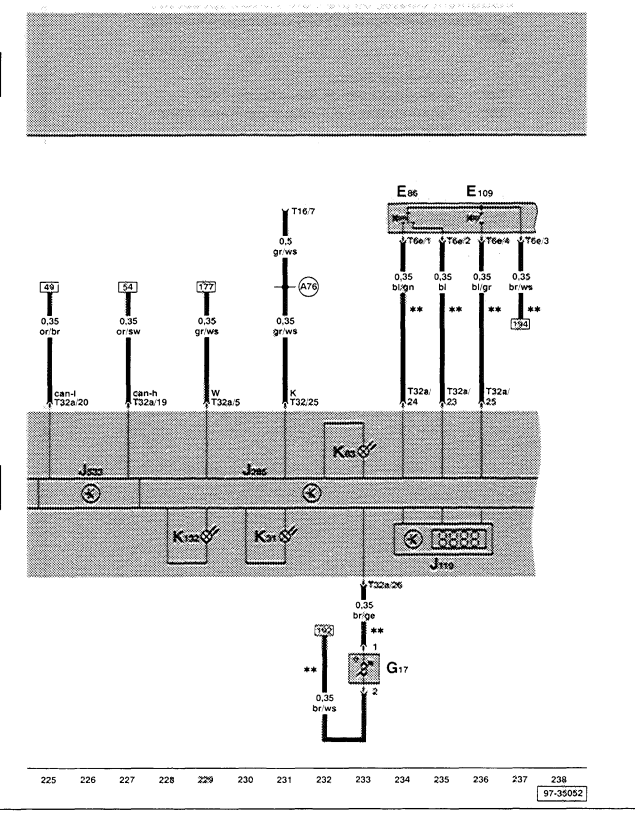
Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light

- G1 - Fuel gauge
- G3 - Engine Coolant Temperature (ECT) Gauge
- G5 - Tachometer
- G21 - Speedometer
- H3 - Warning Buzzer
- J285 - Control module with indicator unit in instrument panel insert
- K2 - Generator (GEN) Warning Light
- K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
- K105 - Low Fuel Level Warning Light
- T32 - 32-Pin Connector, blue

- (A13) - Wire connection (door contact switch), in instrument panel wiring harness
- (A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness

*** - Through April 2002

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp

- E86 - Multi-Function Indicator Mode Select Switch
- E109 - Multi-Function Indicator Memory Switch
- G17 - Outside Air Temperature Sensor
- J119 - Multi-function Indicator (MFI)
- J285 - Control module with indicator unit in instrument panel insert
- J533 - Data Bus On Board Diagnostic Interface
- K31 - Cruise Control Indicator Light
- K83 - Malfunction Indicator Lamp (MIL)
- K132 - Electronic Power Control (EPC) Warning Lamp
- T6e - 6-Pin Connector
- T16 - Data Link Connector (DLC), below instrument panel, left
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green

- (A76) - Connection (K-diagnosis wire), in instrument panel wiring harness

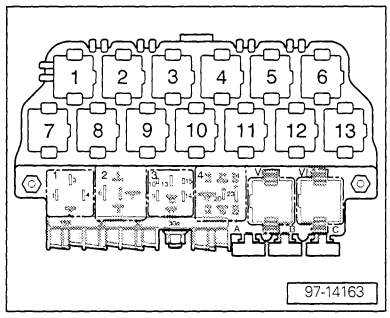
** - Vehicles with Multi-Function Indicator (MFI) only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66 kW, code ALH, (with manual transmission),

from September 2001

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations"



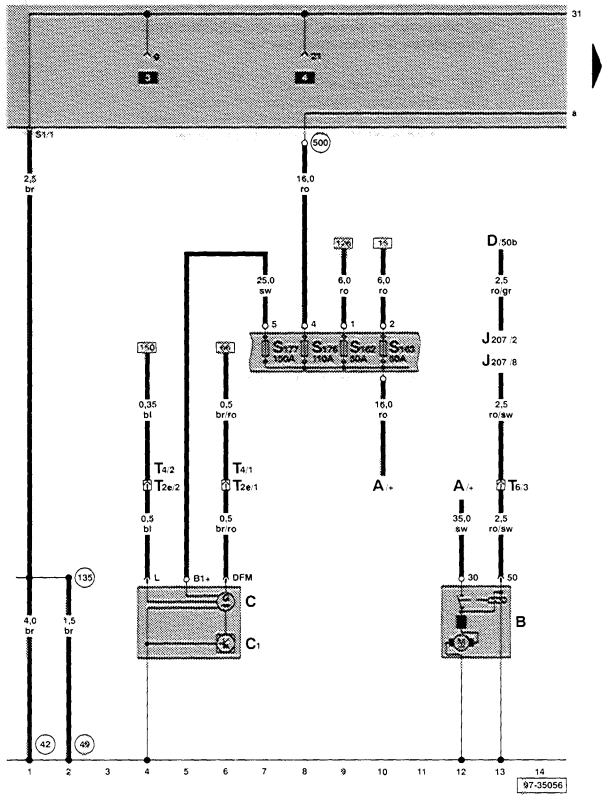
Relay location on the thirteenfold auxiliary relay panel, above relay panel:

12 J317 - Power Supply (Terminal 30, B+) Relay (109)

Relay panel:

1 J4 - Dual Horn Relay (53)

2 J59 - Load Reduction Relay (100)

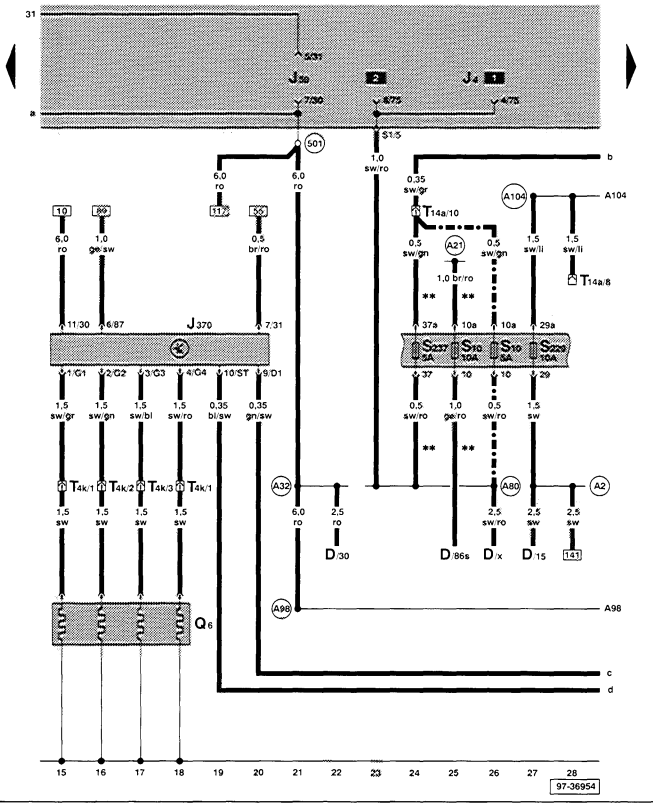


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Generator (GEN), starter

A - Battery
B - Starter
C - Generator (GEN)
C1 - Voltage Regulator (VR)
D - Ignition/Starter Switch
J207 - Starting Interlock Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
T2e - Double Connector, near starter (vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left

(42) - Ground connection, beside steering column
(49) - Ground connection, on steering column
(135) - Ground connection -2-, in instrument panel wiring harness
(500) - Threaded connection -1- (30) on the relay plate



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Control module for glow plug triggering, glow plugs (engine)

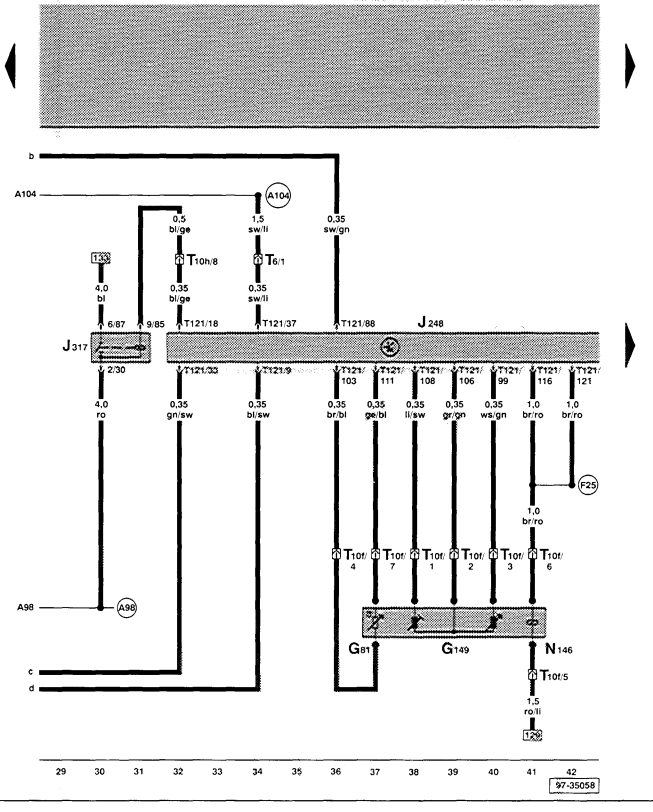
D - Ignition/Starter Switch
J4 - Dual Horn Relay
J59 - Load Reduction Relay
J370 - Control module for glow plug triggering, in plenum chamber, center
Q6 - Glow plugs (engine)
S10 - Fuse 10 in fuse holder
S229 - Fuse 29 in fuse holder
S237 - Fuse 37 in fuse holder
T4k - 4-Pin Connector, in engine compartment, in wiring duct, left
T14a - 14-Pin Connector, near battery

(501) - Threaded connection -2- (30) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A21) - Wire connection (86s), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A80) - Connection -1- (X) in instrument panel wiring harness
(A98) - Plus connection -4- (30), in instrument panel wiring harness
(A104) - Plus connection -2- (15), in instrument panel wiring harness

** - Beginning November 2001
-•-•- Through October 2001

Edition 09.03

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ws = white
sw = black
ro = red
br = brown
gn = green
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or = orange

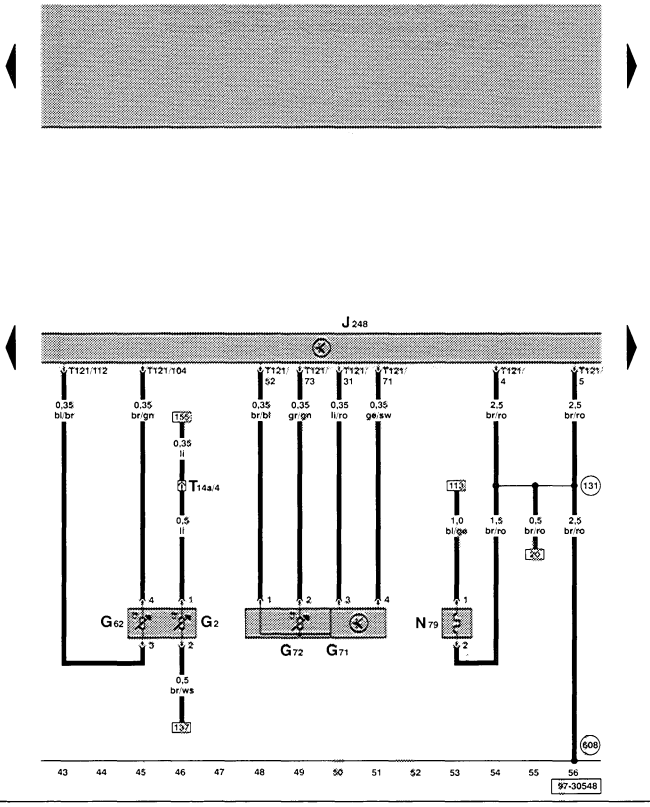
Diesel direct fuel injection (DFI) engine control module (ECM), power supply (terminal 30, B+) relay, fuel temperature sensor, quantity adjuster, modulating piston displacement sensor

G81 - Fuel Temperature Sensor
G149 - Modulating Piston Displacement Sensor
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
J317 - Power Supply (Terminal 30, B+) Relay, on the thirteenfold auxiliary relay panel, above relay panel
N146 - Quantity Adjuster
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10f - 10-Pin Connector, in engine compartment, front
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T121 - 121-Pin Connector

(A98) - Plus connection -4- (30), in instrument panel wiring harness
(A104) - Plus connection -2- (15), in instrument panel wiring harness
(F25) - Wire connection -1-, in Diesel Direct Fuel Injection (DFI) system wiring harness

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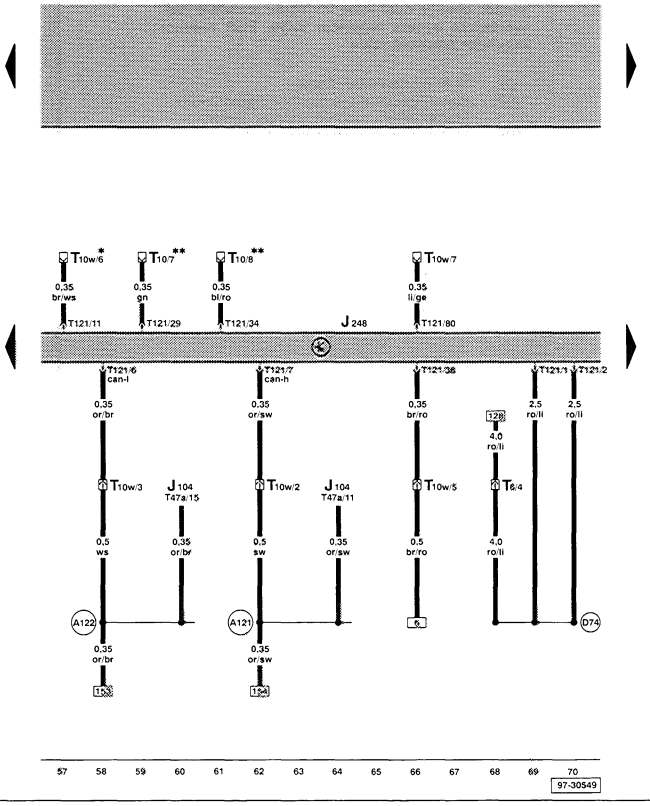


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Diesel direct fuel injection (DFI) engine control module (ECM), engine coolant temperature (ECT) sensor, intake air temperature (IAT) sensor, manifold absolute pressure (MAP) sensor

- G2 - Engine Coolant Temperature (ECT) Sensor
- G62 - Engine Coolant Temperature (ECT) Sensor
- G71 - Manifold Absolute Pressure (MAP) Sensor
- G72 - Intake Air Temperature (IAT) Sensor
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- N79 - Positive Crankcase Ventilation (PCV) Heating Element
- T14a - 14-Pin Connector, near battery
- T121 - 121-Pin Connector

- (131) - Ground connection -2-, in engine compartment wiring harness
- (608) - Ground connection (in center plenum chamber)



ws = white
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ro = red
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bl = blue
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or = orange

Diesel direct fuel injection (DFI) engine control module (ECM)

- J104 - ABS Control Module (w/EDL), in engine compartment, left
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T47a - 47-Pin Connector, on ABS Control Module
- T121 - 121-Pin Connector

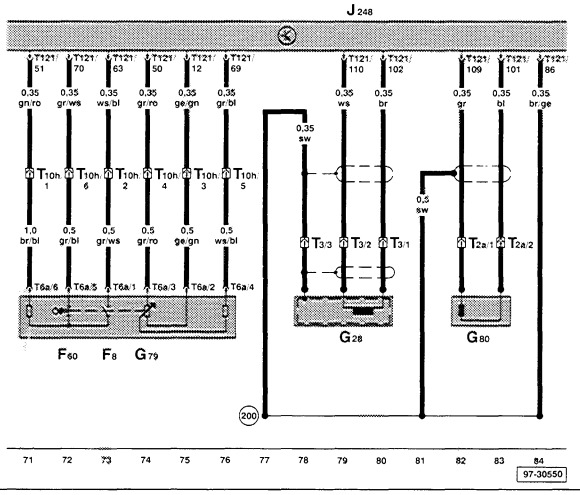
- (A121) - Connection (high bus), in instrument panel wiring harness
- (A122) - Connection (low bus), in instrument panel wiring harness
- (D74) - Wire connection (86), in engine compartment wiring harness

- * - Coolant Fan Control (FC) Control Module connection
- ** - A/C connection

Diesel direct fuel injection (DFI) engine control module (ECM), kick down switch, (CTP) switch, engine speed (RPM) sensor, throttle position (TP) sensor, needle lift sensor

F8 - Kick Down Switch
F60 - Closed Throttle Position (CTP) Switch
G28 - Engine Speed (RPM) Sensor
G79 - Throttle Position (TP) Sensor
G80 - Needle Lift Sensor
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
T2a - Double Connector, in engine compartment, front
T3 - 3-Pin Connector, in engine compartment, front
T6a - 6-Pin Connector
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T121 - 121-Pin Connector

(200) - Ground connection (shielding), in engine compartment wiring harness

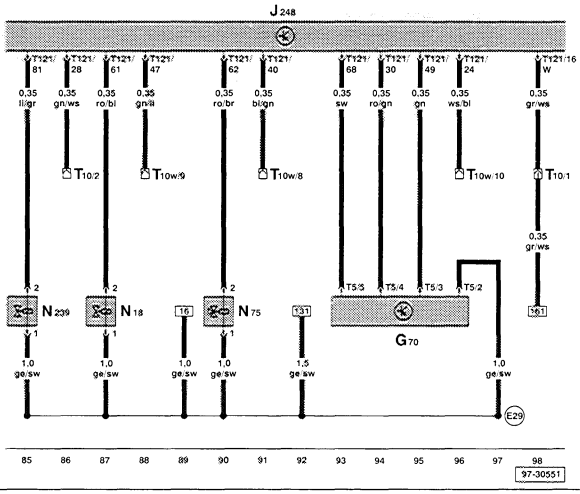


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li = lilac
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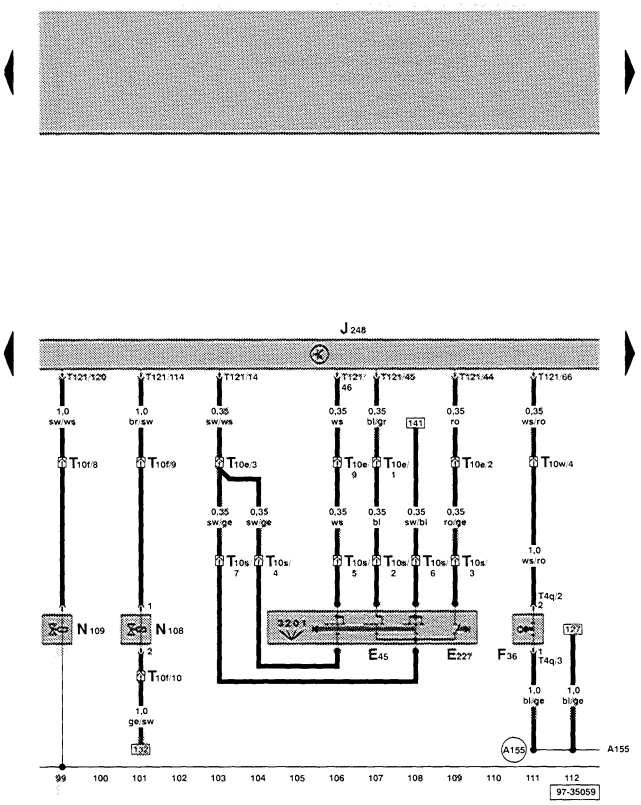
(DFI) engine control module (ECM), mass air flow sensor, change-over valve for intake manifold flap, wastegate bypass regulator valve, EGR vacuum regulator solenoid valve

G70 - Mass Air Flow (MAF) Sensor
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
N18 - EGR Vacuum Regulator Solenoid Valve
N75 - Wastegate Bypass Regulator Valve
N239 - Change-over valve for intake manifold flap
T5 - 5-Pin Connector
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
T121 - 121-Pin Connector

(E29) - Connection, in wiring harness engine



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gr = grey
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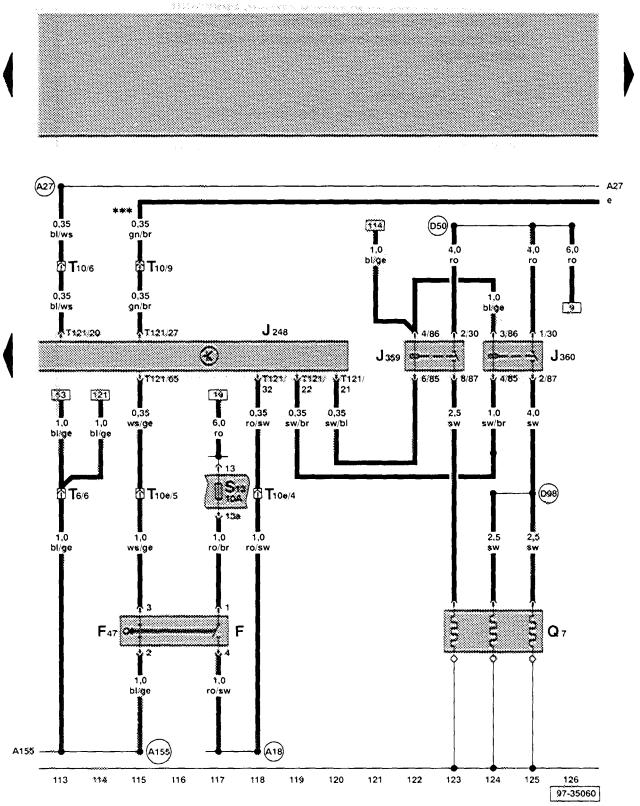


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Diesel direct fuel injection (DFI) engine control module (ECM), cruise control switch, clutch vacuum vent valve switch, cold start injector, fuel cut-off valve

- E45 - Cruise Control Switch
- E227 - Cruise Control Push Button (SET)
- F36 - Clutch Vacuum Vent Valve Switch
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- N108 - Cold Start Injector
- N109 - Fuel Cut-off Valve
- T4q - 4-Pin Connector (beginning May 2001)
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T10f - 10-Pin Connector, in engine compartment, front
- T10s - 10-Pin Connector, near steering column
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector

(A155) - Connection -2- (86), in instrument panel wiring harness



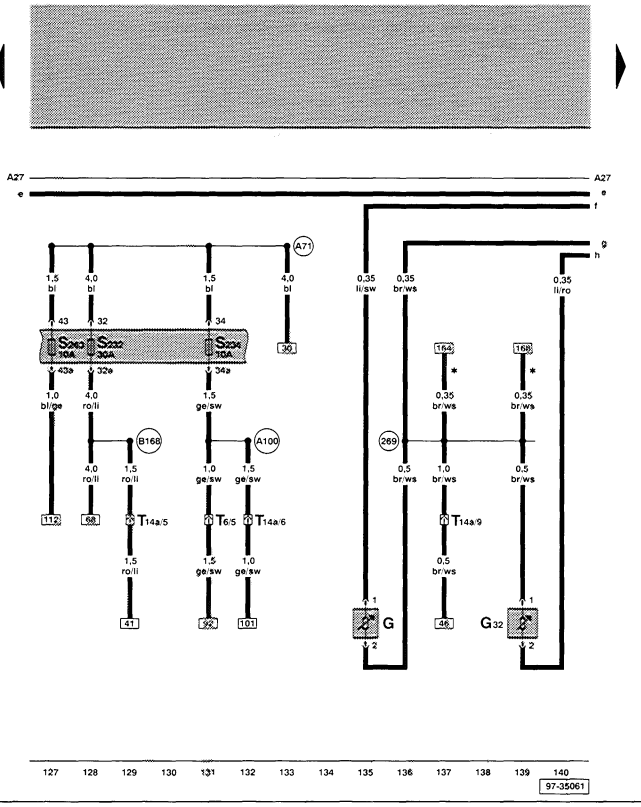
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Diesel direct fuel injection (DFI) engine control module (ECM), brake light switch, brake vacuum vent valve switch for cruise control/diesel, glow plugs (coolant)

- F - Brake Light Switch
- F47 - Brake Vacuum Vent Valve Switch for cruise control/diesel
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- J359 - Relay for preheating coolant, low heat output, in protective housing, in engine compartment, left, production control number (53)
- J360 - Relay for preheating coolant, high heat output, in protective housing, in engine compartment, left, production control number (53)
- Q7 - Glow plugs (coolant)
- S13 - Fuse 13 in fuse holder
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector

(A18) - Wire connection (54), in instrument panel wiring harness
(A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness
(A155) - Connection -2- (86), in instrument panel wiring harness
(D50) - Plus connection (30), in engine compartment wiring harness
(D98) - Wire connection (glow plugs), in engine compartment wiring harness

*** - Through April 2002



Fuel level sensor, engine coolant level (ECL) sensor

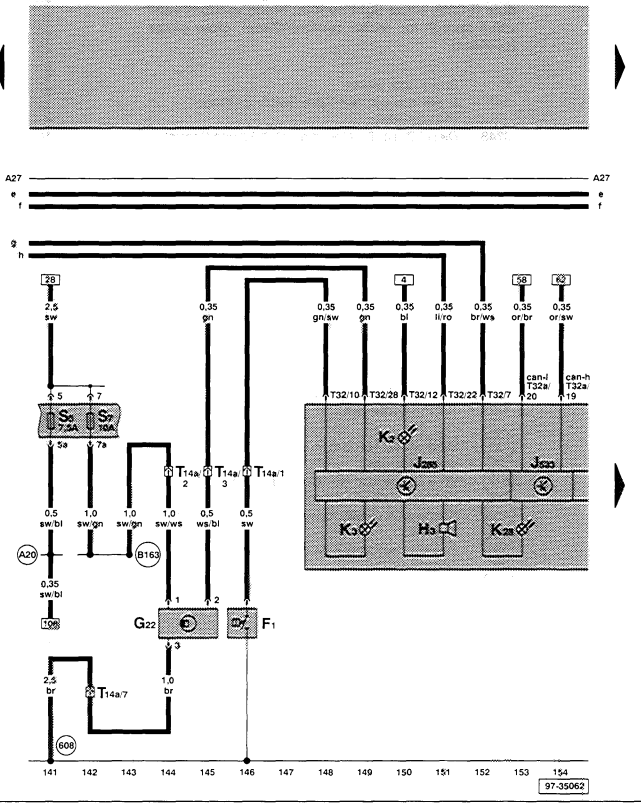
- G - Fuel Level Sensor
- G32 - Engine Coolant Level (ECL) Sensor
- S232 - Fuse 32 in fuse holder
- S234 - Fuse 34 in fuse holder
- S243 - Fuse 43 in fuse holder
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery

- (269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
- (A71) - Connection (86), in instrument panel wiring harness
- (A100) - Connection -2- (87), in instrument panel wiring harness
- (B168) - Connection (86) in passenger compartment wiring harness

* - Vehicles with Multi-Function Indicator (MFI) only

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sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03



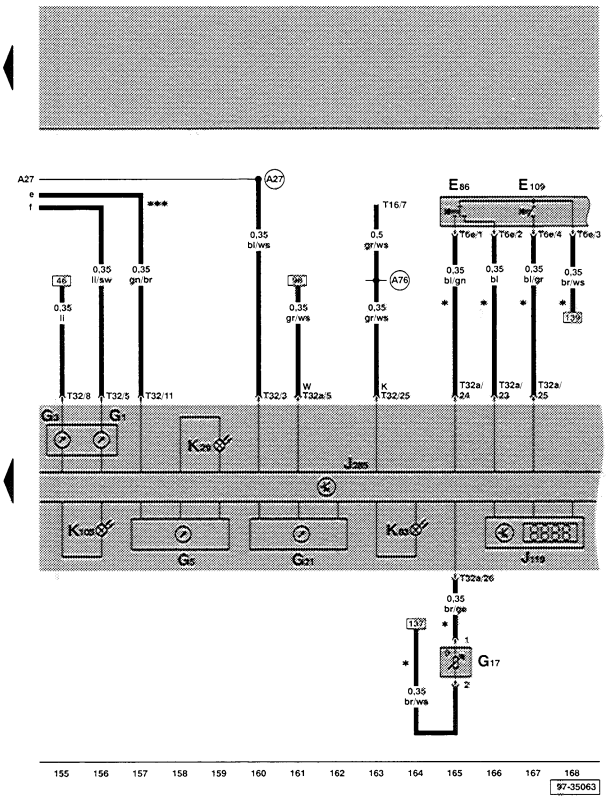
Instrument cluster, oil pressure switch, speedometer vehicle speed sensor, generator (GEN) warning light, engine coolant level/temperature (ECL/ECT) warning light

- F1 - Oil Pressure Switch
- G22 - Speedometer Vehicle Speed Sensor (VSS)
- H3 - Warning Buzzer
- J285 - Control module with indicator unit in instrument panel insert
- J533 - Data Bus On Board Diagnostic Interface
- K2 - Generator (GEN) Warning Light
- K3 - Oil Pressure Warning Light
- K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
- S5 - Fuse 5 in fuse holder
- S7 - Fuse 7 in fuse holder
- T14a - 14-Pin Connector, near battery
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green

- (608) - Ground connection (in center plenum chamber)
- (A20) - Wire connection (15a), in instrument panel wiring harness
- (B163) - Plus connection -1- (15) in wiring harness interior

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
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li = lilac
ge = yellow
or = orange

Edition 04.03



Instrument cluster, engine coolant temperature (ECT) gauge, fuel gauge, tachometer, speedometer, glow plug indicator light

- E86 - Multi-Function Indicator Mode Select Switch*
- E109 - Multi-Function Indicator Memory Switch*
- G1 - Fuel gauge
- G3 - Engine Coolant Temperature (ECT) Gauge
- G5 - Tachometer
- G17 - Outside Air Temperature Sensor*
- G21 - Speedometer
- J119 - Multi-function Indicator (MFI)
- J285 - Control module with indicator unit in instrument panel insert
- K29 - Glow Plug Indicator Light
- K83 - Malfunction Indicator Lamp (MIL)
- K105 - Low Fuel Level Warning Light
- T6e - 6-Pin Connector
- T16 - Data Link Connector (DLC), below instrument panel, left
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green
- (A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness
- (A76) - Connection (K-diagnosis wire), in instrument panel wiring harness
- * - Vehicles with Multi-Function Indicator (MFI) only
- *** - Through April 2002

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

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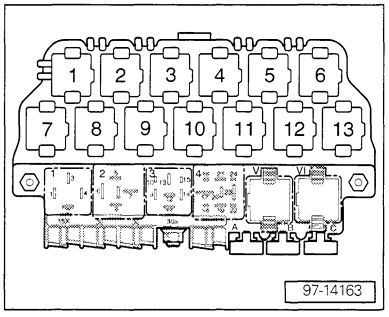
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Repair Manual page number 97-684

1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66 kW, code ALH, (with automatic transmission),

from September 2001

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations"



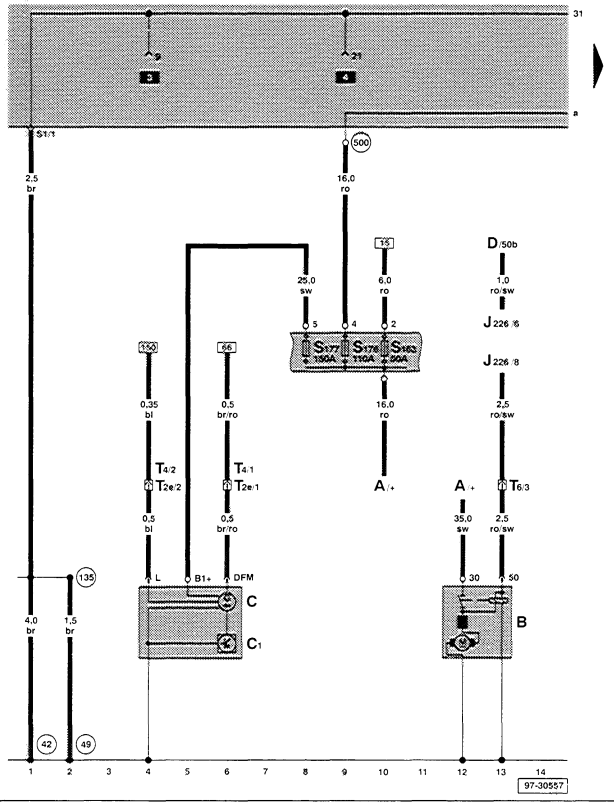
Relay location on the thirteenfold auxiliary relay panel, above relay panel:

12 J317 - Power Supply (Terminal 30, B+) Relay (109)

Relay panel:

1 J4 - Dual Horn Relay (53)

2 J59 - Load Reduction Relay (100)

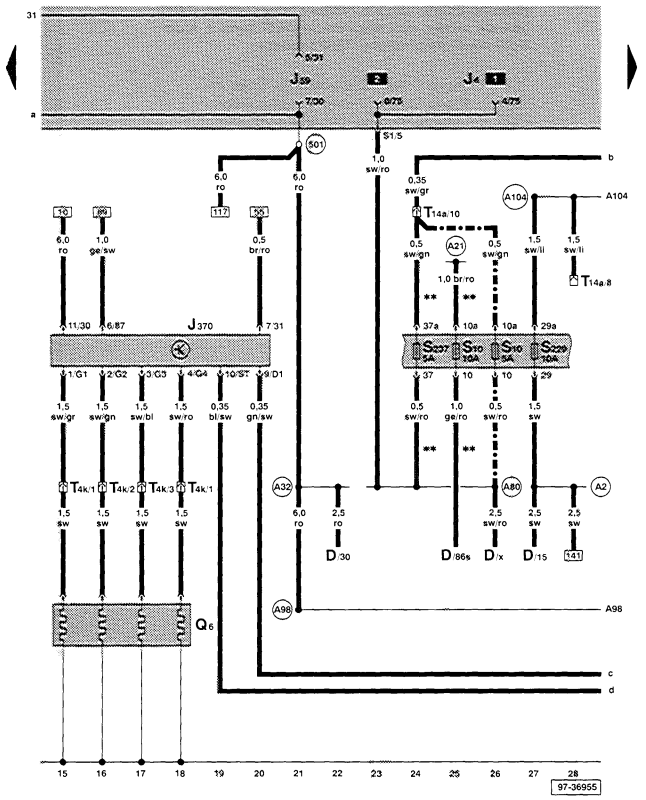


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Generator (GEN), starter

A - Battery
B - Starter
C - Generator (GEN)
C1 - Voltage Regulator (VR)
D - Ignition/Starter Switch
J226 - Park/Neutral Position (PNP) Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
T2e - Double Connector, near starter (vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left

(42) - Ground connection, beside steering column
(49) - Ground connection, on steering column
(135) - Ground connection -2-, in instrument panel wiring harness
(500) - Threaded connection -1- (30) on the relay plate



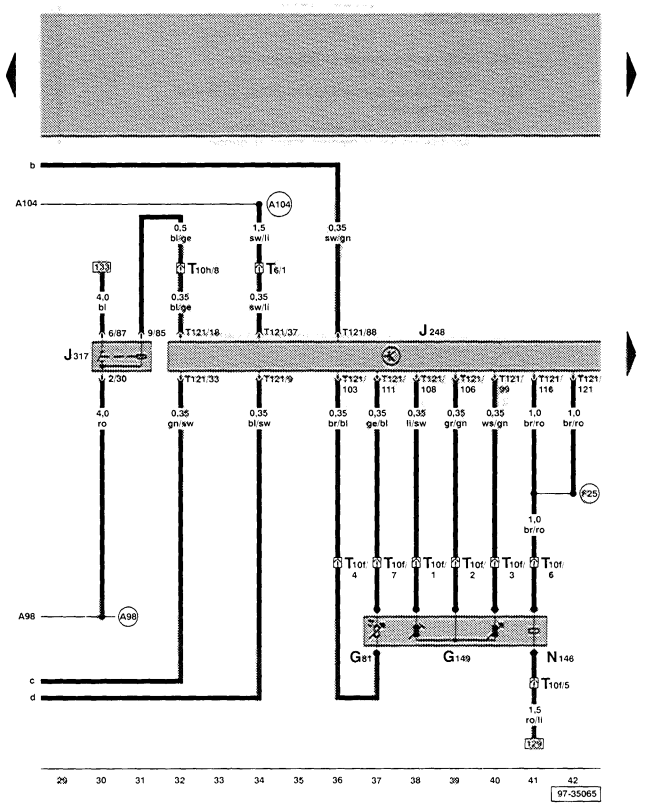
ws = white
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or = orange

Control module for glow plug triggering, glow plugs (engine)

- D - Ignition/Starter Switch
- J4 - Dual Horn Relay
- J59 - Load Reduction Relay
- J370 - Control module for glow plug triggering, in plenum chamber, center
- Q6 - Glow plugs (engine)
- S10 - Fuse 10 in fuse holder
- S229 - Fuse 29 in fuse holder
- S237 - Fuse 37 in fuse holder
- T4k - 4-Pin Connector, in engine compartment, in wiring duct, left
- T14a - 14-Pin Connector, near battery

- (501) - Threaded connection -2- (30) on the relay plate
- (A2) - Plus connection (15), in instrument panel wiring harness
- (A21) - Wire connection (86s), in instrument panel wiring harness
- (A32) - Plus connection (30), in instrument panel wiring harness
- (A80) - Connection -1- (X) in instrument panel wiring harness
- (A98) - Plus connection -4- (30), in instrument panel wiring harness
- (A104) - Plus connection -2- (15), in instrument panel wiring harness

** - Beginning November 2001
-•-•- Through October 2001

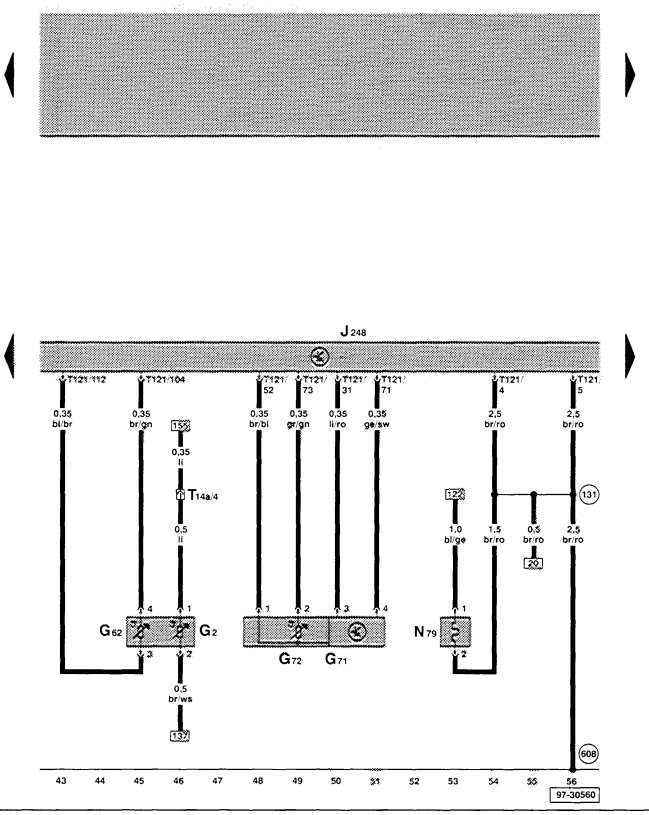


ws = white
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li = lilac
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Diesel direct fuel injection (DFI) engine control module (ECM), power supply (terminal 30, B+) relay, fuel temperature sensor, quantity adjuster, modulating piston displacement sensor

- G81 - Fuel Temperature Sensor
- G149 - Modulating Piston Displacement Sensor
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- J317 - Power Supply (Terminal 30, B+) Relay, on the thirteenfold auxiliary relay panel, above relay panel
- N146 - Quantity Adjuster
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T10f - 10-Pin Connector, in engine compartment, front
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector

- (A98) - Plus connection -4- (30), in instrument panel wiring harness
- (A104) - Plus connection -2- (15), in instrument panel wiring harness
- (F25) - Wire connection -1-, in Diesel Direct Fuel Injection (DFI) system wiring harness

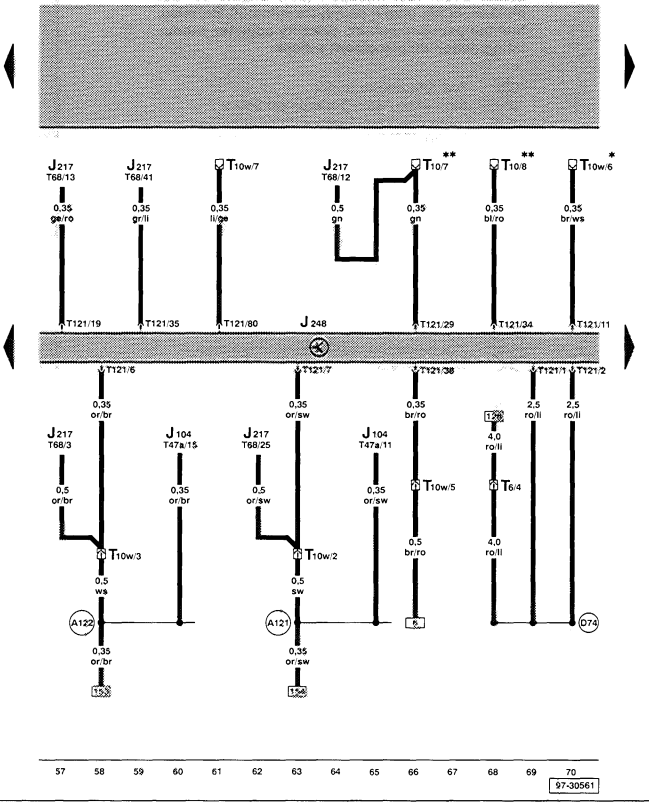


Diesel direct fuel injection (DFI) engine control module (ECM), engine coolant temperature (ECT) sensor, intake air temperature (IAT) sensor, manifold absolute pressure (MAP) sensor

- G2 - Engine Coolant Temperature (ECT) Sensor
- G62 - Engine Coolant Temperature (ECT) Sensor
- G71 - Manifold Absolute Pressure (MAP) Sensor
- G72 - Intake Air Temperature (IAT) Sensor
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- N79 - Positive Crankcase Ventilation (PCV) Heating Element
- T14a - 14-Pin Connector, near battery
- T121 - 121-Pin Connector

- (131) - Ground connection -2-, in engine compartment wiring harness
- (608) - Ground connection (in center plenum chamber)

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Diesel direct fuel injection (DFI) engine control module (ECM)

- J104 - ABS Control Module (w/EDL), in engine compartment, left
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T47a - 47-Pin Connector, on ABS Control Module
- T68 - 68-Pin Connector
- T121 - 121-Pin Connector

- (A121) - Connection (high bus), in instrument panel wiring harness
- (A122) - Connection (low bus), in instrument panel wiring harness
- (D74) - Wire connection (86), in engine compartment wiring harness

- * - Coolant Fan Control (FC) Control Module connection
- ** - A/C connection

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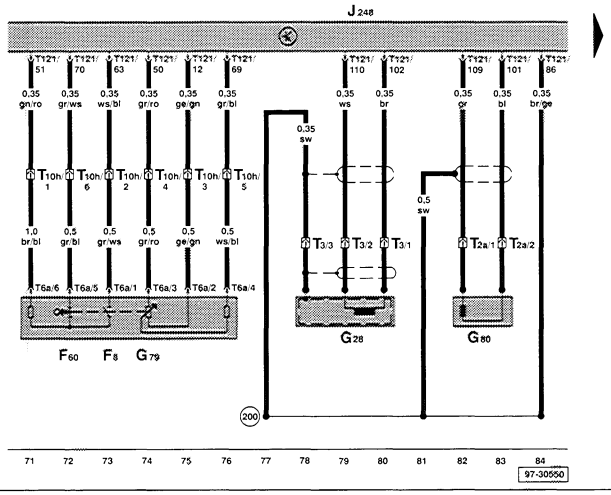
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Diesel direct fuel injection (DFI) engine control module (ECM), kick down switch, (CTP) switch, engine speed (RPM) sensor, throttle position (TP) sensor, needle lift sensor

- F8 - Kick Down Switch
- F60 - Closed Throttle Position (CTP) Switch
- G28 - Engine Speed (RPM) Sensor
- G79 - Throttle Position (TP) Sensor
- G80 - Needle Lift Sensor
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- T2a - Double Connector, in engine compartment, front
- T3 - 3-Pin Connector, in engine compartment, front
- T6a - 6-Pin Connector
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector

(200) - Ground connection (shielding), in engine compartment wiring harness

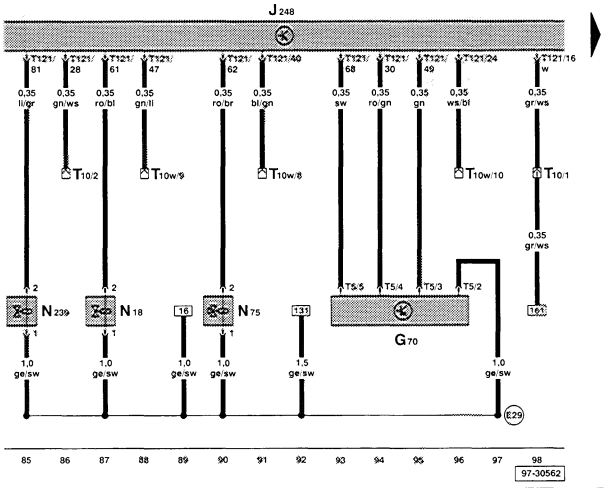


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ge = yellow
or = orange

(DFI) engine control module (ECM), mass air flow sensor, change-over valve for intake manifold flap, wastegate bypass regulator valve, EGR vacuum regulator solenoid valve

- G70 - Mass Air Flow (MAF) Sensor
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- N18 - EGR Vacuum Regulator Solenoid Valve
- N75 - Wastegate Bypass Regulator Valve
- N239 - Change-over valve for intake manifold flap
- T5 - 5-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector

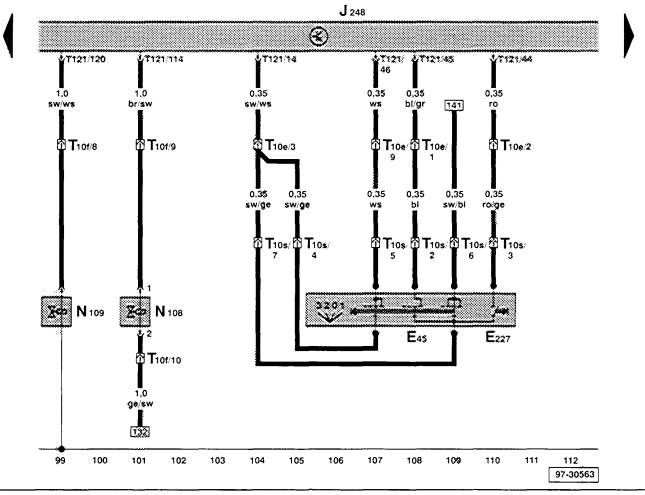
(E29) - Connection, in wiring harness engine



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Diesel direct fuel injection (DFI) engine control module (ECM), cruise control switch, fuel cut-off valve

- E45 - Cruise Control Switch
- E227 - Cruise Control Push Button (SET)
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- N108 - Cold Start Injector
- N109 - Fuel Cut-off Valve
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T10f - 10-Pin Connector, in engine compartment, front
- T10s - 10-Pin Connector, near steering column
- T121 - 121-Pin Connector



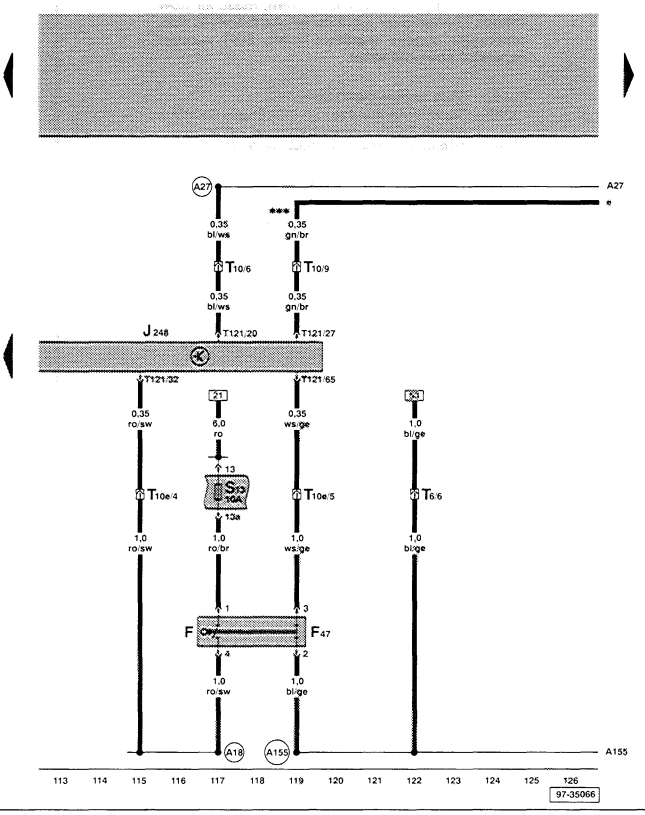
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03

Diesel direct fuel injection (DFI) engine control module (ECM), brake light switch, brake vacuum vent valve switch for cruise control/diesel

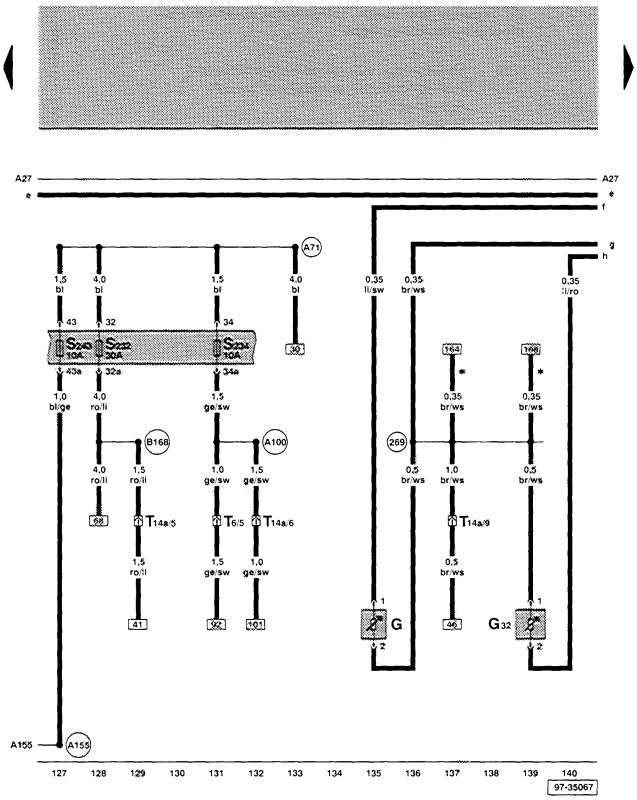
- F - Brake Light Switch
- F47 - Brake Vacuum Vent Valve Switch for cruise control/diesel
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- S13 - Fuse 13 in fuse holder
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector
- (A18) - Wire connection (54), in instrument panel wiring harness
- (A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness
- (A155) - Connection -2- (86), in instrument panel wiring harness

*** - Through April 2002



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03



Fuel level sensor, engine coolant level (ECL) sensor

- G - Fuel Level Sensor
- G32 - Engine Coolant Level (ECL) Sensor
- S232 - Fuse 32 in fuse holder
- S234 - Fuse 34 in fuse holder
- S243 - Fuse 43 in fuse holder
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery

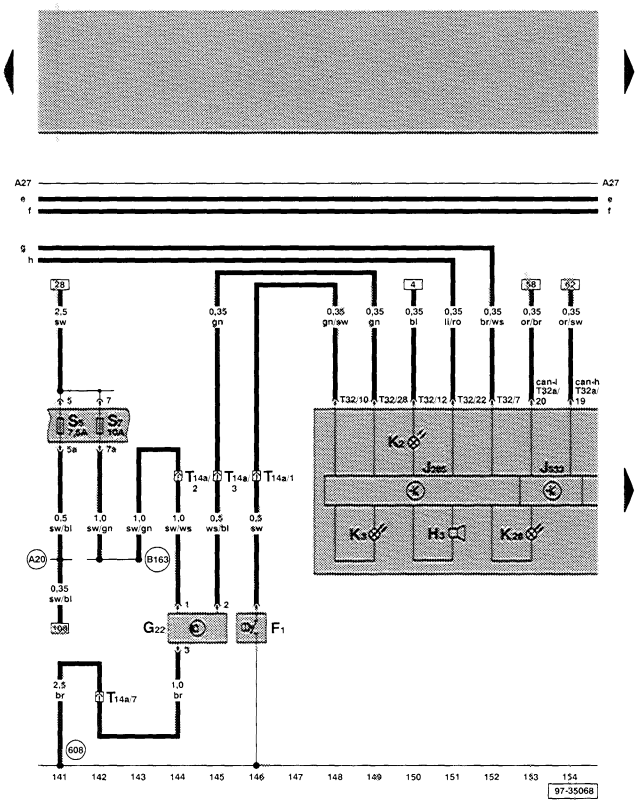
- (269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
- (A71) - Connection (86), in instrument panel wiring harness
- (A100) - Connection -2- (87), in instrument panel wiring harness
- (A155) - Connection -2- (86), in instrument panel wiring harness
- (B168) - Connection (86) in passenger compartment wiring harness

* - Vehicles with Multi-Function Indicator (MFI) only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03

Repair Manual page number 97-697



Instrument cluster, oil pressure switch, speedometer vehicle speed sensor, generator (GEN) warning light, engine coolant level/temperature (ECL/ECT) warning light

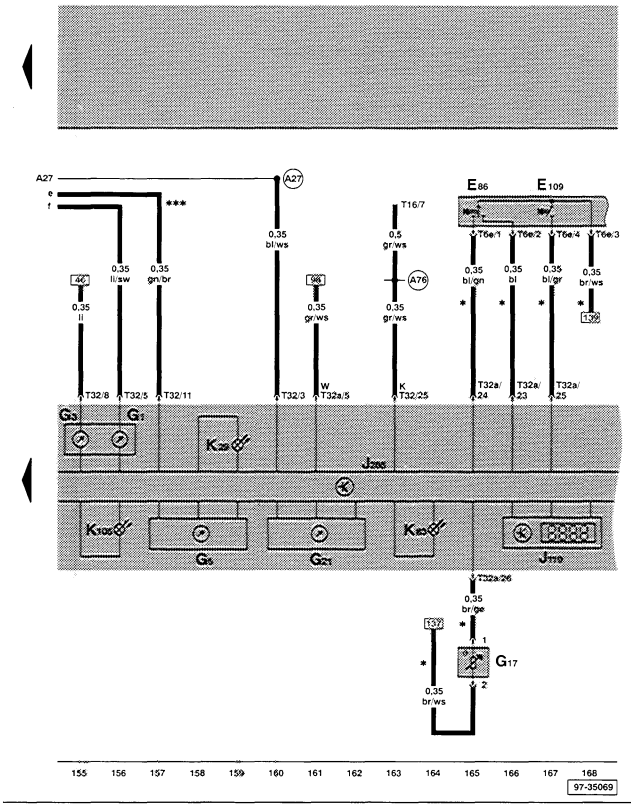
- F1 - Oil Pressure Switch
- G22 - Speedometer Vehicle Speed Sensor (VSS)
- H3 - Warning Buzzer
- J285 - Control module with indicator unit in instrument panel insert
- J533 - Data Bus On Board Diagnostic Interface
- K2 - Generator (GEN) Warning Light
- K3 - Oil Pressure Warning Light
- K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
- S5 - Fuse 5 in fuse holder
- S7 - Fuse 7 in fuse holder
- T14a - 14-Pin Connector, near battery
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green

- (608) - Ground connection (in center plenum chamber)
- (A20) - Wire connection (15a), in instrument panel wiring harness
- (B163) - Plus connection -1- (15) in wiring harness interior

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03

Repair Manual page number 97-696



Instrument cluster, engine coolant temperature (ECT) gauge, fuel gauge, tachometer, speedometer, glow plug indicator light

- E86 - Multi-Function Indicator Mode Select Switch*
- E109 - Multi-Function Indicator Memory Switch*
- G1 - Fuel gauge
- G3 - Engine Coolant Temperature (ECT) Gauge
- G5 - Tachometer
- G17 - Outside Air Temperature Sensor*
- G21 - Speedometer
- J119 - Multi-function Indicator (MFI)
- J285 - Control module with indicator unit in instrument panel insert
- K29 - Glow Plug Indicator Light
- K83 - Malfunction Indicator Lamp (MIL)
- K105 - Low Fuel Level Warning Light
- T6e - 6-Pin Connector
- T16 - Data Link Connector (DLC), below instrument panel, left
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green

- (A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness
- (A76) - Connection (K-diagnosis wire), in instrument panel wiring harness

- * - Vehicles with Multi-Function Indicator (MFI) only
- *** - Through April 2002

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03

Repair Manual page number 97-699

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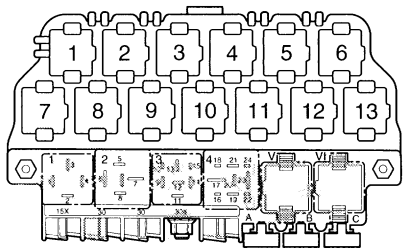
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Repair Manual page number 97-698

Washer nozzle heaters,

from May 1999

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

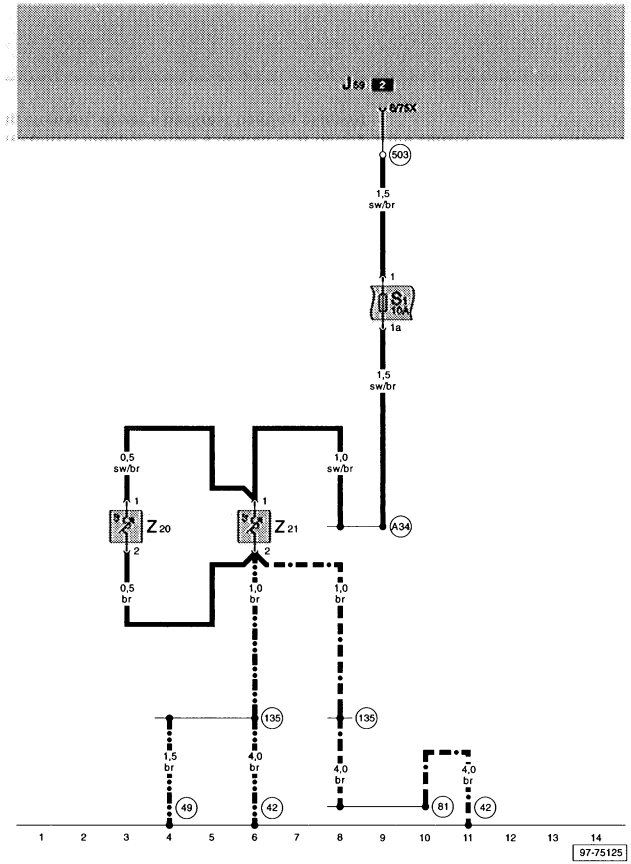
Relay panel:

2 Load Reduction Relay (18)/(100)

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

J59 - Load Reduction Relay
S1 - Fuse 1 in fuse holder
Z20 - Left Washer Nozzle Heater
Z21 - Right Washer Nozzle Heater

(42) - Ground connection, beside steering column
(49) - Ground connection, on steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(503) - Threaded connection -2- (75x) on the relay plate

(A34) - Wire connection (75x), in instrument panel wiring harness

---- - Beginning May 2000
---- - Through April 2000

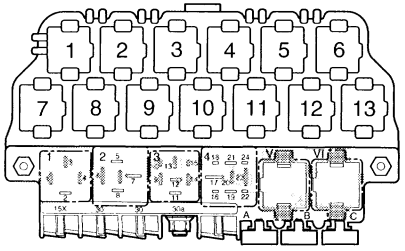
Repair Manual page number **97-700**

Repair Manual page number **97-701**

Heated seats,

from May 1999

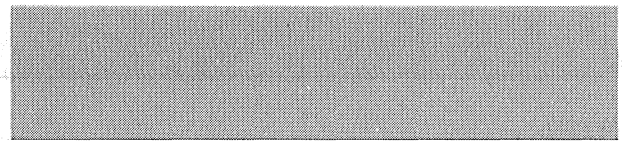
Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".

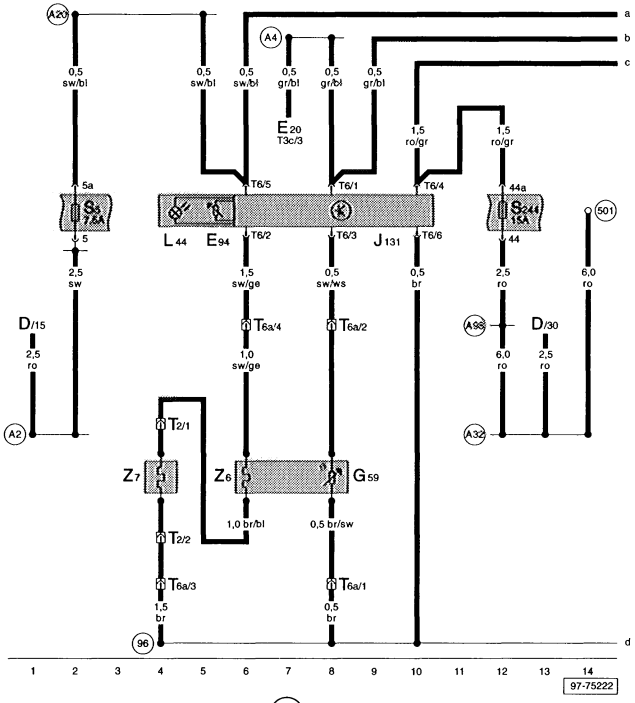


97-14163

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



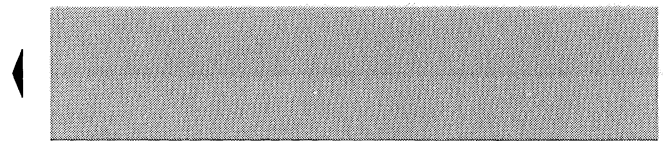


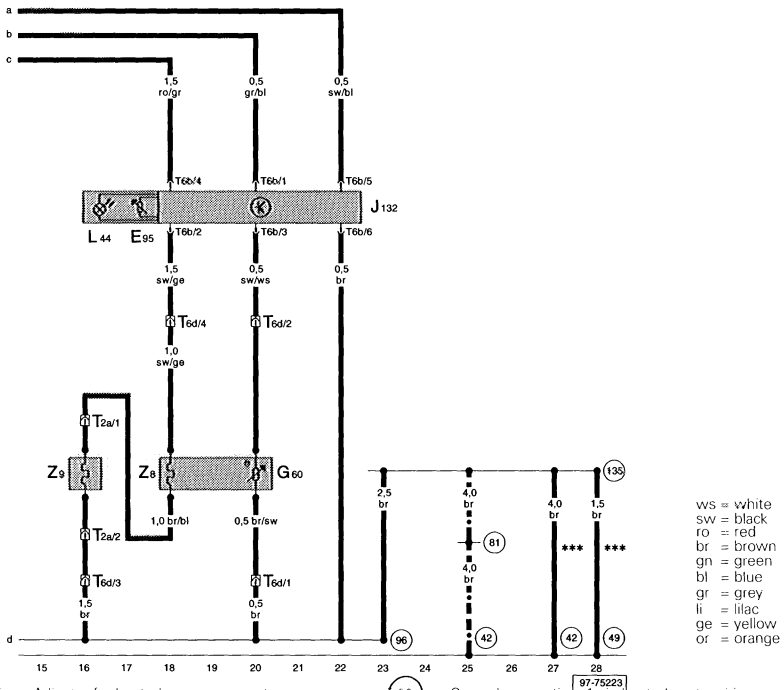
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

D - Ignition/Starter Switch
E20 - Instrument Panel Light Dimmer Switch
E94 - Adjuster for heated driver's seat
G59 - Driver's Heated Seat Temperature Sensor
J131 - Driver's Heated Seat Control Module
L44 - Heated Seat Switch Illumination Light
S5 - Fuse 5 in fuse holder
S244 - Fuse 44 in fuse holder
T2 - Double Connector, below driver's seat
T3c - 3-Pin Connector
T6 - 6-Pin Connector
T6a - 6-Pin Connector, green, below driver's seat
Z6 - Driver's Seat Heating Element
Z7 - Driver's Backrest Heating Element

(96) - Ground connection -1-, in heated seats wiring harness
(501) - Threaded connection -2- (30) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A4) - Plus connection (58b), in instrument panel wiring harness
(A20) - Wire connection (15a), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connector -4- (30), in instrument panel wiring harness

Driver's heated seat control module, driver's heated seat temperature sensor, driver's seat heating element, driver's backrest heating element





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E95 - Adjuster for heated passenger seat
G60 - Passenger's Heated Seat Temperature Sensor
J132 - Passenger's Heated Seat Control Module
L44 - Heated Seat Switch Illumination Light
T2a - Double Connector, below passenger's seat
T6b - 6-Pin Connector
T6d - 6-Pin Connector, green, below passenger's seat
Z8 - Passenger's Seat Heating Element
Z9 - Passenger's Backrest Heating Element

(42) - Ground connection, beside steering column
(49) - Ground connection, on steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(96) - Ground connection -1-, in heated seats wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness

*** - Beginning May 2000
-•--- - Through April 2000

Edition 09/01
USA.5102.11.21

Passenger's heated seat control module, passenger's heated seat temperature sensor, passenger's seat heating element, passenger's backrest heating element

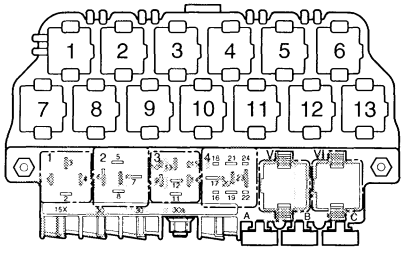
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Heated leather seats,

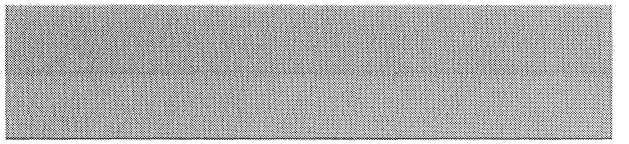
from May 1999

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".

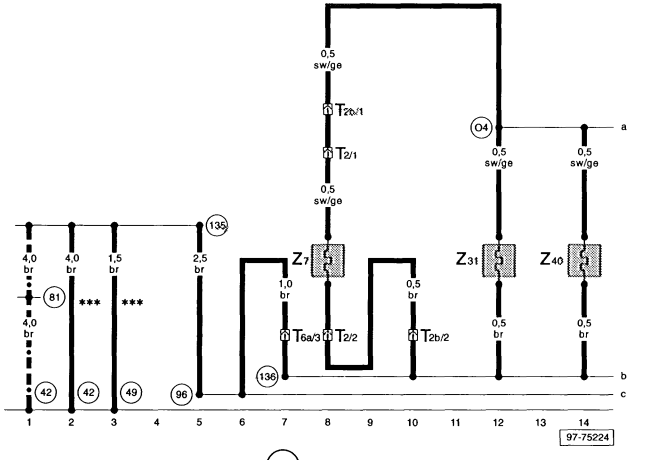


Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



T2 - Double Connector, below driver's seat
T2b - Double Connector, below driver's seat
T6a - 6-Pin Connector, green, below driver's seat
Z7 - Driver's Seat Backrest Heater
Z31 - Driver's Seat Side Bolster Heater
Z40 - Driver's Seat Side Bolster Heater 2

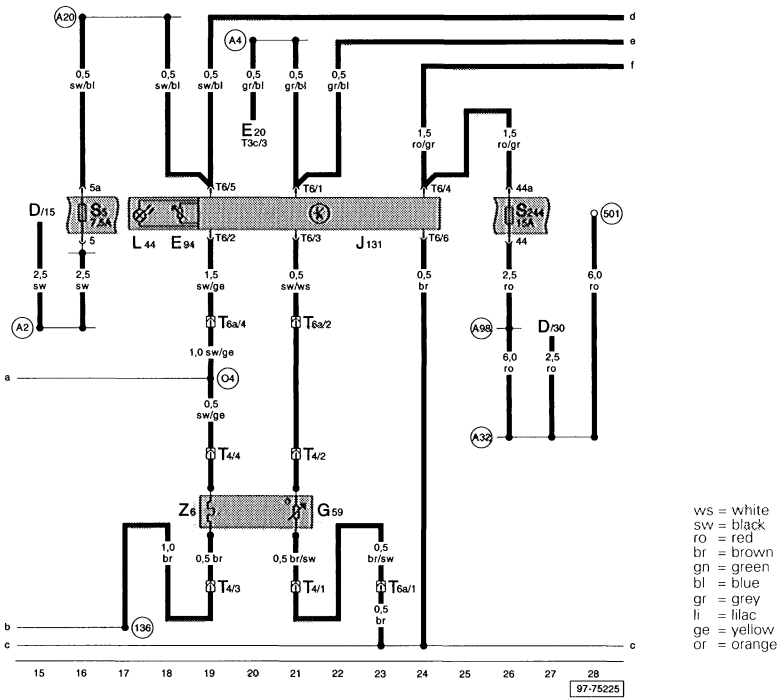
(42) - Ground connection, beside steering column
(49) - Ground connection, on steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(96) - Ground connection -1-, in heated seats wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(136) - Ground connection -2-, in heated seats wiring harness
(O4) - Plus connection (30a), in heated seats wiring harness

*** - Beginning May 2000
-•--- - Through April 2000

Driver's seat backrest and side bolster heaters

Repair Manual page number 97-706

Repair Manual page number 97-707

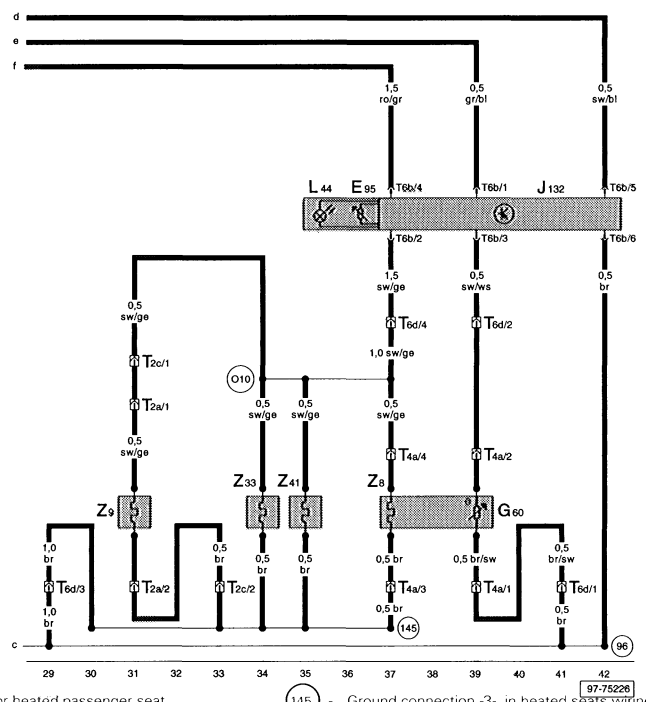


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

- D - Ignition/Starter Switch
- E20 - Instrument Panel Light Dimmer Switch
- E94 - Adjuster for heated driver's seat
- G59 - Driver's Heated Seat Temperature Sensor
- J131 - Driver's Heated Seat Control Module
- L44 - Heated Seat Switch Illumination Light
- S5 - Fuse 5 in fuse holder
- S244 - Fuse 44 in fuse holder
- T3c - 3-Pin Connector
- T4 - 4-Pin Connector, below driver's seat
- T6 - 6-Pin Connector
- T6a - 6-Pin Connector, green, below driver's seat
- Z6 - Driver's Seat Heater

- (501) - Threaded connection -2- (30) on the relay plate
- (A2) - Plus connection (15), in instrument panel wiring harness
- (A4) - Plus connection (58b), in instrument panel wiring harness
- (A20) - Wire connection (15a), in instrument panel wiring harness
- (A32) - Plus connection (30), in instrument panel wiring harness
- (A98) - Plus connector -4- (30), in instrument panel wiring harness
- (O4) - Plus connection (30a), in heated seats wiring harness
- (136) - Ground connection -2-, in heated seats wiring harness

Driver's heated seat control module, driver's heated seat temperature sensor, driver's seat heater



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

- E95 - Adjuster for heated passenger seat
- G60 - Passenger's Heated Seat Temperature Sensor
- J132 - Passenger's Heated Seat Control Module
- L44 - Heated Seat Switch Illumination Light
- T2a - Double Connector, below passenger's seat
- T2c - Double Connector, below passenger's seat
- T4a - 4-Pin Connector, below passenger's seat
- T6b - 6-Pin Connector
- T6d - 6-Pin Connector, green, below passenger's seat
- Z8 - Passenger's Seat Heater
- Z9 - Passenger's Seat Backrest Heater
- Z33 - Passenger's Seat Side Bolster Heater
- Z41 - Passengers Seat Side Bolster Heater 2

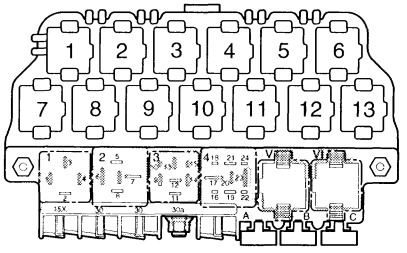
- (96) - Ground connection -1-, in heated seats wiring harness
- (145) - Ground connection -3-, in heated seats wiring harness
- (O10) - Plus connector -2- (30a), in wiring harness heated seat

Passenger's heated seat control module, passenger's heated seat temperature sensor, passenger's seat heater, backrest and side bolster heaters

Interior rear view mirror (self-dimming), rain-sensor,

from May 1999

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

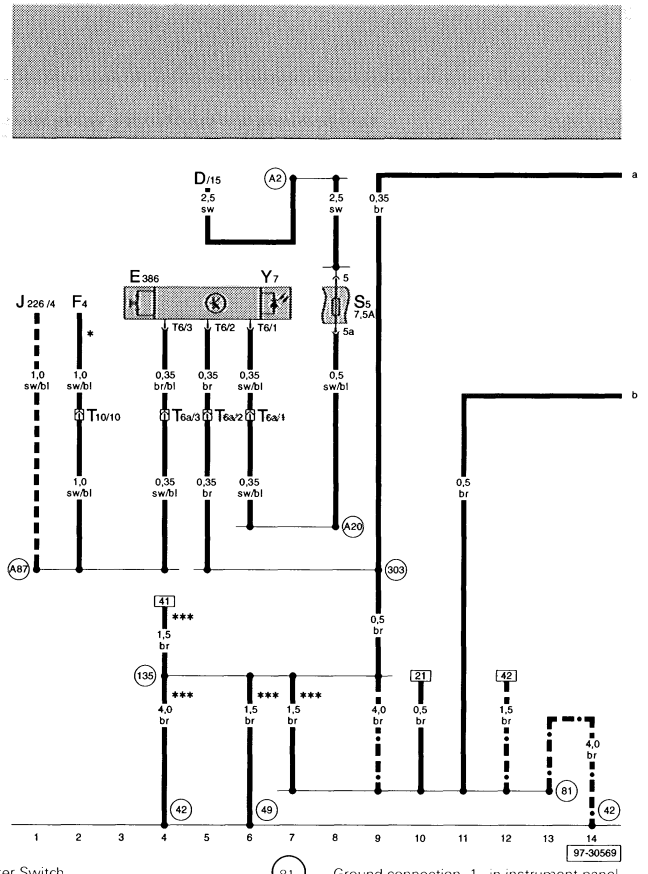
V Wiper/Washer Intermittent Relay (192)

VI

Note: Number in parentheses indicates production control number stamped on relay housing.

Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



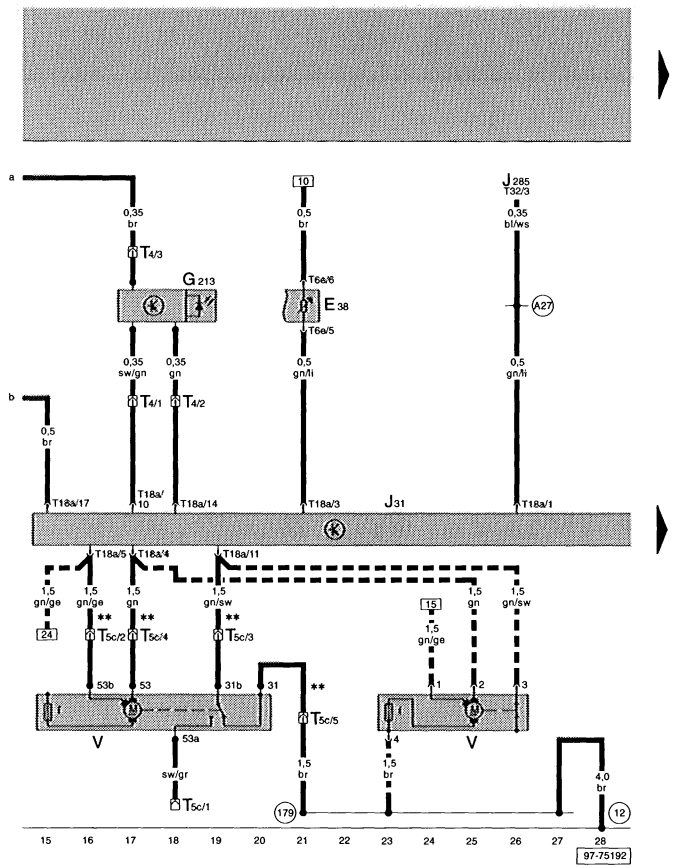
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

D - Ignition/Starter Switch
E386 - Automatic Day/Night Interior Mirror Switch (beginning May 2001)
F4 - Back-Up Light Switch
J226 - Park/Neutral Position (PNP) Relay
S5 - Fuse 5 in fuse holder
T6 - 6-Pin Connector
T6a - 6-Pin Connector, near front interior light
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
Y7 - Automatic day/night interior mirror

(42) - Ground connection, beside steering column
(49) - Ground connection, on steering column
(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(303) - Ground connection -rain-sensor/mirror-, in wiring harness interior
(A2) - Plus connection (15), in instrument panel wiring harness
(A20) - Wire connection (15a), in instrument panel wiring harness
(A87) - Connector (reverse lamp), in instrument panel wiring harness
* - Manual transmission only
---- - Automatic transmission only
*** - Beginning May 2000
-•--- - Through April 2000

Repair Manual page number 97-710

Repair Manual page number 97-711



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

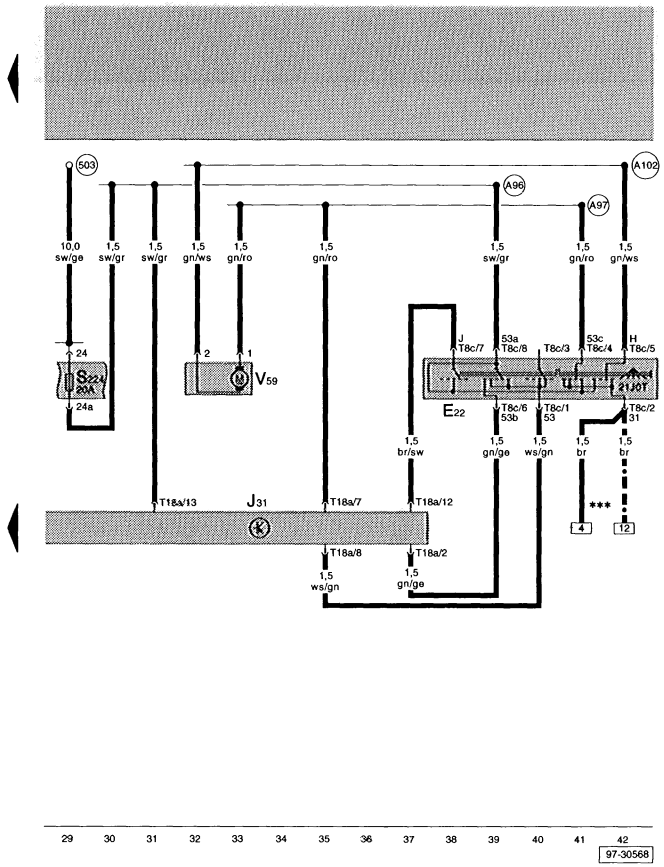
E38 - Windshield Wiper Intermittent Regulator
G213 - Rain-Sensor
J31 - Wiper/Washer Intermittent Relay, on relay panel
J285 - Control module with indicator unit in instrument panel insert
T4 - 4-Pin Connector, near front interior light
T5c - 5-Pin Connector, on windshield wiper motor
T6e - 6-Pin Connector
T18a - 18-Pin Connector
T32 - 32-Pin Connector, blue
V - Windshield Wiper Motor

(12) - Ground connection, in engine compartment, left

(179) - Ground connection, in left headlight wiring harness
(A27) - Wire Connection (vehicle speed signal), in instrument panel wiring harness

** - Through August 2000
--- - Beginning September 2000

Windshield wiper motor, windshield wiper intermittent regulator, rain-sensor



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E22 - Windshield Wiper/Washer Switch
J31 - Wiper/Washer Intermittent Relay, on relay panel
S224 - Fuse 24 in fuse holder
T8c - 8-Pin Connector
T18a - 18-Pin Connector
V59 - Windshield and Rear Window Washer Pump

(503) - Threaded connection -2- (75x) on the relay plate
(A96) - Connector (53a), in instrument panel wiring harness
(A97) - Connector (53), in instrument panel wiring harness
(A102) - Connector (windshield wiper), in instrument panel wiring harness

*** - Beginning May 2000
-•-- - Through April 2000

Windshield wiper/washer switch, wiper/washer intermittent relay, windshield and rear window Washer pump

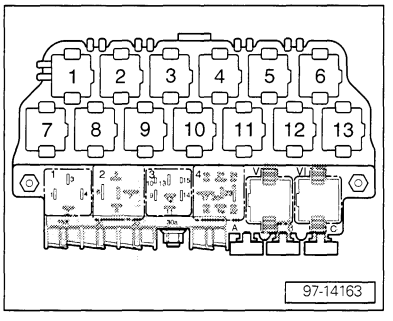
Repair Manual page number 97-715

2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/147 kW, code BDF,

from October 2001

Additional Fuse, Relay, Control Module and Connector locations ⇒ Compontent Locations

Troubleshooting Procedures ⇒ Guided Fault Finding using VAS 5051/5052

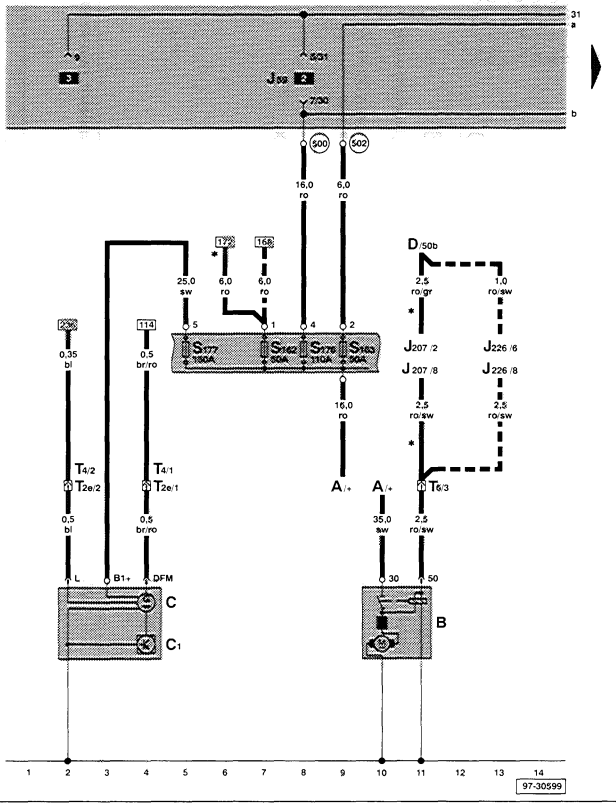


Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

2 J52 - Load Reduction Relay (100)

4 J17 - Fuel Pump (FP) Relay (409)



Generator (GEN), starter

A - Battery
B - Starter
C - Generator (GEN)
C1 - Voltage Regulator (VR)
D - Ignition/Starter Switch
J59 - Load Reduction Relay
J207 - Starting Interlock Relay
J226 - Park/Neutral Position (PNP) Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
T2e - Double Connector, near starter (vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left

(500) - Threaded connection -1- (30) on the relay plate

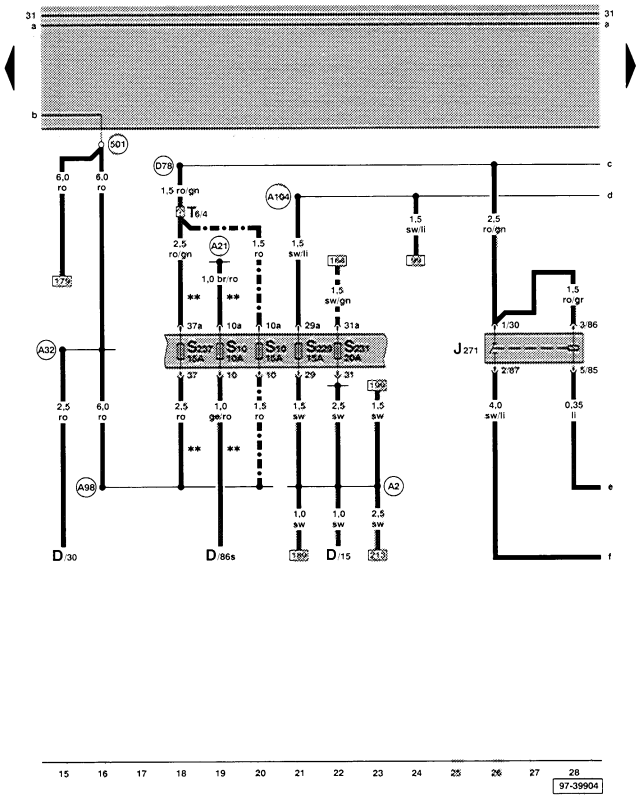
(502) - Threaded connection -1- (30a) on the relay plate

* - Manual transmission only

--- Automatic transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Repair Manual page number 97-714



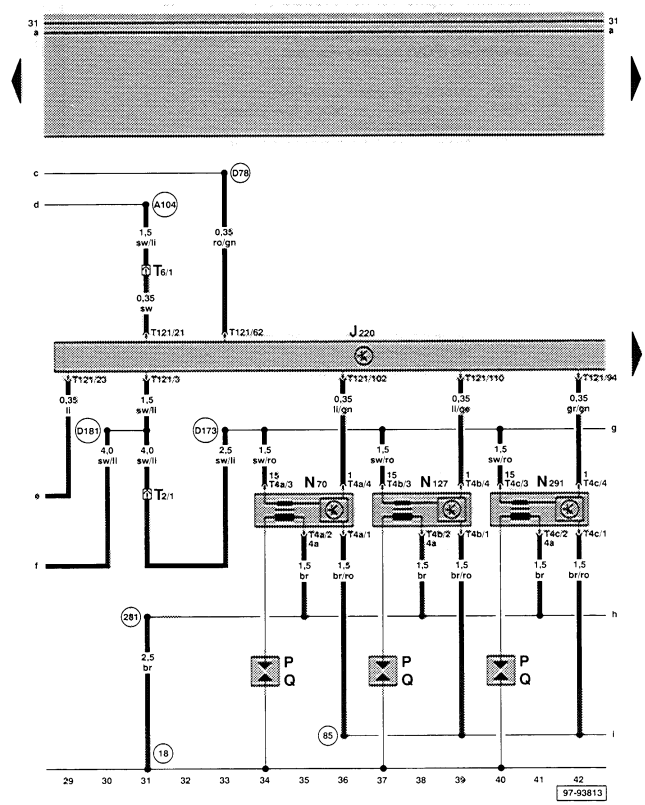
Motronic engine control module (ECM) power supply relay

D - Ignition/Starter Switch
J271 - Motronic engine control module (ECM) power supply relay, in protective housing, in engine compartment, left, production control number (428)
S10 - Fuse 10 in fuse holder
S229 - Fuse 29 in fuse holder
S231 - Fuse 31 in fuse holder
S237 - Fuse 37 in fuse holder
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left

(501) - Threaded connection -2- (30) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A21) - Wire connection (86s), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connection -4- (30), in instrument panel wiring harness
(A104) - Plus connection -2- (15), in instrument panel wiring harness
(D78) - Plus connection -1- (30a), in engine compartment wiring harness

--- Automatic transmission only
** - Beginning November 2001
-•-•- Through October 2001

ws = white
sw = ∞ black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

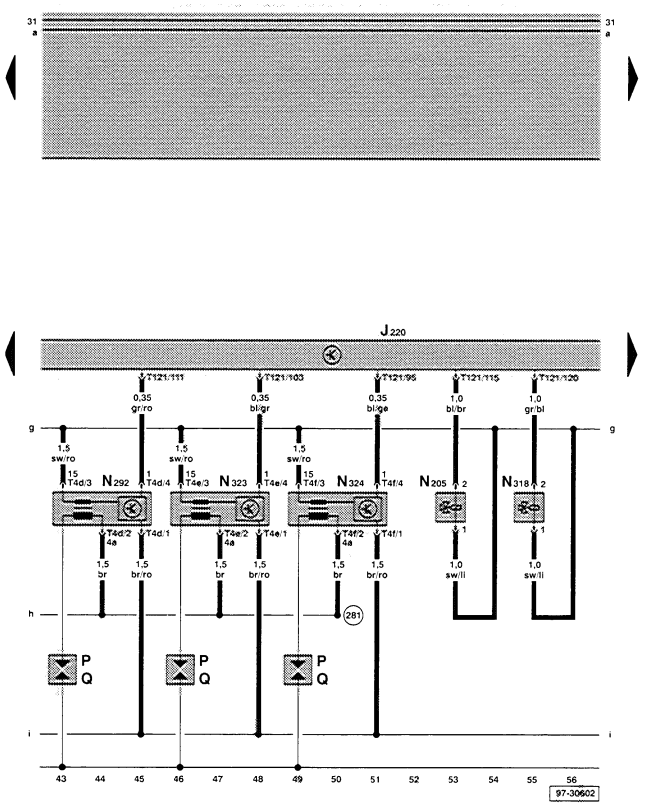


Motronic engine control module (ECM), ignition system

J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N70 - Ignition Coil 1 with Power Output Stage
N127 - Ignition Coil 2 with Power Output Stage
N291 - Ignition Coil 3 with Power Output Stage
P - Spark Plug Connectors
Q - Spark Plugs
T2 - Double Connector, in engine compartment, in wiring duct, left
T4a - 4-Pin Connector
T4b - 4-Pin Connector
T4c - 4-Pin Connector
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T121 - 121-Pin Connector

(18) - Ground connection, on engine block
(85) - Ground connection -1-, in engine compartment wiring harness
(281) - Ground connection -1-, in wiring harness engine pre-wiring
(A104) - Plus connection -2- (15), in instrument panel wiring harness
(D78) - Plus connection -1- (30a), in engine compartment wiring harness
(D173) - Connection (87)(in engine wiring harness)
(D181) - Connection 2 (87a) (in engine wiring harness)

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

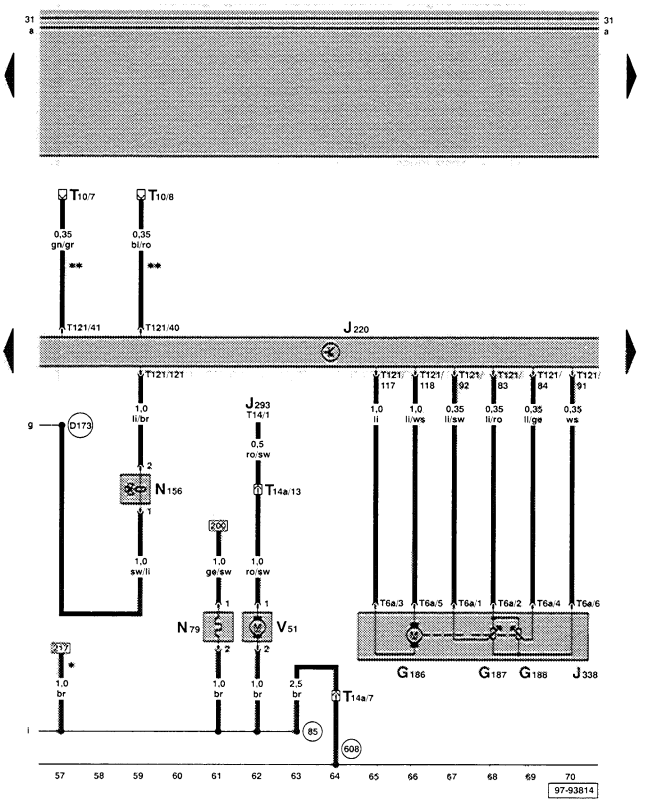


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), ignition system, camshaft adjustment valve (exhaust), valve for camshaft adjustment

- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- N205 - Valve -1- for camshaft adjustment
- N292 - Ignition Coil 4 with Power Output Stage
- N318 - Camshaft Adjustment Valve 1 (exhaust)
- N323 - Ignition Coil 5 with Power Output Stage
- N324 - Ignition Coil 6 with Power Output Stage
- P - Spark Plug Connectors
- Q - Spark Plugs
- T4d - 4-Pin Connector
- T4e - 4-Pin Connector
- T4f - 4-Pin Connector
- T121 - 121-Pin Connector

(281) - Ground connection -1-, in wiring harness engine pre-wiring



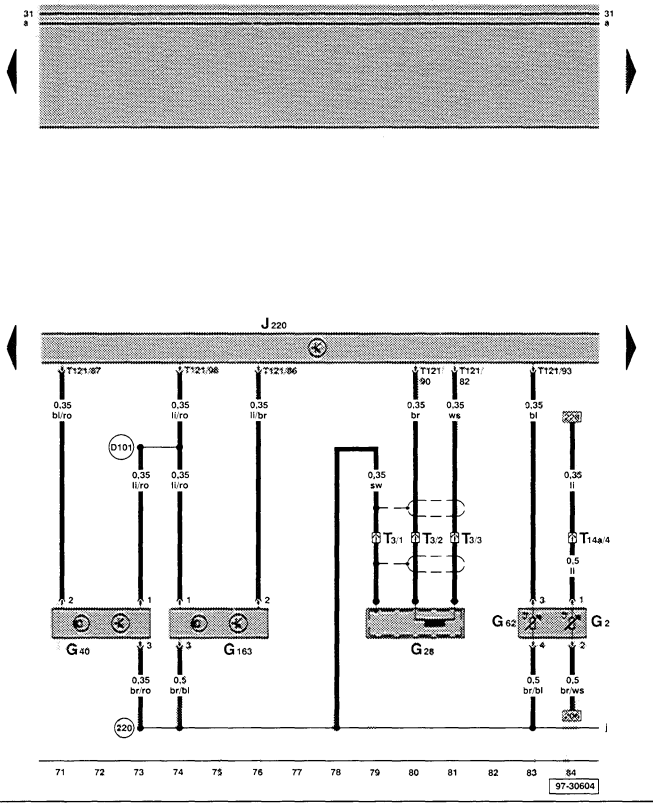
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sw = black
ro = red
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Motronic engine control module (ECM), throttle valve control module, intake manifold change-over valve, after-run coolant pump, positive crankcase ventilation (PCV) heating element

- G186 - Throttle drive (power accelerator actuation)
- G187 - Angle sensor -1- for throttle drive (power accelerator actuation)
- G188 - Angle sensor -2- for throttle drive (power accelerator actuation)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J293 - Coolant FC (Fan Control) Control Module
- J338 - Throttle Valve Control Module
- N79 - Positive Crankcase Ventilation (PCV) Heating Element
- N156 - Intake Manifold Change-Over Valve
- T6a - 6-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T14 - 14-Pin Connector
- T14a - 14-Pin Connector, near battery
- T121 - 121-Pin Connector
- V51 - After-Run Coolant Pump

(85) - Ground connection -1-, in engine compartment wiring harness
(608) - Ground connection (in center plenum chamber)
(D173) - Connection (87)(in engine wiring harness)

* - Manual transmission only
** - A/C connection

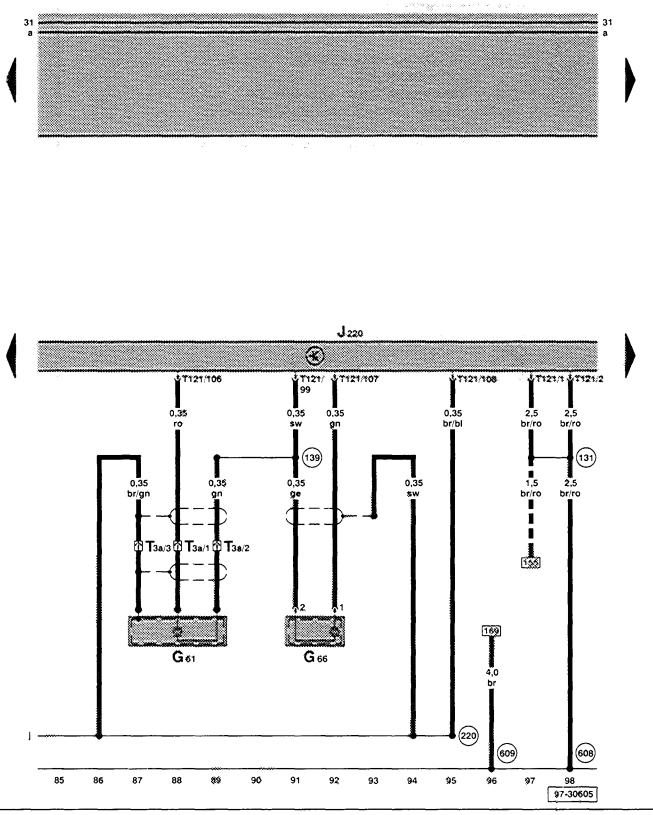


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), engine coolant temperature (ECT) sensor, engine speed (RPM) sensor, camshaft position (CMP) sensor

- G2 - Engine Coolant Temperature (ECT) Gauge Sensor
- G28 - Engine Speed (RPM) Sensor
- G40 - Camshaft Position (CMP) Sensor
- G62 - Engine Coolant Temperature (ECT) Sensor
- G163 - Camshaft Position (CMP) Sensor 2
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T3 - 3-Pin Connector, in engine compartment, front
- T14a - 14-Pin Connector, near battery
- T121 - 121-Pin Connector

- (220) - Ground connection (sensor ground), in engine compartment wiring harness
- (D101) - Wire connection -1-, in engine compartment wiring harness



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), knock sensor (KS) 1, knock sensor (KS) 2

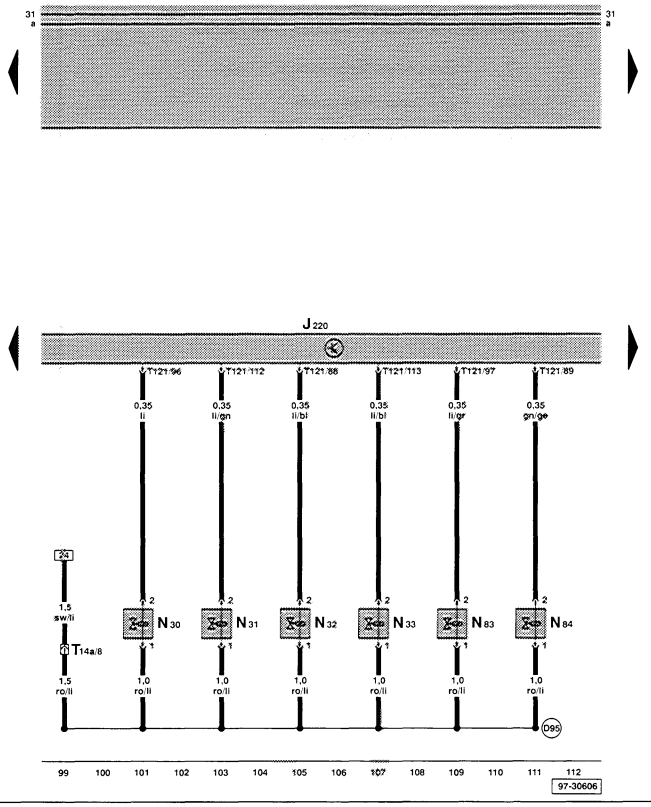
- G61 - Knock Sensor (KS) 1
- G66 - Knock Sensor (KS) 2
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T3a - 3-Pin Connector, in engine compartment, front
- T121 - 121-Pin Connector

- (131) - Ground connection -2-, in engine compartment wiring harness
- (139) - Ground connection (sensor Ground), in Motronic Multiport Fuel Injection (MFI) wiring harness
- (220) - Ground connection (sensor ground), in engine compartment wiring harness
- (608) - Ground connection (in center plenum chamber)
- (609) - Ground connection (in right plenum chamber)

--- Automatic transmission only

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Repair Manual page number 97-720

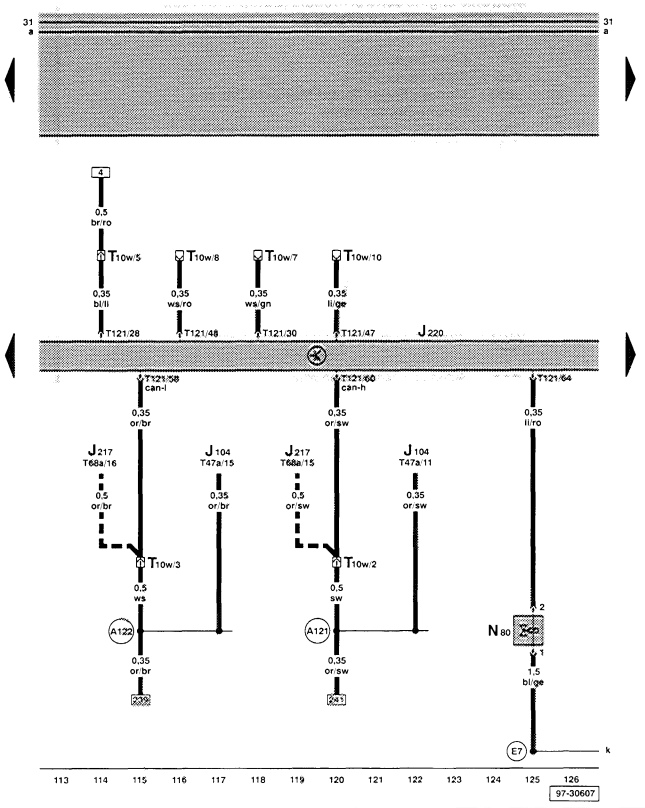


Motronic engine control module (ECM), injectors

J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N30 - Cylinder 1 Fuel Injector
N31 - Cylinder 2 Fuel Injector
N32 - Cylinder 3 Fuel Injector
N33 - Cylinder 4 Fuel Injector
N83 - Cylinder 5 Fuel Injector
N84 - Cylinder 6 Fuel Injector
T14a - 14-Pin Connector, near battery
T121 - 121-Pin Connector

(D95) - Wire connection (injectors), in engine compartment wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Motronic engine control module (ECM), evaporative emission (EVAP) canister purge regulator valve

J104 - ABS Control Module (w/EDL), in engine compartment, left
J217 - Transmission Control Module (TCM)
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N80 - Evaporative Emission (EVAP) Canister Purge Regulator Valve
T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
T47a - 47-Pin Connector, on ABS Control Module
T68a - 68-Pin Connector, on Transmission Control Module (TCM)
T121 - 121-Pin Connector

(A121) - Connection (high bus), in instrument panel wiring harness
(A122) - Connection (low bus), in instrument panel wiring harness
(E7) - Plus connection (87a), in Motronic Multiport Fuel Injection (MFI) wiring harness

--- Automatic transmission only

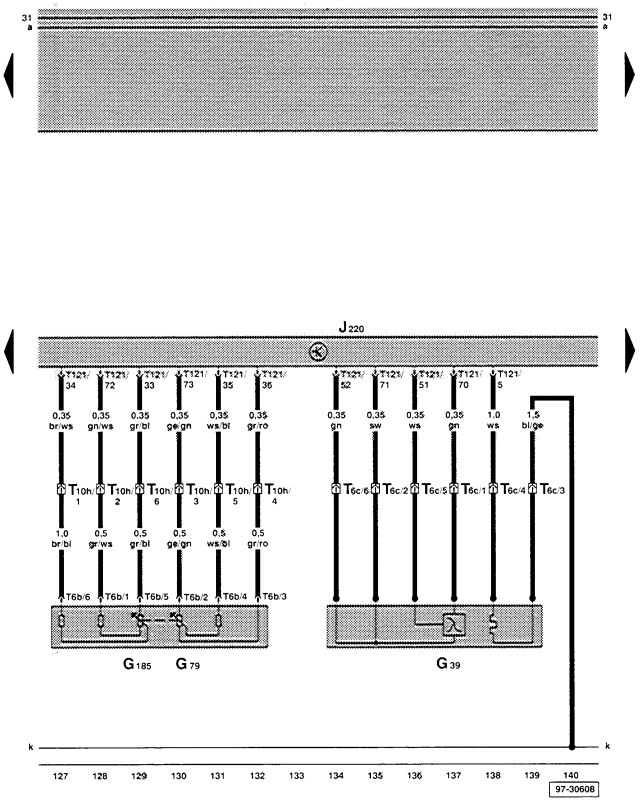
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Repair Manual page number 97-723

Repair Manual page number 97-722

Motronic engine control module (ECM), throttle position (TP) sensor, heated oxygen sensor (HO2S)

- G39 - Heated Oxygen Sensor (HO2S)
- G79 - Throttle Position (TP) Sensor
- G185 - Sender -2- for accelerator pedal position
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T6b - 6-Pin Connector
- T6c - 6-Pin Connector, in protective housing for connectors under right floor
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector



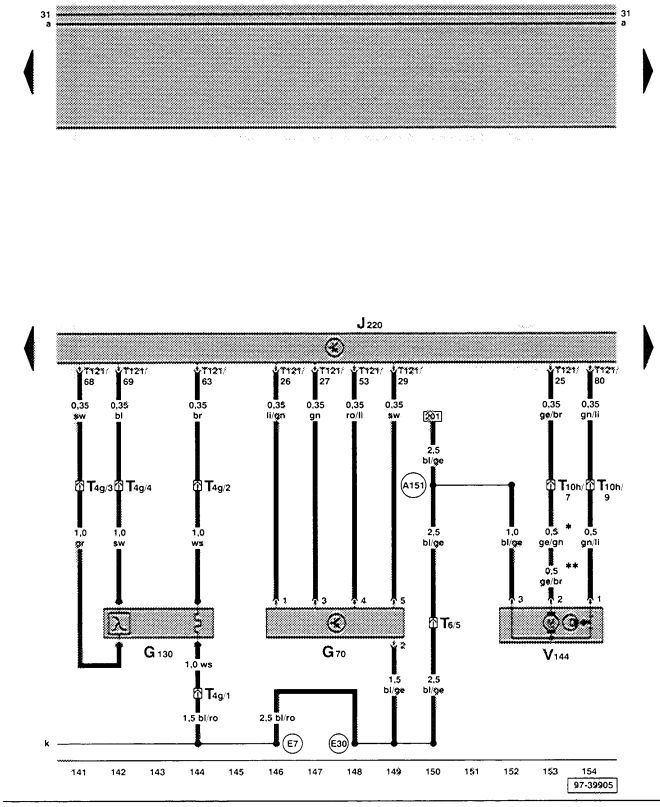
ws = white
sw = black
ro = red
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gn = green
bl = blue
gr = grey
li = lilac
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or = orange

Motronic engine control module (ECM), mass air flow (MAF) sensor, oxygen sensor (O2S) behind three way catalytic converter (TWC), leak detection pump (LDP)

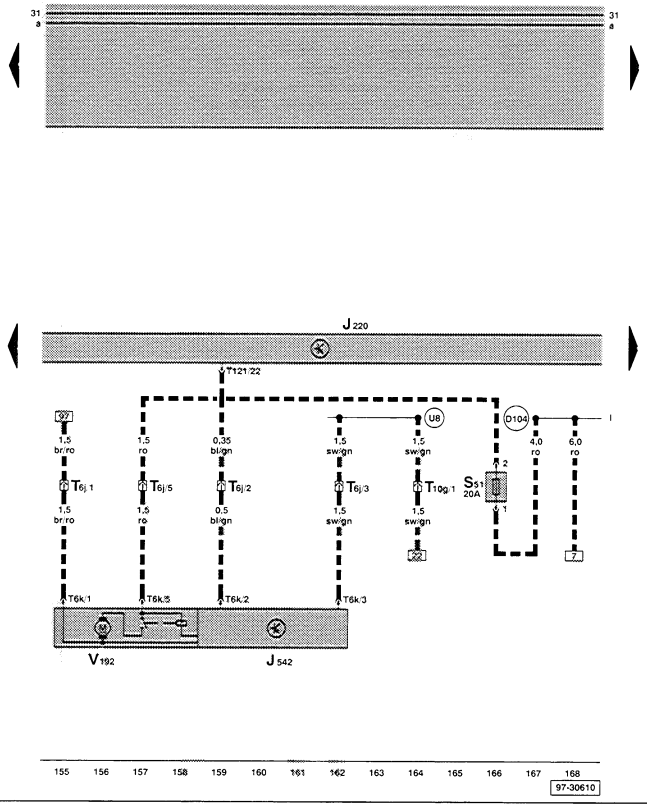
- G70 - Mass Air Flow (MAF) Sensor
- G130 - Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T4g - 4-Pin Connector, in protective housing for connectors under right floor
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector
- V144 - Leak Detection Pump (LDP)

- (A151) - Connection -4- (87), in instrument panel wiring harness
- (E7) - Plus connection (87a), in Motronic Multiport Fuel Injection (MFI) wiring harness
- (E30) - Connection (87a), in wiring harness engine

- * - Jetta only
- ** - Golf only



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



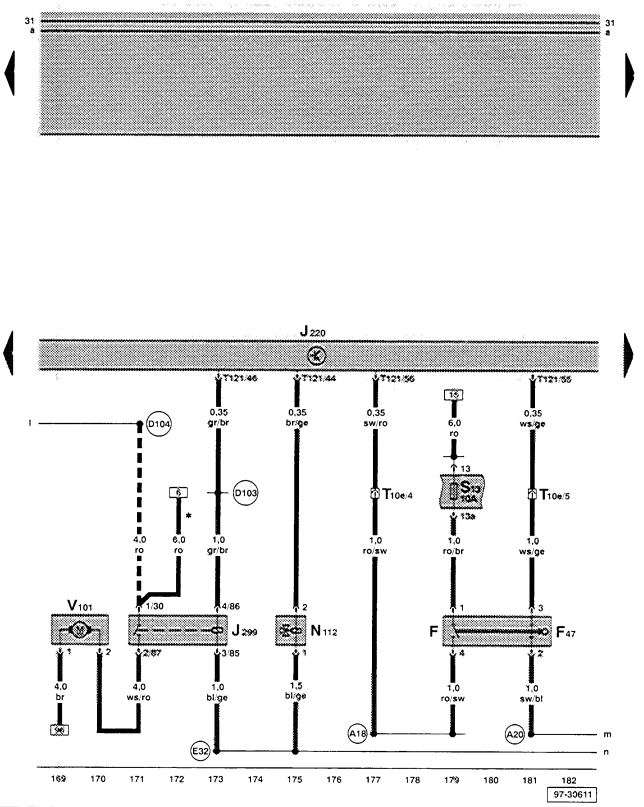
Motronic engine control module (ECM), brake booster control module, brake system vacuum pump

- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J542 - Brake Booster Control Module
- S51 - Fuse, in protective housing, in engine compartment, left
- T6j - 6-Pin Connector, in engine compartment left
- T6k - 6-Pin Connector
- T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector
- V192 - Brake System Vacuum Pump

- (D104) - Plus connection -2- (30a), in engine compartment wiring harness
- (U8) - Plus connection (15a) in automatic transmission wiring harness

--- Automatic transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Motronic engine control module (ECM), secondary air injection (AIR) pump system, brake light switch, brake pedal switch

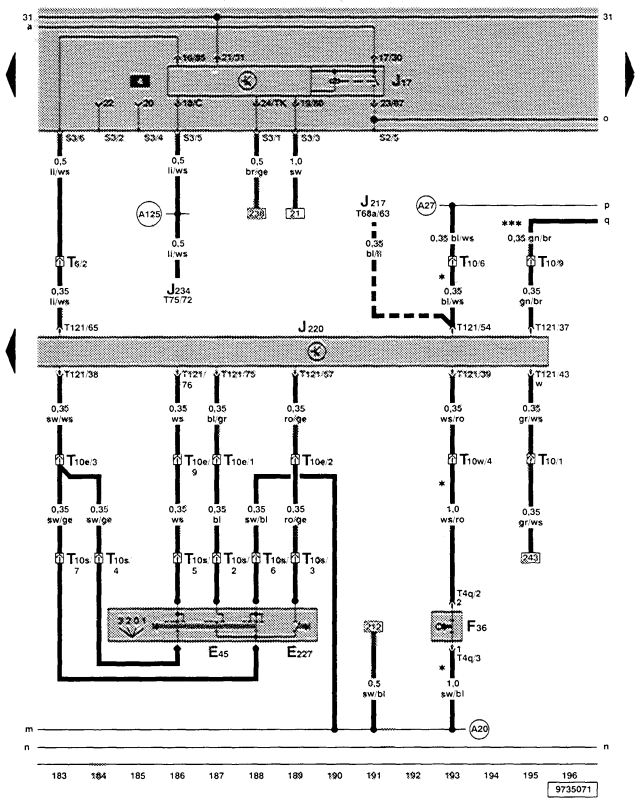
- F - Brake Light Switch
- F47 - Brake Pedal Switch
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J299 - Secondary Air Injection (AIR) Pump Relay, in protective housing, in engine compartment, left, production control number (100)
- N112 - Secondary Air Injection (AIR) Solenoid Valve
- S13 - Fuse 13 in fuse holder
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector
- V101 - Secondary Air Injection (AIR) Pump Motor

- (A18) - Wire connection (54), in instrument panel
- (A20) - Wire connection (15a), in instrument panel wiring harness
- (D103) - Wire connection -3-, in engine compartment wiring harness
- (D104) - Plus connection -2- (30a), in engine compartment wiring harness
- (E32) - Connection (87), in wiring harness Motronic

* - Manual transmission only

--- Automatic transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



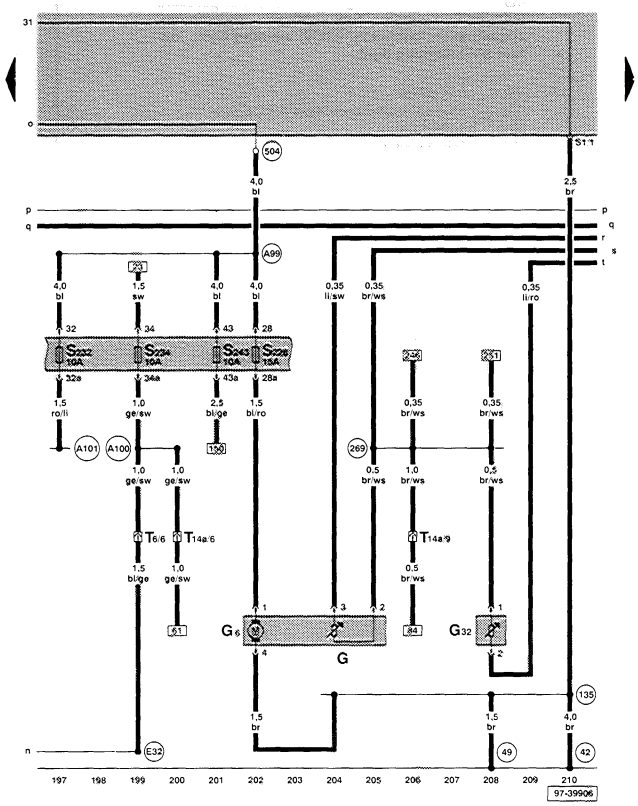
ws = white
sw = black
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gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), cruise control switch, clutch vacuum vent valve switch, fuel pump (FP) relay

- E45 - Cruise Control Switch
- E227 - Cruise Control Push Button (SET)
- F36 - Clutch Pedal Switch
- J17 - Fuel Pump (FP) Relay
- J217 - Transmission Control Module (TCM)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J234 - Airbag Control Module
- T4q - 4-Pin Connector (beginning May 2001)
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T10s - 10-Pin Connector, near steering column
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T68a - 68-Pin Connector, on Transmission Control Module (TCM)
- T75 - 75-Pin Connector
- T121 - 121-Pin Connector

- (A20) - Wire connection (15a), in instrument panel wiring harness
- (A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness
- (A125) - Connection (crash signal) in instrument panel wiring harness

- * - Manual transmission only
- --- - Automatic transmission only
- -•-•- - Vehicles with Climatronic only
- *** - Through April 2002

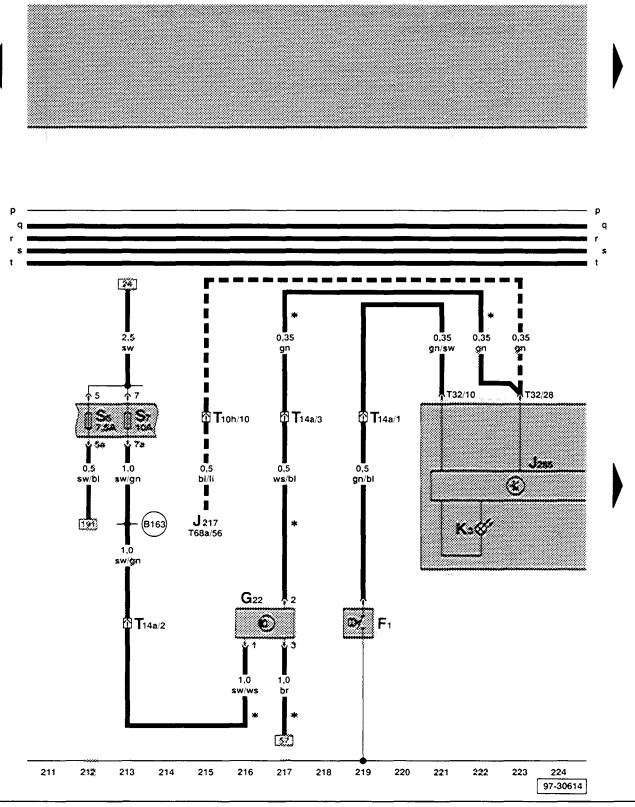


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor

- G - Fuel Level Sensor
- G6 - Fuel Pump (FP)
- G32 - Engine Coolant Level (ECL) Sensor
- S228 - Fuse 28 in fuse holder
- S232 - Fuse 32 in fuse holder
- S234 - Fuse 34 in fuse holder
- S243 - Fuse 43 in fuse holder
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery

- (42) - Ground connection, beside steering column
- (49) - Ground connection, on steering column
- (135) - Ground connection -2-, in instrument panel wiring harnes
- (269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
- (504) - Threaded connection -1- (87) on the relay plate
- (A99) - Connection -1- (87), in instrument panel wiring harness
- (A100) - Connection -2- (87), in instrument panel wiring harness
- (A101) - Connection -3- (87a), in instrument panel wiring harness
- (E32) - Connection (87), in wiring harness Motronic



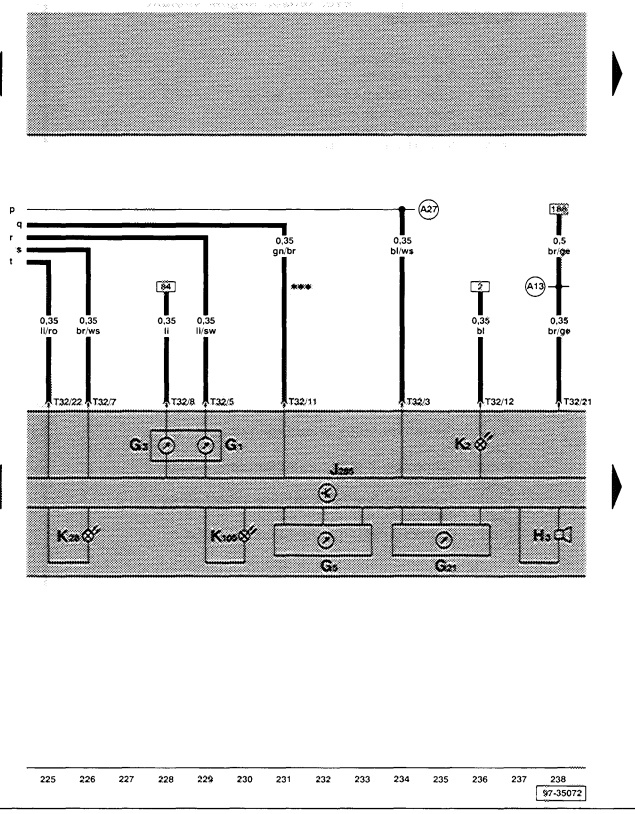
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light

F1 - Oil Pressure Switch
G22 - Speedometer Vehicle Speed Sensor (VSS)
J217 - Transmission Control Module (TCM)
J285 - Control module with indicator unit in instrument panel insert
K3 - Oil Pressure Warning Light
S5 - Fuse 5 in fuse holder
S7 - Fuse 7 in fuse holder
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, near battery
T32 - 32-Pin Connector, blue
T68a - 68-Pin Connector, on Transmission Control Module (TCM)

(B163) - Plus connection -1- (15) in wiring harness interior

* - Manual transmission only
--- Automatic transmission only



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light

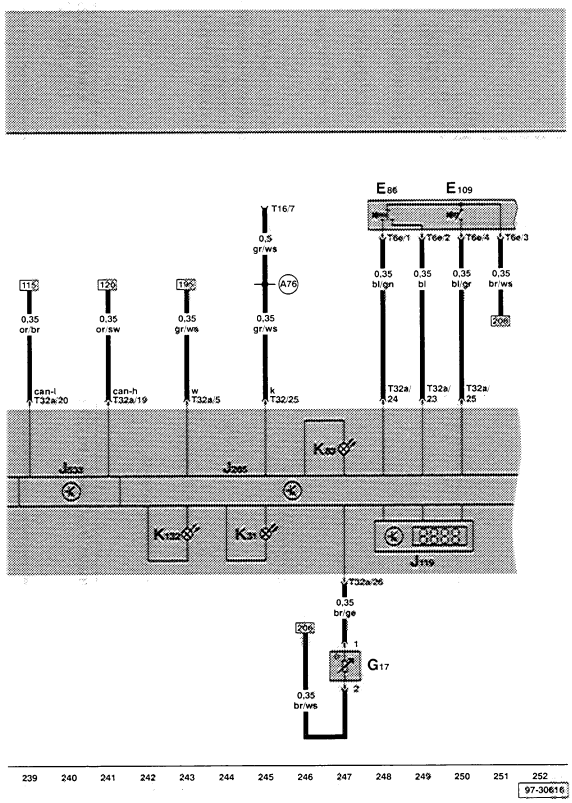
G1 - Fuel gauge
G3 - Engine Coolant Temperature (ECT) Gauge
G5 - Tachometer
G21 - Speedometer
H3 - Warning Buzzer
J285 - Control module with indicator unit in instrument panel insert
K2 - Generator (GEN) Warning Light
K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
K105 - Low Fuel Level Warning Light
T32 - 32-Pin Connector, blue

(A13) - Wire connection (door contact switch), in instrument panel wiring harness
(A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness

*** - Through April 2002

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Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp

E86 - Multi-Function Indicator Mode Select Switch
E109 - Multi-Function Indicator Memory Switch
G17 - Outside Air Temperature Sensor
J119 - Multi-function Indicator (MFI)
J285 - Control module with indicator unit in instrument panel insert
J533 - Data Bus On Board Diagnostic Interface
K31 - Cruise Control Indicator Light
K83 - Malfunction Indicator Lamp (MIL)
K132 - Electronic Power Control (EPC) Warning Lamp
T6e - 6-Pin Connector
T16 - Data Link Connector (DLC), below instrument panel, left
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green
(A76) - Connection (K-diagnosis wire), in instrument panel wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Repair Manual page number 97-733

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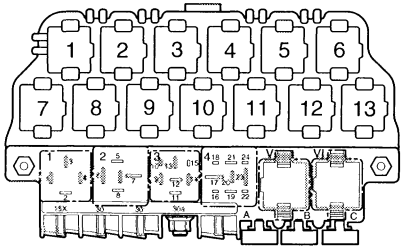
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Repair Manual page number 97-732

Radio system "Monsoon" (with CD changer wiring preparation)

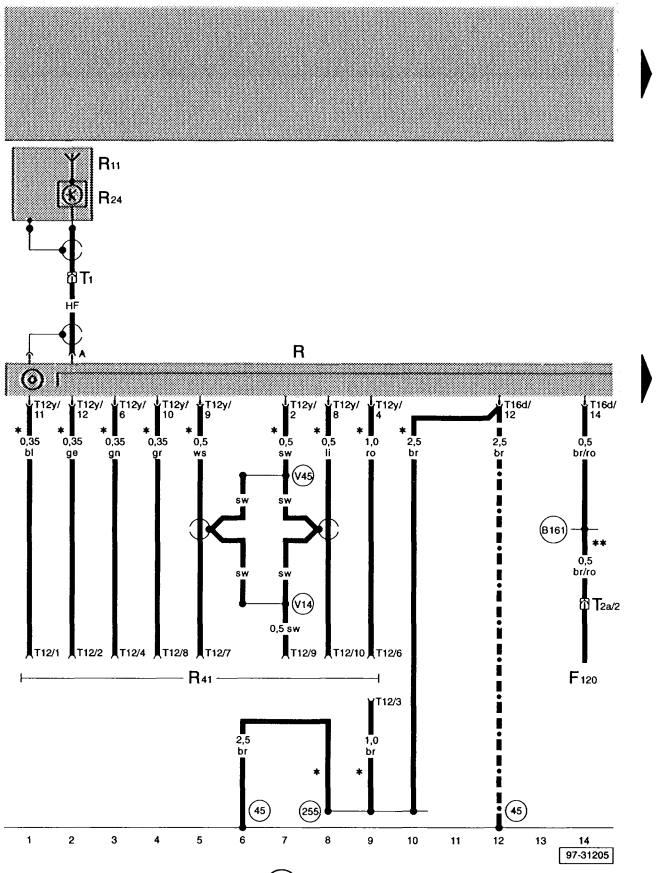
from August 2001

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

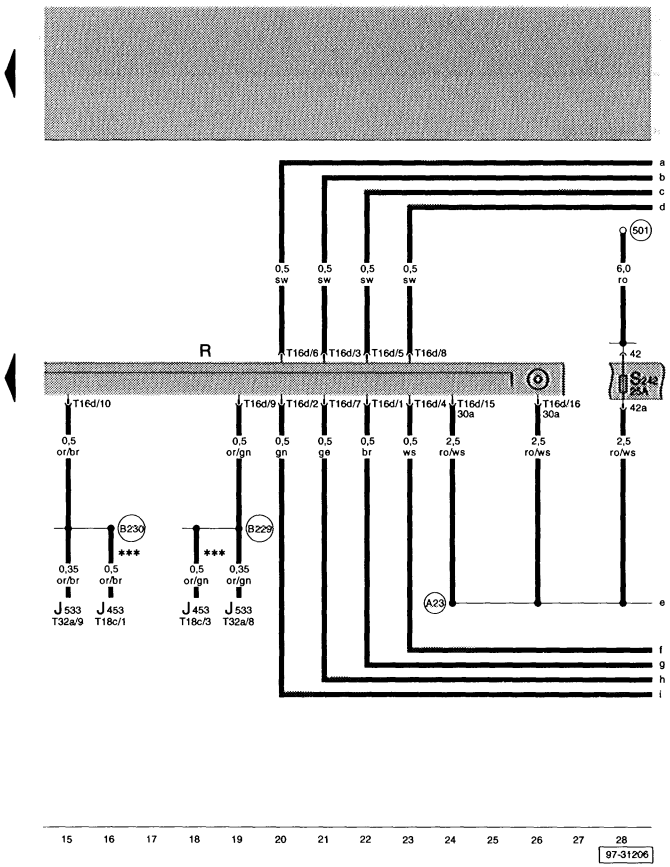
*F120 - Hood Alarm Switch***
R - Radio
R11 - Antenna
R24 - Antenna Amplifier
R41 - CD Changer Unit
T1 - Single Connector
T2a - Double Connector, near headlight, right
T12 - 12-Pin Connector
T12y - 12-Pin Connector
T16d - 16-Pin Connector

(45) - Ground connection, behind instrument panel, center
(255) - Ground connection, -1-, in wiring harness radio

*(B161) - Connector (anti-theft warning system), in wiring harness interior***
(V14) - Wire connection (shielding), in CD-changer wiring harness
(V45) - Wire connection 2 (shielding), in CD-changer wiring harness

** - Vehicles with CD changer wiring preparation*
-•--- - Vehicles without CD changer wiring preparation
*** - Vehicles with anti-theft warning system only (see wiring diagram comfort system/ central locking)*

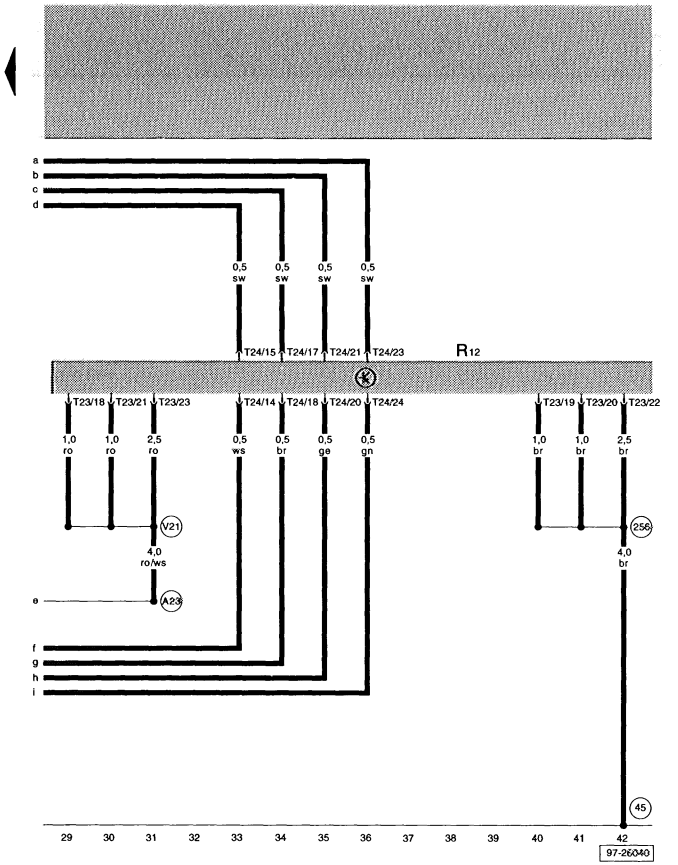
Radio, antenna, wiring harness from radio to CD changer unit



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

J453 - *Control module for multi-function steering wheel*
J533 - *Data Bus On Board Diagnostic Interface, in instrument cluster*
R - *Radio*
S242 - *Fuse 42 in fuse holder*
T16d - *16-Pin Connector*
T18c - *18-Pin Connector*
T32a - *32-Pin Connector, green*

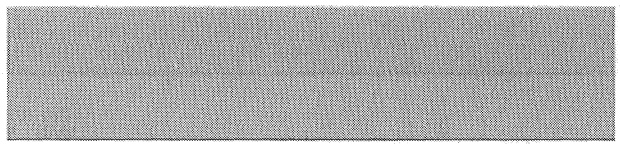
(501) - *Threaded connection -2- (30) on the relay plate*
(A23) - *Wire connection (30a), in instrument panel wiring harness*
(B229) - *Connection (High-Bus) (interior wiring harness)*
(B230) - *Connection (Low-Bus) (interior wiring harness)*
*** - *Vehicles with multi-function steering wheel only*

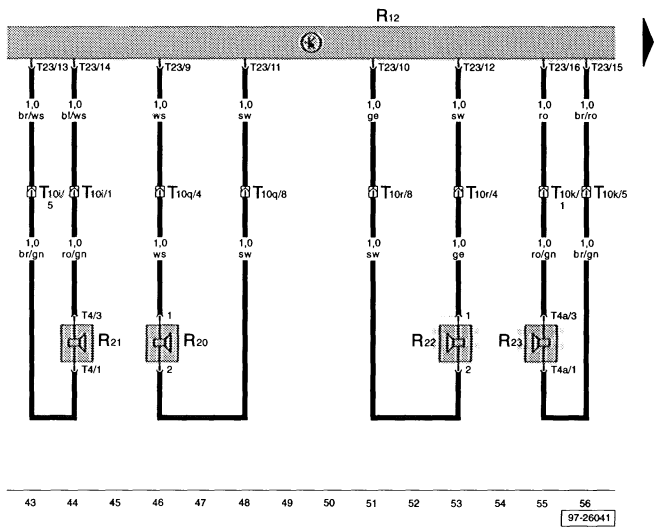


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

R12 - *Amplifier, (Golf: in luggage compartment, left), (Jetta: below rear window shelf, right)*
T23 - *23-Pin Connector*
T24 - *24-Pin Connector*

(45) - *Ground connection, behind instrument panel, center*
(256) - *Ground connection, -2-, in wiring harness radio*
(A23) - *Wire connection (30a), in instrument panel wiring harness*
(V21) - *Plus connector (30), in wiring harness Radio-Amplifier*



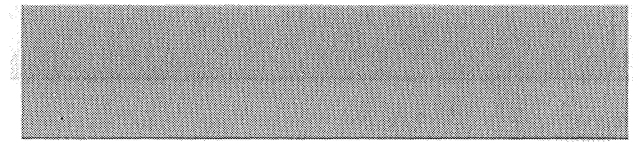


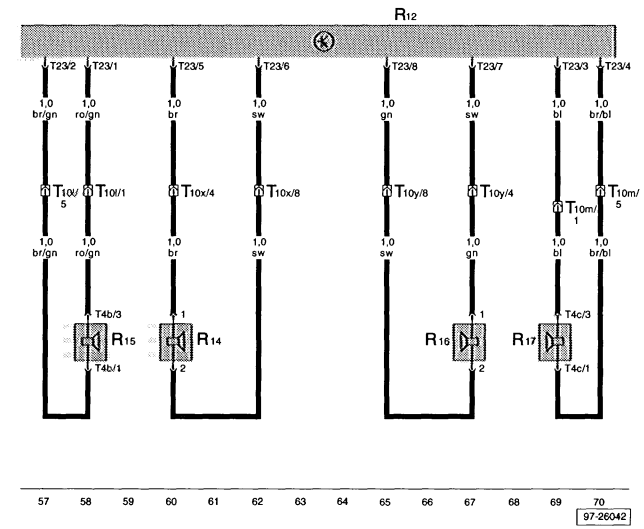
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

R12 - *Amplifier, (Golf: in luggage compartment, left), (Jetta: below rear window shelf, right)*
R20 - *Treble speaker, left front*
R21 - *Bass speaker, left front*
R22 - *Treble speaker, right front*
R23 - *Bass speaker, right front*
T4 - *4-Pin Connector*
T4a - *4-Pin Connector*
T10l - *10-Pin Connector, black, connector station A-pillar, left*
T10k - *10-Pin Connector, black, connector station A-pillar, right*
T10q - *10-Pin Connector, blue, connector station A-pillar, left*
T10r - *10-Pin Connector, blue, connector station A-pillar, right*
T23 - *23-Pin Connector*

Edition 12/01
USA.5102.12.21

Amplifier, loud speakers front





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

R12 - *Amplifier, (Golf: in luggage compartment, left), (Jetta: below rear window shelf, right)*
R14 - *Treble speaker, left rear*
R15 - *Bass speaker, left rear*
R16 - *Treble speaker, right rear*
R17 - *Bass speaker, right rear*
T4b - *4-Pin Connector*
T4c - *4-Pin Connector*
T10l - *10-Pin Connector, black, connector station B-pillar, left*
T10m - *10-Pin Connector, black, connector station B-pillar, right*
T10x - *10-Pin Connector, blue, connector station B-pillar, left*
T10y - *10-Pin Connector, blue, connector station B-pillar, right*
T23 - *23-Pin Connector*

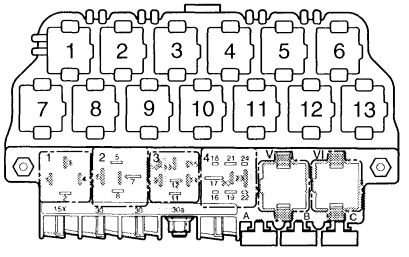
Amplifier, loud speakers rear

Edition 12/01
USA.5102.12.21

Radio system (with CD changer wiring preparation)

from August 2001

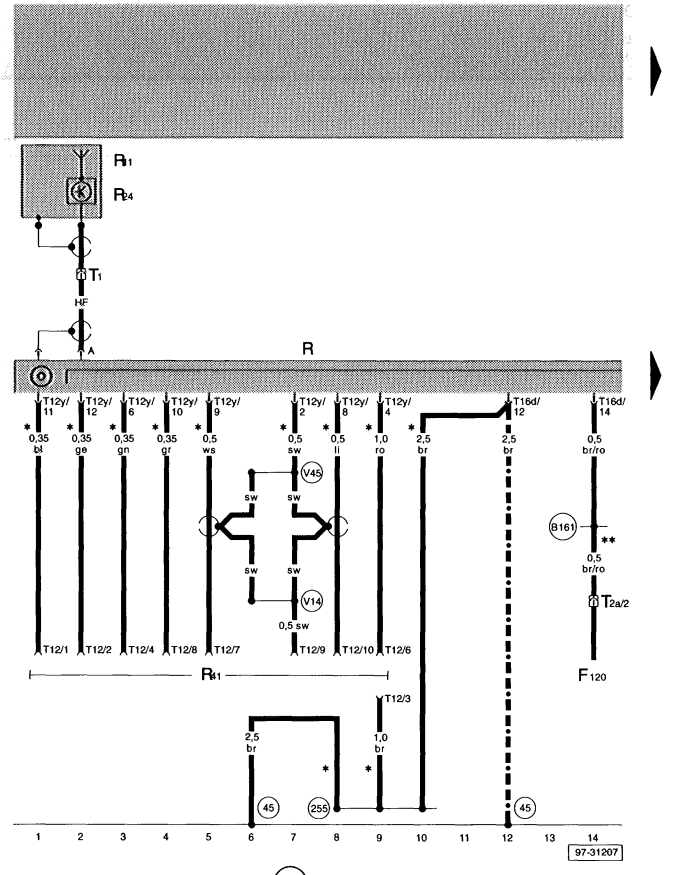
Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations".



Fuse colors

30 A - green
25 A - white
20 A - yellow
15 A - blue
10 A - red
7,5 A - brown
5 A - beige
3 A - violet

Repair Manual page number **97-740**



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

*F120 - Hood Alarm Switch***
R - Radio
R11 - Antenna
R24 - Antenna Amplifier
R41 - CD Changer Unit
T1 - Single Connector
T2a - Double Connector, near headlight, right
T12 - 12-Pin Connector
T12y - 12-Pin Connector
T16d - 16-Pin Connector

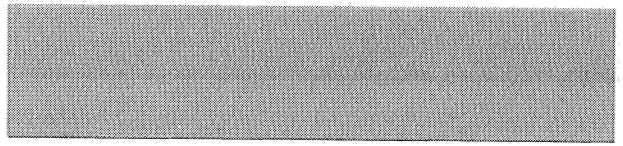
(45) - Ground connection, behind instrument panel, center
(255) - Ground connection, -1-, in wiring harness radio

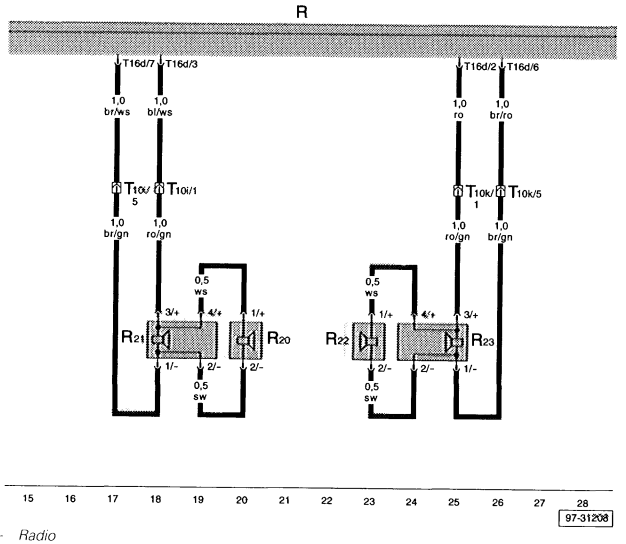
*(B161) - Connector (anti-theft warning system), in wiring harness interior***
(V14) - Wire connection (shielding), in CD-changer wiring harness
(V45) - Wire connection 2 (shielding), in CD-changer wiring harness

** - Vehicles with CD changer wiring preparation*
-•--- - Vehicles without CD changer wiring preparation
*** - Vehicles with anti-theft warning system only (see wiring diagram comfort system/ central locking)*

Radio, antenna, wiring harness from radio to CD changer unit

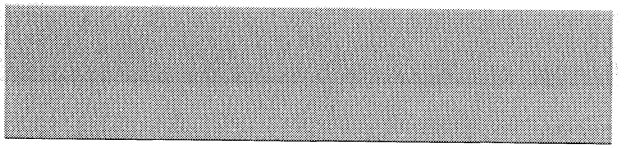
Repair Manual page number **97-741**

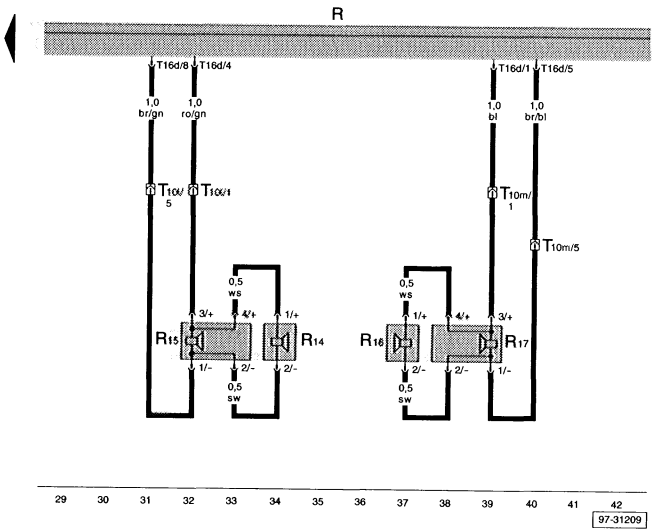




ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

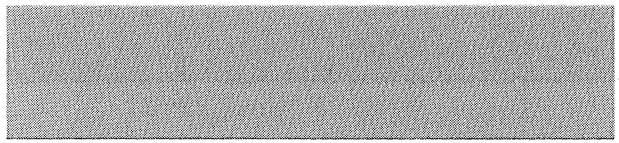
R - Radio
R20 - Treble speaker, left front
R21 - Bass speaker, left front
R22 - Treble speaker, right front
R23 - Bass speaker, right front
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10k - 10-Pin Connector, black, connector station A-pillar, right
T16d - 16-Pin Connector

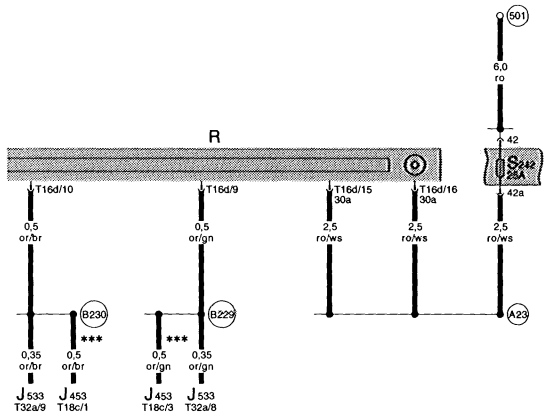




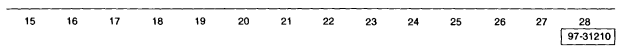
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

R - Radio
R14 - Treble speaker, left rear
R15 - Bass speaker, left rear
R16 - Treble speaker, right rear
R17 - Bass speaker, right rear
T10l - 10-Pin Connector, black, connector station B-pillar, left
T10m - 10-Pin Connector, black, connector station B-pillar, right
T16d - 16-Pin Connector





ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



J453 - Control module for multi-function steering wheel
J533 - Data Bus On Board Diagnostic Interface, in instrument cluster
R - Radio
S242 - Fuse 42 in fuse holder
T16d - 16-Pin Connector
T18c - 18-Pin Connector
T32a - 32-Pin Connector, green

(501) - Threaded connection -2- (30) on the relay plate
(A23) - Wire connection (30a), in instrument panel wiring harness
(B229) - Connection (High-Bus) (interior wiring harness)
(B230) - Connection (Low-Bus) (interior wiring harness)
*** - Vehicles with multi-function steering wheel only

Repair Manual page number 97-744

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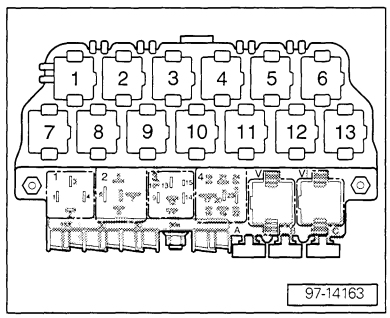
Repair Manual page number 97-745

Repair Manual page number 97-747

CAN-Bus, Powertrain and Comfort System,

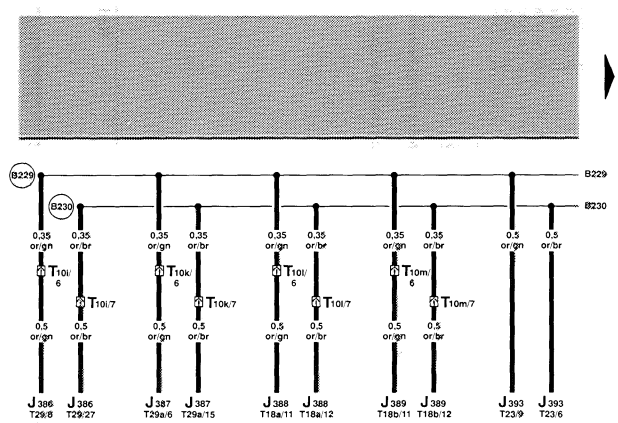
from May 2001

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations"



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:



CAN connection for: door control module (driver side, passenger side), door control module (rear, left and rear, right), central control module for comfort system

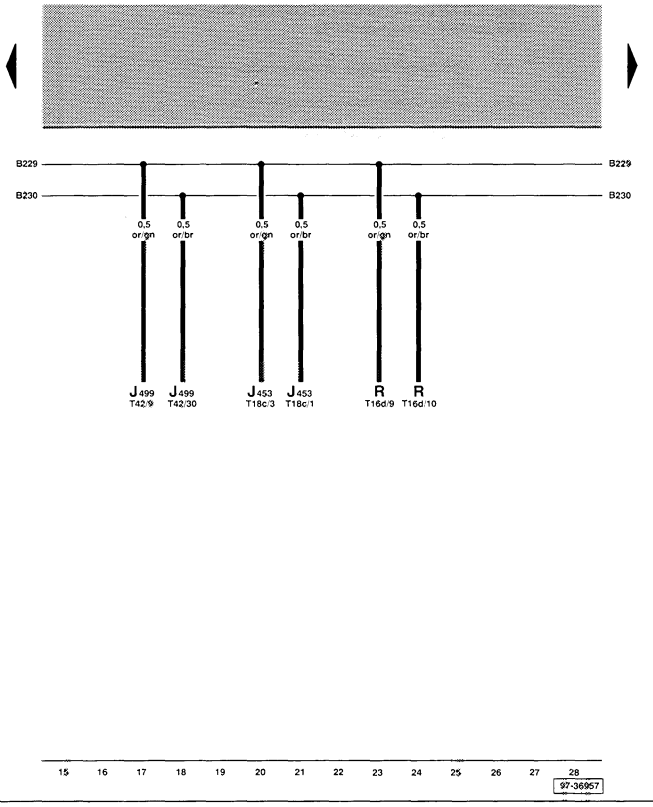
- J386 - Door control module, driver side
- J387 - Door control module, passenger side
- J388 - Door control module, rear, left
- J389 - Door control module, rear, right
- J393 - Central control module for comfort system, behind instrument panel, left
- T10l - 10-Pin Connector, black, connector station A-pillar, left
- T10k - 10-Pin Connector, black, connector station A-pillar, right
- T10l - 10-Pin Connector, black, connector station B-pillar, left
- T10m- 10-Pin Connector, black, connector station B-pillar, right
- T18a - 18-Pin Connector
- T18b - 18-Pin Connector
- T23 - 23-Pin Connector
- T29 - 29-Pin Connector
- T29a - 29-Pin Connector

(B229) - Connection (high bus), in instrument panel wiring harness

(B230) - Connection (low bus), in instrument panel wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

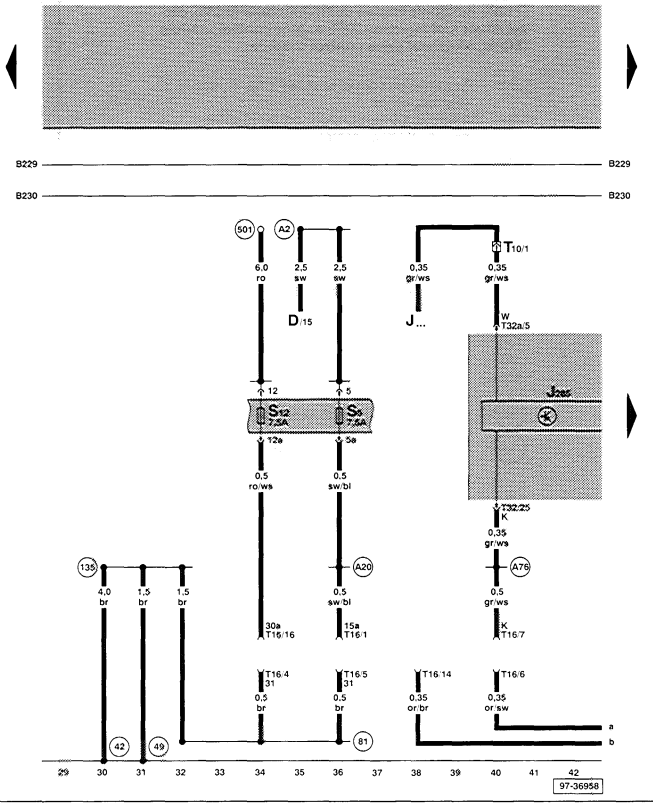
Repair Manual page number 97-746



CAN connection for: telematic control module, control module for multi-function steering wheel, radio

- J453 - Control module for multi-function steering wheel
- J499 - Telematic Control Module
- R - Radio
- T16d - 16-Pin Connector (beginning August 2001)
- T18c - 18-Pin Connector
- T42 - 42-Pin Connector

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



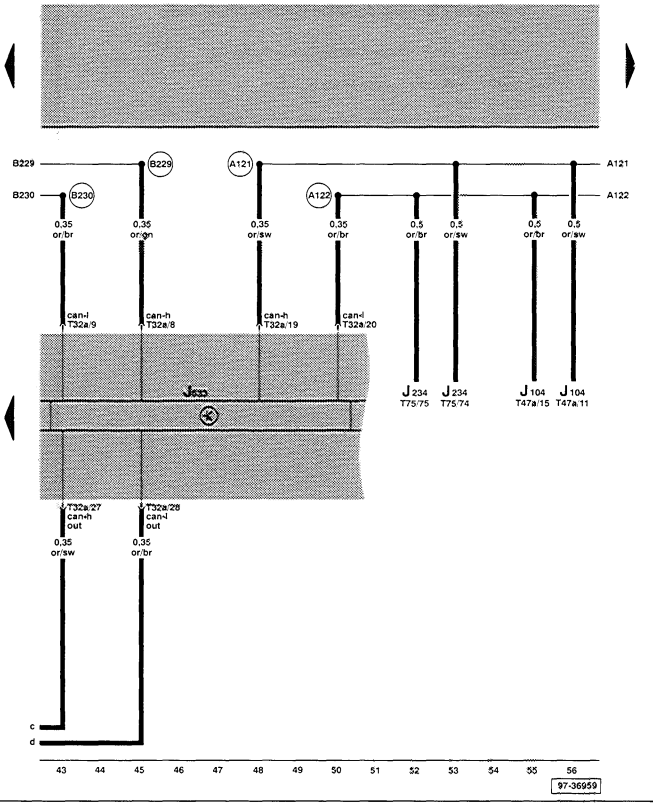
instrument cluster, Data Link Connector (DLC)

- D - Ignition/Starter Switch
- J285 - Control module with indicator unit in instrument panel insert
- J... - Engine Control Module (ECM)
- S5 - Fuse 5 in fuse holder
- S12 - Fuse 12 in fuse holder
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T16 - Data Link Connector (DLC), below instrument panel, left
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green
- (42) - Ground connection, beside steering column
- (49) - Ground connection, on steering column
- (81) - Ground connection -1-, in instrument panel wiring harness
- (135) - Ground connection -2-, in instrument panel wiring harness
- (501) - Threaded connection -2- (30) on the relay plate
- (A2) - Plus connection (15), in instrument panel wiring harness
- (A20) - Wire connection (15a), in instrument panel wiring harness
- (A76) - Connection (K-diagnosis wire) in instrument panel wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Repair Manual page number 97-749

Repair Manual page number 97-748



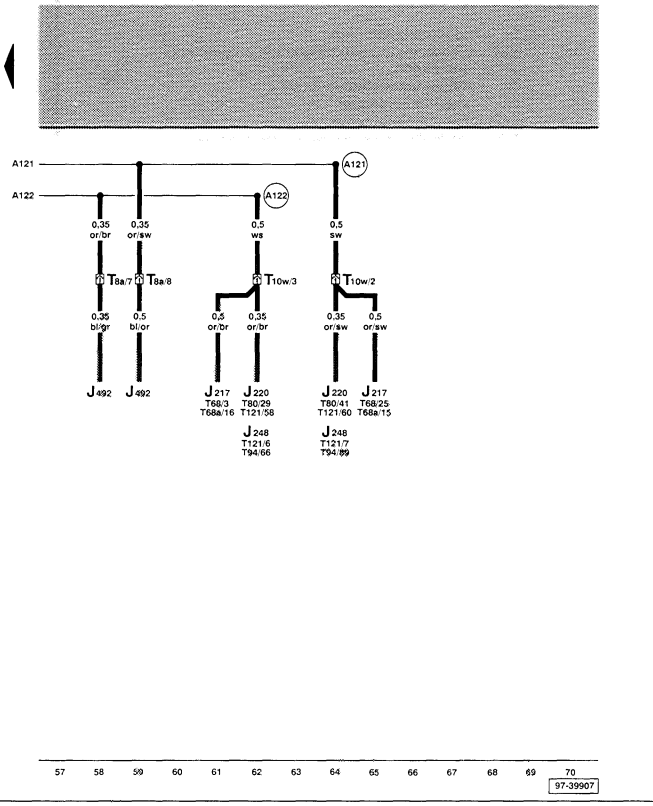
instrument cluster, data bus on board diagnostic interface, CAN connection for: airbag control module, ABS control module (w/EDL)

- J104 - ABS Control Module, in engine compartment, left
- J234 - Airbag Control Module, behind console, lower part
- J533 - Data Bus On Board Diagnostic Interface
- T32a - 32-Pin Connector, green
- T47a - 47-Pin Connector
- T75 - 75-Pin Connector

- (A121) - Connection (high bus), in instrument panel wiring harness
- (A122) - Connection (low bus), in instrument panel wiring harness
- (B229) - Connection (high bus), in instrument panel wiring harness
- (B230) - Connection (low bus), in instrument panel wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

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CAN connection for: transmission control module (TCM), motronic engine control module (ECM), diesel direct fuel injection (DFI) engine control module (ECM), all-wheel drive control module

- J217 - Transmission Control Module (TCM), in plenum chamber, center
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- J492 - All-Wheel Drive Control Module, in Haldex Coupling (02A)
- T8a - 8-Pin Connector, near Haldex clutch
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T68 - 68-Pin Connector, on Transmission Control Module (TCM) (4 speed automatic)
- T68a - 68-Pin Connector, on Transmission Control Module (TCM) (5 speed automatic)
- T80 - 80-Pin Connector
- T94 - 94-Pin Connector
- T121 - 121-Pin Connector

- (A121) - Connection (high bus) in instrument panel wiring harness
- (A122) - Connection (low bus) in instrument panel wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Repair Manual page number 97-750

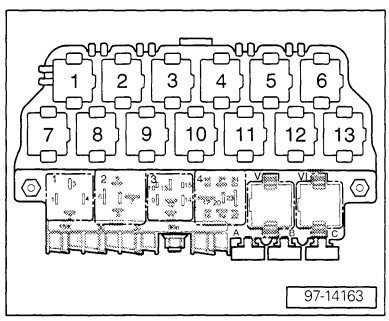
Repair Manual page number 97-753

Anti-lock brake system (ABS) with electronic differential lock (EDL), anti-slip regulation (ASR) and electronic stabilization program (ESP),

from May 2002

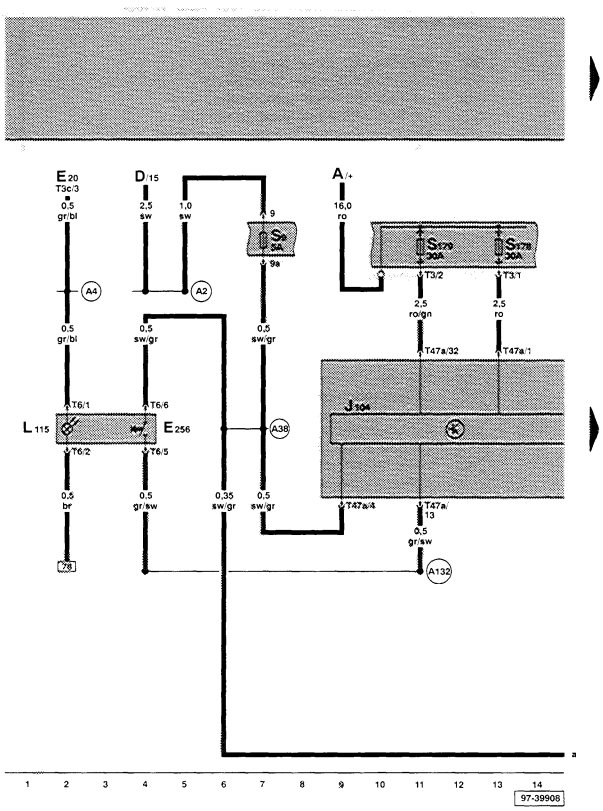
Additional Fuse, Relay, Control Module and Connector locations ⇒ Compontent Locations

Troubleshooting Procedures ⇒ Guided Fault Finding using VAS 5051/5052



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:



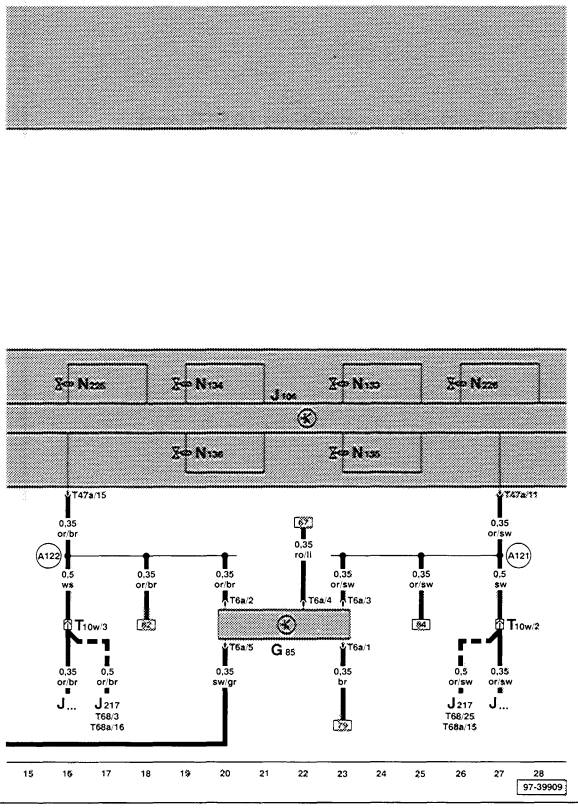
ABS control module, ESP Button

A - Battery
D - Ignition/Starter Switch
E20 - Instrument Panel Light Dimmer Switch
E256 - ESP Button
J104 - ABS Control Module, in engine compartment, left
L115 - ESP Button Illumination
S9 - Fuse 9 in fuse holder
S178 - Fuse 6 (30) in fuse bracket/battery
S179 - Fuse 7 (30) in fuse bracket/battery
T3 - 3-Pin Connector
T3c - 3-Pin Connector
T6 - 6-Pin Connector
T47a - 47-Pin Connector

(A2) - Plus connection (15), in instrument panel wiring harness
(A4) - Plus connection (58b), in instrument panel wiring harness
(A38) - Plus connection 2 (15a), in instrument panel wiring harness
(A132) - ESP Connection (in instrument panel wiring harness)

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Repair Manual page number 97-752



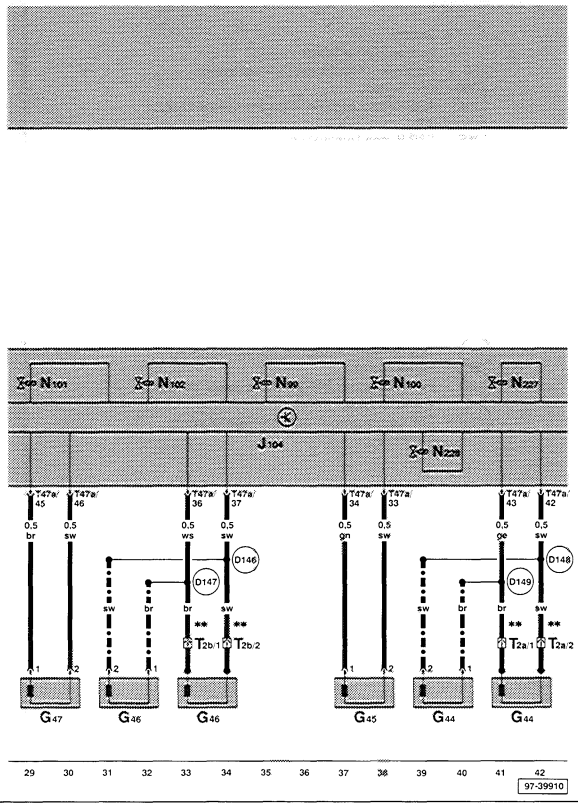
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

ABS control module, steering angle sender, inlet and outlet valves

- G85 - Steering Angle Sensor
- J104 - ABS Control Module, in engine compartment, left
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- J... - Engine Control Module (ECM)
- N133 - Right Rear ABS Inlet Valve
- N134 - Left Rear ABS Inlet Valve
- N135 - Right Rear ABS Outlet Valve
- N136 - Left Rear ABS Outlet Valve
- N225 - Pilot valve 1 traction control
- N226 - Pilot valve 2 traction control
- T6a - 6-Pin Connector
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T47a - 47-Pin Connector
- T68 - 68-Pin Connector, on transmission control module (TCM) (4 speed automatic)
- T68a - 68-Pin Connector, on Transmission Control Module (TCM) (5 speed automatic with Tiptronic)

- (A121) - Connection (high bus), in instrument panel wiring harness
- (A122) - Connection (low bus), in instrument panel wiring harness

--- Automatic transmission only



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

ABS control module, front and rear ABS wheel speed sensors

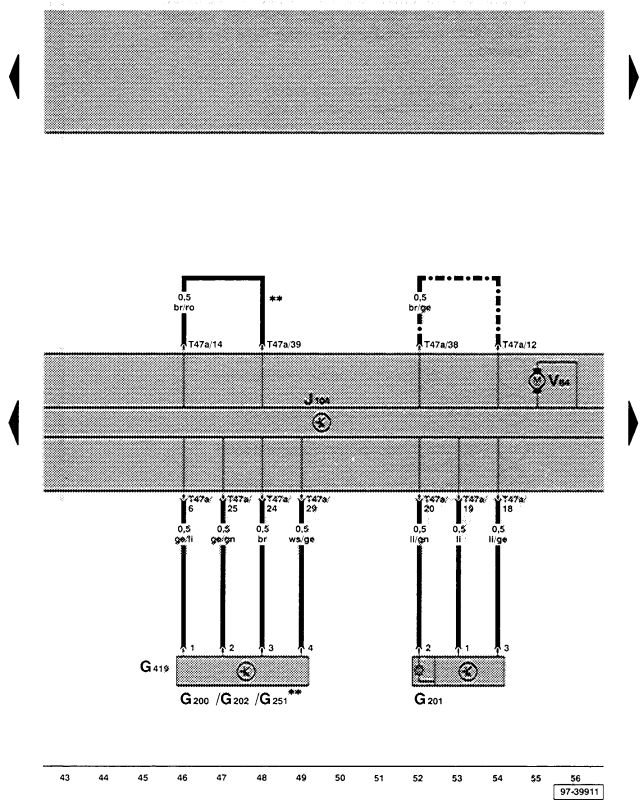
- G44 - Right Rear ABS Wheel Speed Sensor
- G45 - Right Front ABS Wheel Speed Sensor
- G46 - Left Rear ABS Wheel Speed Sensor
- G47 - Left Front ABS Wheel Speed Sensor
- J104 - ABS Control Module, in engine compartment, left
- N99 - Right Front ABS Inlet Valve
- N100 - Right Front ABS Outlet Valve
- N101 - Left Front ABS Inlet Valve
- N102 - Left Front ABS Outlet Valve
- N227 - High pressure switch valve 1 traction control
- N228 - High pressure switch valve 2 traction control
- T2a - Double Connector, near right rear ABS wheel speed sensor
- T2b - Double Connector, near left rear ABS wheel speed sensor
- T47a - 47-Pin Connector

- (D146) - Connection (speed sensor rear, left +), in wiring harness engine compartment
- (D147) - Connection (speed sensor rear, left -), in wiring harness engine compartment
- (D148) - Connection (speed sensor rear, right +), in wiring harness engine compartment
- (D149) - Connection (speed sensor rear, right -), in wiring harness engine compartment

** - Vehicles with All-Wheel Drive Control only
-*- - Vehicles without All-Wheel Drive Control only

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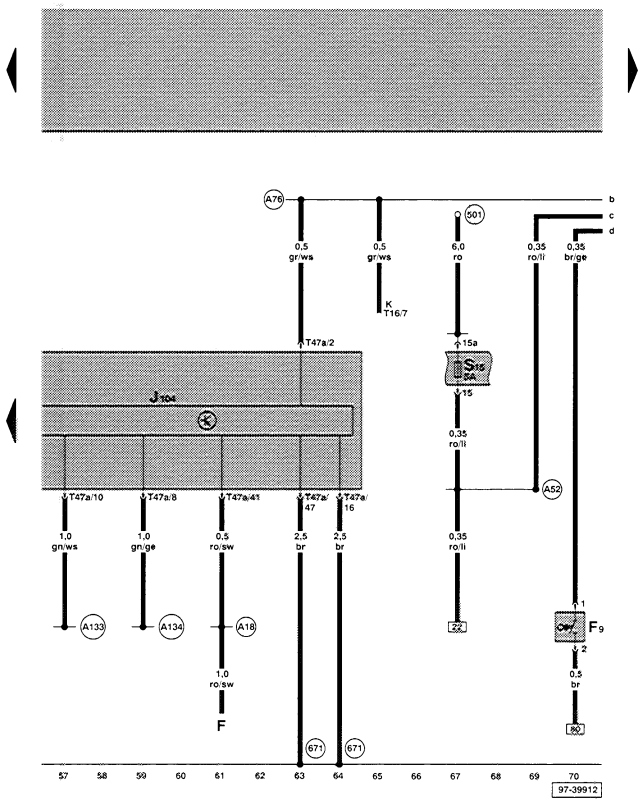
ABS control module, Sensor for transverse acceleration, sender 1 for brake booster, sender for rotation rate, Longitudinal Acceleration Sensor, ESP-sensor unit

- J104 - ABS Control Module, in engine compartment, left
- G200 - Sensor for transverse acceleration
- G201 - Sender 1 for brake booster
- G202 - Sender for Rotation Rate
- G251 - Longitudinal Acceleration Sensor
- G419 - ESP-Sensor Unit
- T47a - 47-Pin Connector
- V64 - ABS Hydraulic Pump

** - 4-Motion only

-•- - front wheel drive only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



ABS control module, parking brake warning light switch, data link connector (DLC)

- F - Brake Light Switch
- F9 - Parking Brake Warning Light Switch
- J104 - ABS Control Module, in engine compartment, left
- S15 - Fuse 15 in fuse holder
- T16 - Data Link Connector (DLC), below instrument panel, left
- T47a - 47-Pin Connector

(671) - Ground Connection 1 (on left front long member)

(501) - Threaded Connection 2 (30) on the relay plate

(A18) - Connection (54), in instrument panel wiring harness

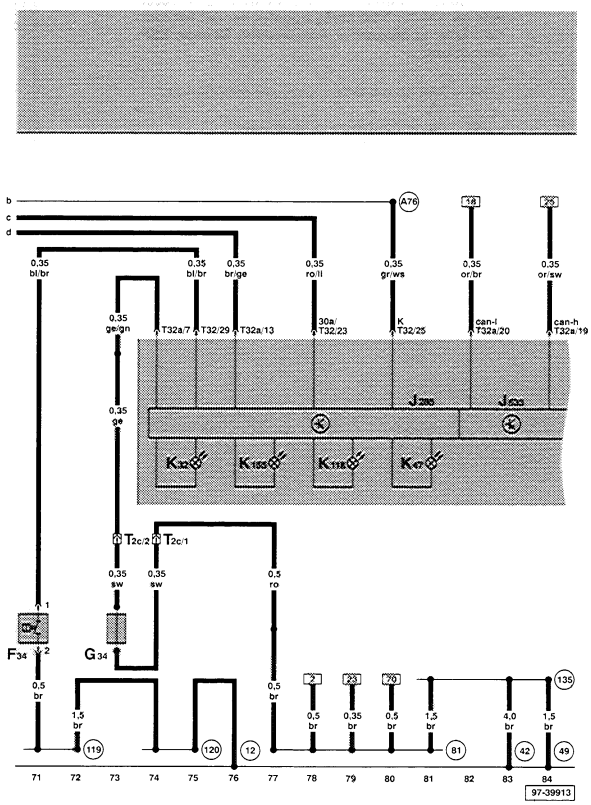
(A52) - Plus Connection 2 (30) (in instrument panel wiring harness)

(A76) - Connection (K-diagnosis wire) in instrument panel wiring harness

(A133) - Left ABS Impulse Connection (in instrument panel wiring harness)

(A134) - Right ABS Impulse Connection (in instrument panel wiring harness)

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Instrument cluster, left front brake pad wear sensor, brake pad wear indicator light, ESP/ASC control lamp, ABS warning light, warning light for brake system

- F34 - Brake Fluid Level Warning Switch
- G34 - Left Front Brake Pad Wear Sensor
- J285 - Control module with indicator unit in instrument panel insert
- J533 - Data Bus On Board Diagnostic Interface
- K32 - Brake Pad Wear Indicator Light
- K47 - ABS Warning Light
- K118 - Warning light for brake system
- K155 - ASR/ESP Indoicator Lamp
- T2c - Double Connector, near left front brake pad wear sensor
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green

- (12) - Ground connection, in engine compartment, left
- (42) - Ground connection, beside steering column
- (49) - Ground connection, on steering column
- (81) - Ground connection 1, in instrument panel wiring harness
- (119) - Ground connection 1, in headlight wiring harness
- (120) - Ground connection 2, in headlight wiring harness
- (135) - Ground connection 2, in instrument panel wiring harness
- (A76) - Connector (K-diagnosis wire) in instrument panel wiring harness

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Golf/Jetta sedan standard equipment from May 2000

	Wiring Diagram page number
● **Golf/Jetta Sedan - Standard Equipment, from May 2000**	**52**/1
- Battery, ignition/starter switch	**52**/2
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay	**52**/3
- Instrument cluster, tachometer, speedometer, odometer display, anti-theft immobilizer, warning light for anti-theft immobilizer sensor	**52**/4
- Instrument cluster, generator (GEN) warning light, low fuel level warning light, warning light for rear lid unlocked/door ajar indicator lamp	**52**/5
- Instrument cluster, left front brake pad wear sensor, brake pad wear indicator light, headlight high beam indicator light, digital clock	**52**/6
- Instrument cluster, parking brake warning light switch, brake fluid level warning switch, low windshield washer fluid level indication, left and right turn signal indicator lights	**52**/7
- Turn signal switch, headlight dimmer/flasher switch, left front turn signal light, light for side marker front left, left headlight	**52**/8
- Emergency flasher switch, turn signal relay, right front turn signal light, light for side marker front right, right headlight	**52**/9
- Left rear turn signal light, left back-up light, left brake/tail light, high-mount brake light (Golf only)	**52**/10
- Back-up light switch, brake light switch, right rear turn signal light, right back-up light, right brake/tail light	**52**/11
- Data Link Connector (DLC)	**52**/12
- Radio connection, cigarette lighter, instrument panel vent illumination	**52**/13
- Light switch	**52**/14
- License plate light, glove compartment light	**52**/15
- Dual tone horn, fuel tank door remote	**52**/16
- Instrument panel light dimmer switch, rear window defogger switch, heated rear window	**52**/17
- Fresh air blower switch, fresh air/recirculating flap switch, fresh air blower	**52**/18
- Motor for rear windshield wiper, windshield and rear window washer pump	**52**/19
- Windshield wiper/washer switch, windshield wiper intermittent regulator, windshield wiper motor, wiper/washer intermittent relay	**52**/20

Golf/Jetta wagon standard equipment from January 2001

	Wiring Diagram page number
● **Golf/Jetta Wagon - Standard Equipment, from January 2001**	**51**/1
- Battery, ignition/starter switch	**51**/2
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay	**51**/3
- Instrument cluster, tachometer, speedometer, odometer display, anti-theft immobilizer, warning light for anti-theft immobilizer sensor	**51**/4
- Instrument cluster, generator (GEN) warning light, low fuel level warning light, warning light for rear lid unlocked/door ajar indicator lamp	**51**/5
- Instrument cluster, left front brake pad wear sensor, brake pad wear indicator light, headlight high beam indicator light, digital clock	**51**/6
- Instrument cluster, parking brake warning light switch, brake fluid level warning switch, low windshield washer fluid level indication, left and right turn signal indicator lights	**51**/7
- Turn signal switch, headlight dimmer/flasher switch, left front turn signal light, light for side marker front left, left headlight	**51**/8
- Emergency flasher switch, turn signal relay, right front turn signal light, light for side marker front right, right headlight	**51**/9
- Back-up light switch, left rear turn signal light, left back-up light, left brake/tail light, high-mount brake light	**51**/10
- Brake light switch, right rear turn signal light, right back-up light, right brake/tail light	**51**/11
- Data Link Connector (DLC), radio connection, cigarette lighter	**51**/12
- Light switch	**51**/13
- License plate light, glove compartment light	**51**/14
- Dual tone horn, fuel tank door remote	**51**/15
- Instrument panel light dimmer switch, rear window defogger switch, heated rear window	**51**/16
- Fresh air blower switch, fresh air/recirculating flap switch, fresh air blower	**51**/17
- Motor for rear windshield wiper, windshield and rear window washer pump	**51**/18
- Windshield wiper/washer switch, windshield wiper intermittent regulator, windshield wiper motor, wiper/washer intermittent relay	**51**/19

Golf CL (Canada) standard equipment from August 2002

	Wiring Diagram page number
● **Golf CL (Canada) - Standard Equipment,** from August 2002	**76**/1
- Battery, ignition/starter switch	**76**/2
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay	**76**/3
- Instrument cluster, tachometer, speedometer, odometer display, anti-theft immobilizer, warning light for anti-theft immobilizer sensor	**76**/4
- Instrument cluster, generator (GEN) warning light, low fuel level warning light, door ajar indicator lamp	**76**/5
- Instrument cluster, left front brake pad wear sensor, brake pad wear indicator light, headlight high beam indicator light, digital clock	**76**/6
- Instrument cluster, brake fluid level warning switch, low windshield washer fluid level indication, left and right turn signal indicator lights	**76**/7
- Turn signal switch, headlight dimmer/flasher switch, left front turn signal light, light for side marker front left, left headlight	**76**/8
- Emergency flasher switch, turn signal relay, right front turn signal light, light for side marker front right, right headlight	**76**/9
- Left rear turn signal light, left back-up light, left brake/tail light, high-mount brake light, luggage compartment light	**76**/10
- Back-up light switch, brake light switch, right rear turn signal light, right back-up light, right brake/tail light	**76**/11
- Data Link Connector (DLC)	**76**/12
- Radio connection, cigarette lighter	**76**/13
- Light switch	**76**/14
- Daytime running lights change-over relay, License plate light, glove compartment light, parking brake warning light switch	**76**/15
- Dual tone horn, fuel tank door remote	**76**/16
- Instrument panel light dimmer switch, rear window defogger switch, heated rear window	**76**/17
- Fresh air blower switch, fresh air/recirculating flap switch, fresh air blower	**76**/18
- Motor for rear windshield wiper, windshield and rear window washer pump	**76**/19
- Windshield wiper/washer switch, windshield wiper intermittent regulator, windshield wiper motor, wiper/washer intermittent relay	**76**/20
- Front Interior lights, left rear reading light, left door warning light, Door contact switch - driver's side, left rear door contact switch	**76**/21
- Right Rear Reading Light, right door warning light, make-up mirror lights	**76**/22

1.8L engine (code AWP) from May 2002

	Wiring Diagram page number
● **1.8L - Engine - Motronic Multiport Fuel Injection (MFI)/132 kW, code AWP,** from May 2002	**78**/1
- Battery, ignition/starter switch (Jetta Wagon)	**51**/2
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Jetta Wagon)	**51**/3
- Battery, ignition/starter switch (Golf/Jetta Sedan)	**52**/2
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Golf/Jetta Sedan)	**52**/3
- Generator (GEN), starter	**78**/2
- Power supply relay	**78**/3
- Motronic engine control module (ECM), ignition system	**78**/4
- Motronic engine control module (ECM)	**78**/5
- Charge air pressure sensor, camshaft position (CMP) sensor, wastegate bypass regulator valve, recirculating valve for turbocharger, valve for camshaft adjustment	**78**/6
- Motronic engine control module (ECM), angle sensor for throttle drive (power accelerator actuation), intake air temperature (IAT) sensor, (ECT) sensor, leak detection pump (LDP)	**78**/7
- Motronic engine control module (ECM), engine speed (RPM) sensor, knock sensor (KS) 1, knock sensor (KS) 2	**78**/8
- Motronic engine control module (ECM), pressure switch/power steering, injectors	**78**/9
- Motronic engine control module (ECM), heated oxygen sensor (HO2S), oxygen sensor (O2S) behind three way catalytic converter (TWC), (EVAP) canister purge regulator valve	**78**/10
- Motronic engine control module (ECM), brake booster control module, brake system vacuum pump	**78**/11
- Motronic engine control module (ECM), secondary air injection (AIR) pump system, brake light switch, brake pedal switch	**78**/12
- Motronic engine control module (ECM), cruise control switch, mass air flow (MAF) sensor, clutch pedal switch	**78**/13
- Motronic engine control module (ECM), throttle position (TP) sensor, fuel pump (FP) relay	**78**/14
- Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor	**78**/15
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light	**78**/16
- Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light	**78**/17
- Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp	**78**/18

1.9L engine (code ALH) from September 2001

	Wiring Diagram page number
● **1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66KW, code ALH, (with manual transmission),** from September 2001	**65**/1
- Battery, ignition/starter switch (Jetta Wagon)	**51**/2
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Jetta Wagon)	**51**/3
- Battery, ignition/starter switch (Golf/Jetta Sedan)	**52**/2
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Golf/Jetta Sedan)	**52**/3
- Battery, ignition/starter switch (Golf Canada)	**76**/2
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Golf Canada)	**76**/3
- Generator (GEN), starter	**65**/2
- Control module for glow plug triggering, glow plugs (engine)	**65**/3
- Diesel direct fuel injection (DFI) engine control module (ECM), power supply (terminal 30, B+) relay, fuel temperature sensor, quantity adjuster, modulating piston displacement sensor	**65**/4
- Diesel direct fuel injection (DFI) engine control module (ECM), engine coolant temperature (ECT) sensor, intake air temperature (IAT) sensor, manifold absolute pressure (MAP) sensor	**65**/5
- Diesel direct fuel injection (DFI) engine control module (ECM)	**65**/6
- Diesel direct fuel injection (DFI) engine control module (ECM), kick down switch, (CTP) switch, engine speed (RPM) sensor, throttle position (TP) sensor, needle lift sensor	**65**/7
- (DFI) engine control module (ECM), mass air flow sensor, change-over valve for intake manifold flap, wastegate bypass regulator valve, EGR vacuum regulator solenoid valve	**65**/8
- Diesel direct fuel injection (DFI) engine control module (ECM), cruise control switch, clutch vacuum vent valve switch, cold start injector, fuel cut-off valve	**65**/9
- Diesel direct fuel injection (DFI) engine control module (ECM), brake light switch, brake vacuum vent valve switch for cruise control/diesel, glow plugs (coolant)	**65**/10
- Fuel level sensor, engine coolant level (ECL) sensor	**65**/11
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor, generator (GEN) warning light, engine coolant level/temperature (ECL/ECT) warning light	**65**/12
- Instrument cluster, engine coolant temperature (ECT) gauge, fuel gauge, tachometer, speedometer, glow plug indicator light	**65**/13
● **1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/66KW, code ALH, (with automatic transmission),** from September 2001	**66**/1
- Battery, ignition/starter switch (Jetta Wagon)	**51**/2
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Jetta Wagon)	**51**/3
- Battery, ignition/starter switch (Golf/Jetta Sedan)	**52**/2
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Golf/Jetta Sedan)	**52**/3
- Battery, ignition/starter switch (Golf Canada)	**76**/2
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Golf Canada)	**76**/3
- Generator (GEN), starter	**66**/2
- Control module for glow plug triggering, glow plugs (engine)	**66**/3
- Diesel direct fuel injection (DFI) engine control module (ECM), power supply (terminal 30, B+) relay, fuel temperature sensor, quantity adjuster, modulating piston displacement sensor	**66**/4
- Diesel direct fuel injection (DFI) engine control module (ECM), engine coolant temperature (ECT) sensor, intake air temperature (IAT) sensor, manifold absolute pressure (MAP) sensor	**66**/5
- Diesel direct fuel injection (DFI) engine control module (ECM)	**66**/6
- Diesel direct fuel injection (DFI) engine control module (ECM), kick down switch, (CTP) switch, engine speed (RPM) sensor, throttle position (TP) sensor, needle lift sensor	**66**/7
- (DFI) engine control module (ECM), mass air flow sensor, change-over valve for intake manifold flap, wastegate bypass regulator valve, EGR vacuum regulator solenoid valve	**66**/8
- Diesel direct fuel injection (DFI) engine control module (ECM), cruise control switch, fuel cut-off valve	**66**/9
- Diesel direct fuel injection (DFI) engine control module (ECM), brake light switch, brake vacuum vent valve switch for cruise control/diesel	**66**/10
- Fuel level sensor, engine coolant level (ECL) sensor	**66**/11
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor, generator (GEN) warning light, engine coolant level/temperature (ECL/ECT) warning light	**66**/12
- Instrument cluster, engine coolant temperature (ECT) gauge, fuel gauge, tachometer, speedometer, glow plug indicator light	**66**/13

2.0L engine (code AVH, AZG) from November 2001

	Wiring Diagram page number
● **2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code AVH, AZG** from November 2001	**79**/1
- Battery, ignition/starter switch (Jetta Wagon)	**51**/2
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Jetta Wagon)	**51**/3
- Battery, ignition/starter switch (Golf/Jetta Sedan)	**52**/2
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Golf/Jetta Sedan)	**52**/3
- Battery, ignition/starter switch (Golf Canada)	**76**/2
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Golf Canada)	**76**/3
- Generator (GEN), starter	**79**/2
- Power supply relay	**79**/3
- Motronic engine control module (ECM), ignition system	**79**/4
- Motronic engine control module (ECM)	**79**/5
- Motronic engine control module (ECM), throttle position (TP) sensor, camshaft position (CMP) sensor	**79**/6
- Motronic engine control module (ECM), angle sensor for throttle drive (power accelerator actuation), (ECT) sensor, leak detection pump (LDP)	**79**/7
- Motronic engine control module (ECM), engine speed (RPM) sensor, knock sensor (KS) 1, knock sensor (KS) 2	**79**/8
- Motronic engine control module (ECM), injectors, positive crankcase ventilation (PCV) heating element	**79**/9
- Heated oxygen sensor (HO2S), oxygen sensor (O2S) behind three way catalytic converter (TWC), evaporative emission (EVAP) canister purge regulator valve	**79**/10
- Motronic engine control module (ECM), secondary air injection (AIR) pump motor, secondary air injection (AIR) pump relay	**79**/11
- Motronic engine control module (ECM), cruise control switch, mass air flow (MAF) sensor, clutch vacuum vent valve switch, fuel pump (FP) relay	**79**/12
- Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor	**79**/13
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light	**79**/14
- Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light	**79**/15
- Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp	**79**/16

2.0L engine (code BBW) from December 2002

	Wiring Diagram page number
● **2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code BBW** from December 2002	**86**/1
- Battery, ignition/starter switch (Jetta Wagon)	**51**/2
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Jetta Wagon)	**51**/3
- Battery, ignition/starter switch (Golf/Jetta Sedan)	**52**/2
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Golf/Jetta Sedan)	**52**/3
- Generator (GEN), starter, starting interlock relay	**86**/2
- Power supply relay	**86**/3
- Motronic engine control module (ECM), ignition system	**86**/4
- Motronic engine control module (ECM)	**86**/5
- Motronic engine control module (ECM), throttle position (TP) sensor, camshaft position (CMP) sensor	**86**/6
- Motronic engine control module (ECM), throttle drive angle sensors, engine coolant temperature (ECT) gauge, leak detection pump (LDP), engine coolant temperature (ECT) sensors	**86**/7
- Motronic engine control module (ECM), engine speed (RPM) sensor, knock sensor (KS) 1, knock sensor (KS) 2	**86**/8
- Motronic engine control module (ECM), injectors, positive crankcase ventilation (PCV) heating element	**86**/9
- Motronic engine control module (ECM), Heated oxygen sensor (HO2S), oxygen sensor (O2S) behind three way catalytic converter (TWC), evaporative emission (EVAP) canister purge regulator valve	**86**/10
- Motronic engine control module (ECM), Oxygen sensor (O2S) 2 behind three way catalytic converter (TWC), exhaust gas temperature (EGT) sensor 1, camshaft adjustment valve 1, brake system vacuum pump	**86**/11
- Motronic engine control module (ECM), secondary air injection (AIR) pump motor, secondary air injection (AIR) pump relay, clutch pedal switch	**86**/12
- Motronic engine control module (ECM), cruise control switch, mass air flow (MAF) sensor, fuel pump (FP) relay	**86**/13
- Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor	**86**/14
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light	**86**/15
- Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light	**86**/16
- Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp	**86**/17

2.8L engine (code BDF) from May 2002

	Wiring Diagram page number
● **2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/147 kW, code BDF,** from May 2002	**80**/1
- Battery, ignition/starter switch (Jetta Wagon)	**51**/2
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Jetta Wagon)	**51**/3
- Battery, ignition/starter switch (Golf/Jetta Sedan)	**52**/2
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay(Golf/Jetta Sedan)	**52**/3
- Generator (GEN), starter	**80**/2
- Power supply relay	**80**/3
- Motronic engine control module (ECM), ignition system	**80**/4
- Motronic engine control module (ECM), ignition system, camshaft adjustment valve (exhaust), valve for camshaft adjustment	**80**/5
- Motronic engine control module (ECM), throttle valve control module, intake manifold change-over valve, after-run coolant pump, positive crankcase ventilation (PCV) heating element	**80**/6
- Motronic engine control module (ECM), engine coolant temperature (ECT) sensor, engine speed (RPM) sensor, camshaft position (CMP) sensor	**80**/7
- Motronic engine control module (ECM), knock sensor (KS) 1, knock sensor (KS) 2	**80**/8
- Motronic engine control module (ECM), injectors	**80**/9
- Motronic engine control module (ECM), evaporative emission (EVAP) canister purge regulator valve	**80**/10
- Motronic engine control module (ECM), throttle position (TP) sensor, heated oxygen sensor (HO2S)	**80**/11
- Motronic engine control module (ECM), mass air flow (MAF) sensor, oxygen sensor (O2S) behind three way catalytic converter (TWC), leak detection pump (LDP)	**80**/12
- Motronic engine control module (ECM), brake booster control module, brake system vacuum pump	**80**/13
- Motronic engine control module (ECM), secondary air injection (AIR) pump system, brake light switch, brake pedal switch	**80**/14
- Motronic engine control module (ECM), cruise control switch, clutch pedal switch, fuel pump (FP) relay	**80**/15
- Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor	**80**/16
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light	**80**/17
- Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light	**80**/18
- Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp	**80**/19

2003 m.y. additional electrical wiring diagrams

	Wiring Diagram page number
● **Airbag systems,** from October 2000	**50/1**
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1.8L - Engine - Motronic Multiport Fuel Injection (MFI)/132 kW, code AWP	**38/1**
2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code AVH, AZG	**38/1**
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● **Anti-lock brake system (ABS), Anti-lock brake system (ABS) with electronic differential lock (EDL) and anti-slip control (ASC),** from August 2000	**48/1**
● **Anti-lock brake system (ABS) with electronic differential lock (EDL), anti-slip regulation (ASR) and electronic stabilization program (ESP),** from May 2002	**75/1**
● **Anti-theft warning system (Jetta Wagon),** from May 2001	
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● **Anti-theft warning system (Golf/Jetta Sedan),** from May 2001	
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1.9L engine (code BEW) with manual trans. from May 2003

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- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Golf Canada)	**76**/3
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- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light, engine coolant level (ECL) sensor	**81**/14
- Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer,speedometer, generator (GEN) warning light, low fuel level warning light, glow plug indicator light	**81**/15
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1.9L engine (code BEW) with automatic trans. from May 2003

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- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Jetta Wagon)	**51**/3
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- Battery, ignition/starter switch (Golf Canada)	**76**/2
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- Generator (GEN), starter	**82**/2
- Glow plug activation control module, engine glow plugs	**82**/3
- Diesel direct fuel injection (DFI) engine control module (ECM), power supply (terminal 30, B+) relay, kick down switch, (CTP) switch, throttle position (TP) sensor	**82**/4
- Diesel direct fuel injection (DFI) engine control module (ECM), engine speed (RPM) sensor, engine coolant temperature (ECT) sensor, intake air temperature (IAT) sensor, charge air pressure sensor	**82**/5
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- Diesel direct fuel injection (DFI) engine control module (ECM), pump/injector valves, camshaft position (CMP) sensor	**82**/7
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- Diesel direct fuel injection (DFI) engine control module (ECM), cruise control switch, fuel temperature sensor	**82**/11
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- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light, engine coolant level (ECL) sensor	**82**/14
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- Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp	**82**/16

2.0L engine (code BBW) from December 2002

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- Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp	**86**/17
- Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor	**86**/14
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light	**86**/15
- Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light	**86**/16
- Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp	**86**/17

2.0L engine (code BEV) from May 2003

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- Generator (GEN), starter	**88**/2
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- Motronic engine control module (ECM), ignition system	**88**/4
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- Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor	**88**/14
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- Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light	**88**/16
- Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp	**88**/17

3.2L engine (code BJS) from October 2003

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- Motronic engine control module (ECM), ignition system, Valve -1- for camshaft adjustment, camshaft adjustment valve 1 (exhaust)	**89**/5
- Motronic engine control module (ECM), throttle valve control module, intake manifold change-over valve, after-run coolant pump, positive crankcase ventilation (PCV) heating element	**89**/6
- Motronic engine control module (ECM), engine speed (RPM) sensor, camshaft position (CMP) sensors, engine coolant temperature (ECT) sensors	**89**/7
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- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light	**89**/17
- Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light	**89**/18
- Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp	**89**/19

2.0L engine (code BEV) from June 2004

	Wiring Diagram page number
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- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Jetta Wagon)	**51**/3
- Battery, ignition/starter switch (Golf/Jetta Sedan)	**52**/2
- Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay (Golf/Jetta Sedan)	**52**/3
- Generator (GEN), starter	**91**/2
- Power supply relay	**91**/3
- Motronic engine control module (ECM), ignition system	**91**/4
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- Motronic engine control module (ECM), throttle position (TP) sensor, camshaft position (CMP) sensor	**91**/6
- Motronic engine control module (ECM), throttle valve control module, engine coolant temperature (ECT) sensor, leak detection pump (LDP)	**91**/7
- Motronic engine control module (ECM), engine speed (RPM) sensor, knock sensor (KS) 1, knock sensor (KS) 2	**91**/8
- Motronic engine control module (ECM), injectors, positive crankcase ventilation (PCV) heating element	**91**/9
- Motronic engine control module (ECM), heated oxygen sensor (HO2S), brake system vacuum pump	**91**/10
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- Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor	**91**/14
- Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light	**91**/15
- Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light	**91**/16
- Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp	**91**/17

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1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/74 kW, code BEW	38/1
1.8L - Engine - Motronic Multiport Fuel Injection (MFI)/132 kW, code AWP	38/1
2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code AVH, BEV	38/1
2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code BBW	87/1
2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/147 kW, code BDF	38/1
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● **Air conditioning (manual control, not Climatronic),** from May 2003	
2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code BBW	87/1
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2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code AVH, BBW, BEV	83/1
● **Automatic transmission, 5 speed automatic with Tiptronic,** from December 2002	
1.8L - Engine - Motronic Multiport Fuel Injection (MFI)/132 kW, code AWP	
2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/147 kW, code BDF	
1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/74 kW, code BEW	84/1
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● **Central locking system with remote control (Jetta Wagon),** from May 2001	
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● **Climatronic (automatic climate control),** from May 1999	
2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/147 kW, code BDF	39/1
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● **Comfort System (without power windows), Jetta Wagon,** from May 2001	55/1
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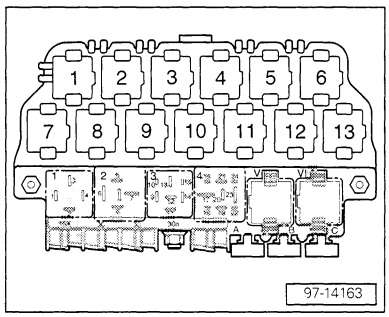
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Golf CL (Canada) - Standard Equipment,

from August 2002

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations"



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

3 J207 - Starting Interlock Relay (53)

7 J89 - Daytime Running Lights Change-over Relay (173)

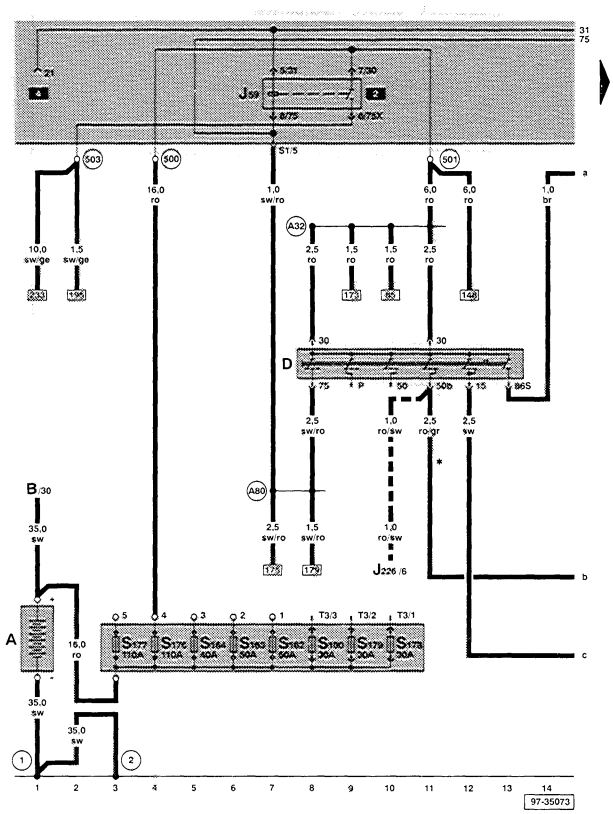
Relay panel:

1 J4 - Dual Horn Relay (53)

2 J52 - Load Reduction Relay (100)

V J31 - Wiper/Washer Intermittent Relay (377)

VI J31 - Wiper/Washer Intermittent Relay (377)



Battery, ignition/starter switch

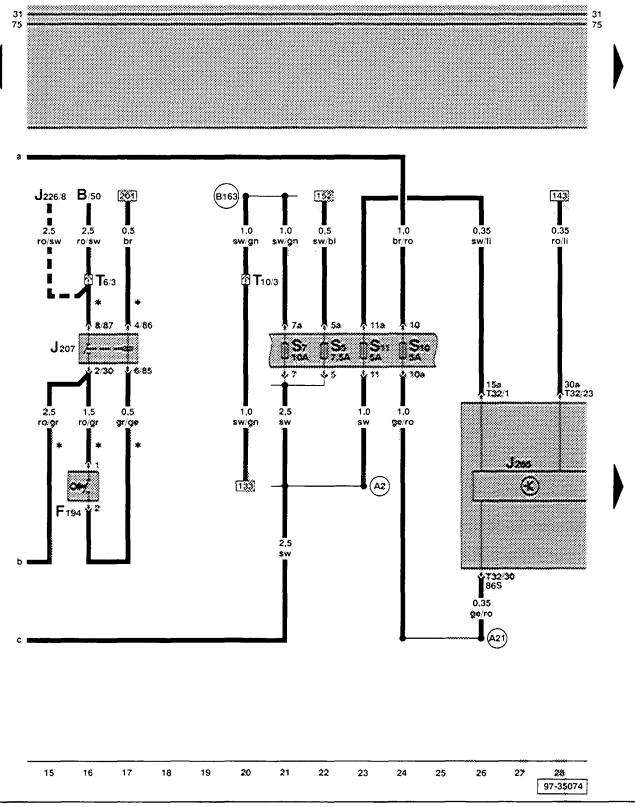
A - Battery
B - Starter
D - Ignition/Starter Switch
J59 - Load Reduction Relay
J226 - Park/Neutral Position (PNP) Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S164 - Fuse -3- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
S178 - Fuse -6- (30) in fuse bracket/battery
S179 - Fuse -7- (30) in fuse bracket/battery
S180 - Fuse -8- (30) in fuse bracket/battery
T3 - 3-Pin Connector

(1) - Ground strap, battery to body
(2) - Ground strap, transmission to body
(500) - Threaded connection -1- (30) on the relay plate
(501) - Threaded connection -2- (30) on the relay plate
(503) - Threaded connection -2- (75x) on the relay plate
(A32) - Plus connection (30), in instrument panel wiring harness
(A80) - Connection -1- (X), in instrument panel wiring harness

* - Manual transmission only
--- Automatic transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

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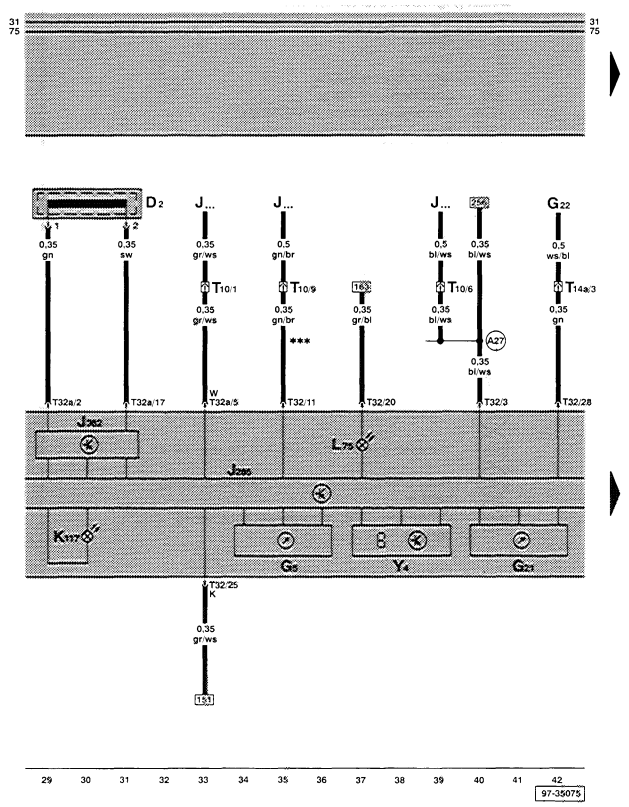
Instrument cluster, clutch pedal position (CPP) switch, starting interlock relay

- B - Starter
- F194 - Clutch Pedal Position (CPP) Switch*
- J207 - Starting Interlock Relay*
- J226 - Park/Neutral Position (PNP) Relay
- J285 - Control module with indicator unit in instrument panel insert
- S5 - Fuse 5 in fuse holder
- S7 - Fuse 7 in fuse holder
- S10 - Fuse 10 in fuse holder
- S11 - Fuse 11 in fuse holder
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T32 - 32-Pin Connector, blue

- (A2) - Plus connection (15), in instrument panel wiring harness
- (A21) - Wire connection (86s), in instrument panel wiring harness
- (B163) - Plus connection -1- (15) in wiring harness interior

- * - Manual transmission only
- --- Automatic transmission only

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sw = black
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br = brown
gn = green
bl = blue
gr = grey
li = lilac
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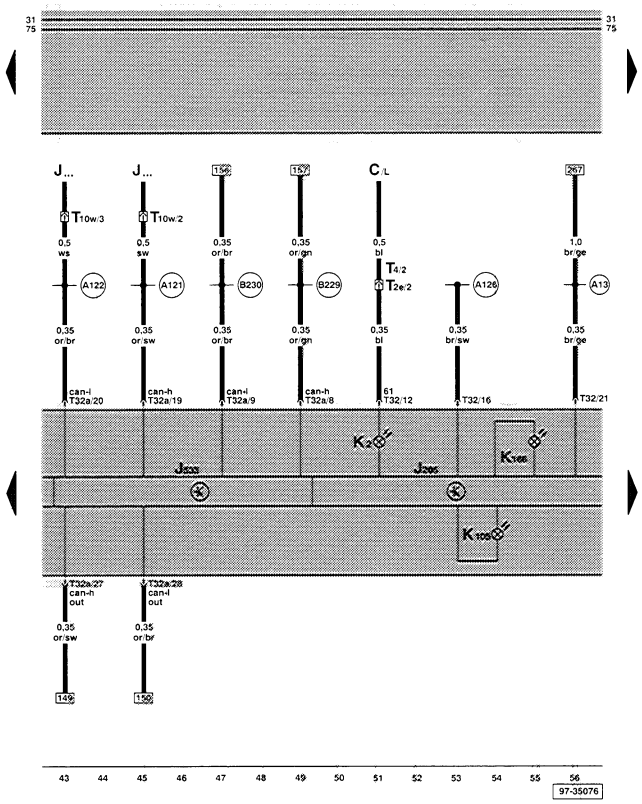


Instrument cluster, tachometer, speedometer, odometer display, anti-theft immobilizer, warning light for anti-theft immobilizer sensor

- D2 - Induction coil of anti-theft immobilizer
- G5 - Tachometer
- G21 - Speedometer
- G22 - Speedometer Vehicle Speed Sensor
- J285 - Control module with indicator unit in instrument panel insert
- J362 - Control module for anti-theft immobilizer
- J... - Engine Control Module (ECM)
- K117 - Warning light for anti-theft immobilizer sensor
- L75 - Digital Display Light
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, in engine compartment, in wiring duct, left
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green
- T68a - 68-Pin Connector, on Transmission Control Module (TCM)
- Y4 - Odometer Display

- (A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness
- * - 4 speed automatic transmission/ manual transmission
- *** - Through April 20002

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sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
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or = orange

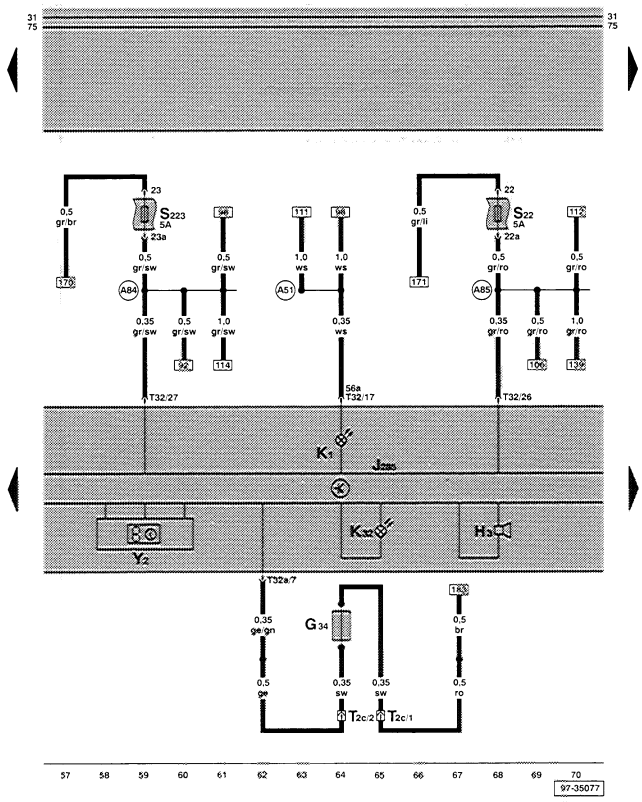


Instrument cluster, generator (GEN) warning light, low fuel level warning light, door ajar indicator lamp

- C - Generator (GEN)
- J285 - Control module with indicator unit in instrument panel insert
- J533 - Data Bus On Board Diagnostic Interface
- J... - Engine Control Module (ECM)
- K2 - Generator (GEN) Warning Light
- K105 - Low Fuel Level Warning Light
- K166 - Door Ajar Indicator Lamp
- T2e - Double Connector, near starter (in vehicles without air conditioning)
- T4 - 4-Pin Connector, near starter (in vehicles with air conditioning)
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green

- (A13) - Wire connection (door contact switch) in instrument panel wiring harness
- (A121) - Connection (high bus), in instrument panel wiring harness
- (A122) - Connection (low bus), in instrument panel wiring harness
- (A126) - Connection (contact switch in rear lid) in instrument panel wiring harness
- (B229) - Connection (high bus), in instrument panel wiring harness
- (B230) - Connection (low bus), in instrument panel wiring harness

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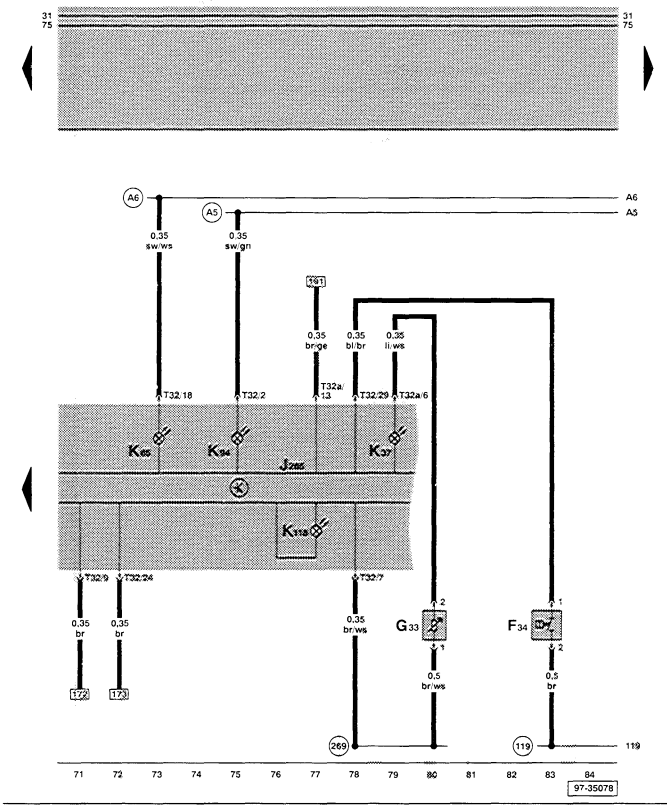


Instrument cluster, left front brake pad wear sensor, brake pad wear indicator light, headlight high beam indicator light, digital clock

- G34 - Left Front Brake Pad Wear Sensor
- H3 - Warning buzzer
- J285 - Control module with indicator unit in instrument panel insert
- K1 - Headlight High Beam Indicator Light
- K32 - Brake Pad Wear Indicator Light
- S22 - Fuse 22 in fuse holder
- S223 - Fuse 23 in fuse holder
- T2c - Double Connector, near left front brake pad wear sensor
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green
- Y2 - Digital Clock

- (A51) - Wire connection (56), in instrument panel wiring harness
- (A84) - Connection (58L) in instrument panel wiring harness
- (A85) - Connection (58R) in instrument panel wiring harness

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ro = red
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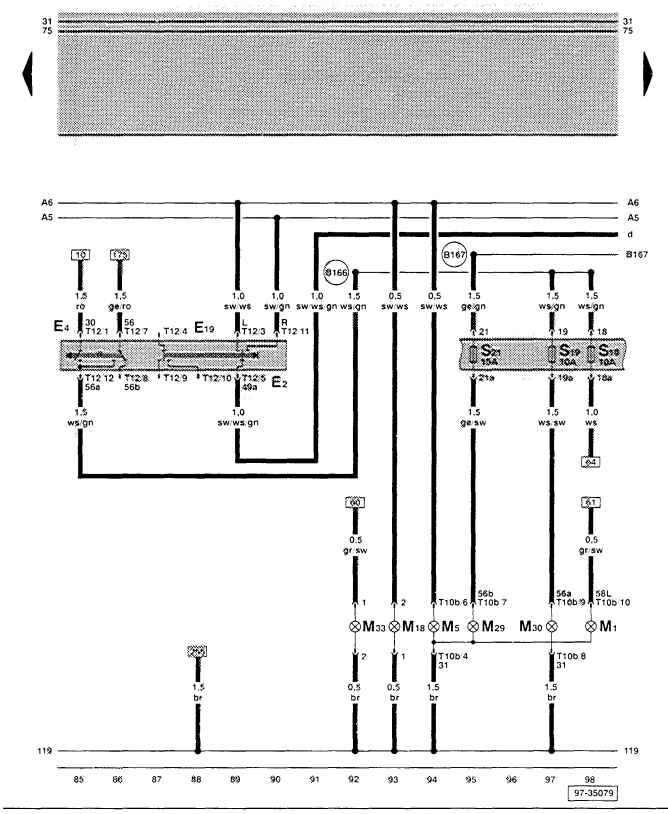
Instrument cluster, brake fluid level warning switch, low windshield washer fluid level indication, left and right turn signal indicator lights

F34 - Brake Fluid Level Warning Switch
G33 - Windshield Washer Fluid Level Sensor
J285 - Control module with indicator unit in instrument panel insert
K37 - Low Windshield Washer Fluid Level Indicator Light
K65 - Left Turn Signal Indicator Light
K94 - Right Turn Signal Indicator Light
K118 - Warning light for brake system
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(119) - Ground connection -1-, in headlight wiring harness
(269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
(A5) - Plus connection (right turn signal), in instrument panel wiring harness
(A6) - Plus connection (left turn signal), in instrument panel wiring harness

Edition 04.03

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ws = white
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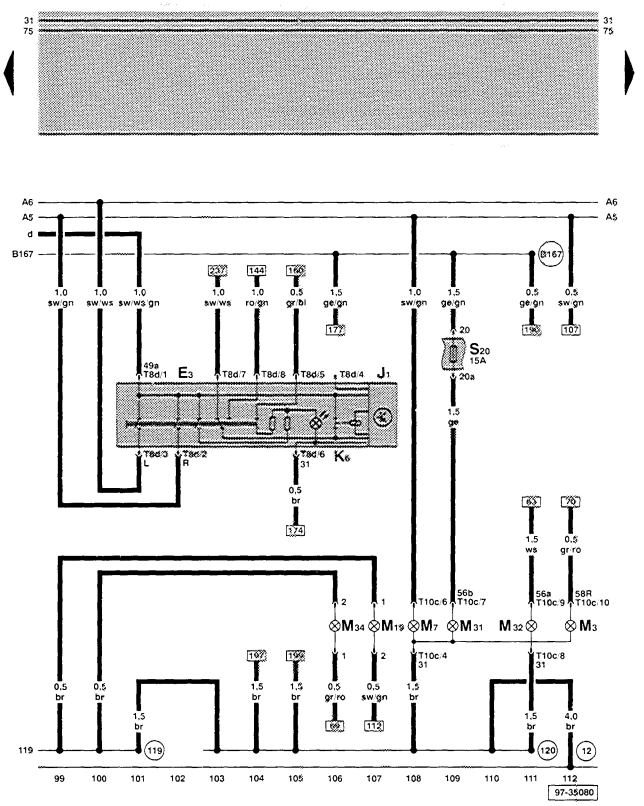
Turn signal switch, headlight dimmer/flasher switch, left front turn signal light, light for side marker front left, left headlight

E2 - Turn signal switch
E4 - Headlight Dimmer/Flasher Switch
E19 - Park Light Switch
M1 - Left Parking Light
M5 - Left Front Turn Signal Light
M18 - Left, Side Turn Signal Light
M29 - Left Low Beam Headlight
M30 - Left High Beam Headlight
M33 - Light for side marker front left
S18 - Fuse 18 in fuse holder
S19 - Fuse 19 in fuse holder
S21 - Fuse 21 in fuse holder
T10b - 10-Pin Connector
T12 - 12-Pin Connector

(B166) - Connection (56a) in passenger compartment wiring harness
(B167) - Connection (56b) in passenger compartment wiring harness

Edition 04.03

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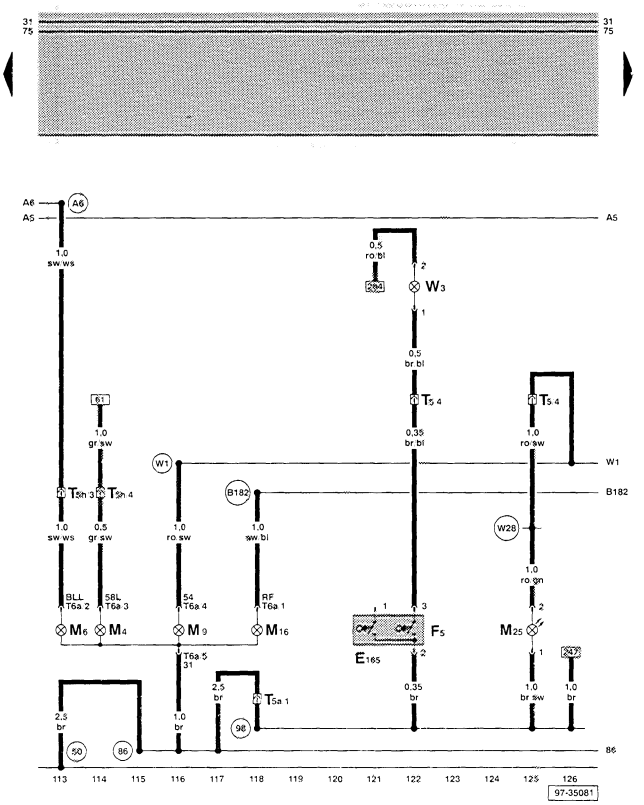


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
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ge = yellow
or = orange

Emergency flasher switch, turn signal relay, right front turn signal light, light for side marker front right, right headlight

- E3 - Emergency Flasher Switch
- J1 - Turn Signal Relay
- K6 - Indicator light for emergency flasher system
- M3 - Right Parking Light
- M7 - Right Front Turn Signal Light
- M19 - Right, Side Turn Signal Light
- M31 - Right Low Beam Headlight
- M32 - Right High Beam Headlight
- M34 - Light for side marker front right
- S20 - Fuse 20 in fuse holder
- T8d - 8-Pin Connector
- T10c - 10-Pin Connector

- (12) - Ground connection, in engine compartment, left
- (119) - Ground connection -1-, in headlight wiring harness
- (120) - Ground connection -2-, in headlight wiring harness
- (B167) - Connection (56b), in passenger compartment wiring harness

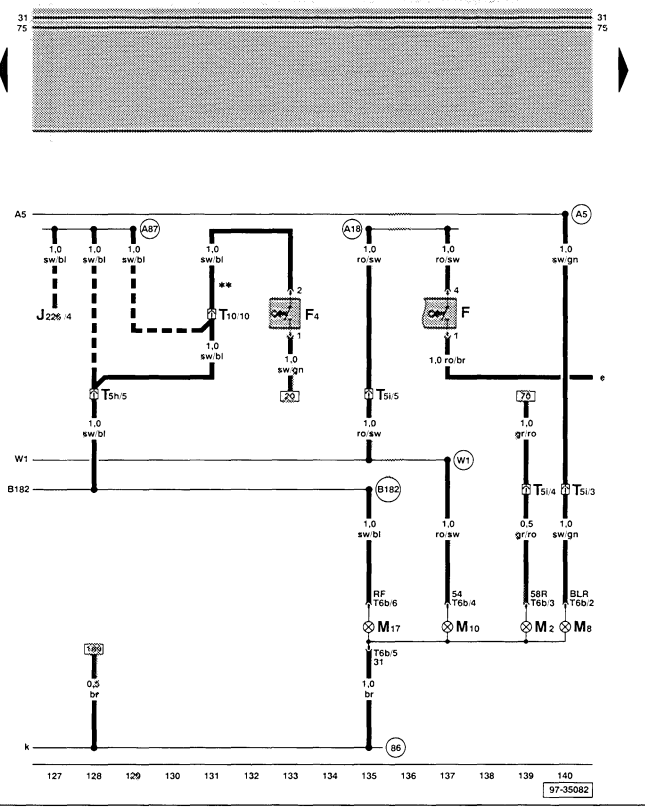


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Left rear turn signal light, left back-up light, left brake/tail light, high-mount brake light, luggage compartment light

- E165 - Trunk Lid Release Switch
- F5 - Luggage Compartment Light Switch
- M4 - Left Tail Light
- M6 - Left Rear Turn Signal Light
- M9 - Left Brake Light
- M16 - Left Back-Up Light
- M25 - High-mount Brake Light (32 light emitting diodes)
- T5 - 5-Pin Connector, black, connector station C-pillar, left
- T5a - 5-Pin Connector, pink, connector station C-pillar, left
- T5h - 5-Pin Connector, near left A-pillar, lower part, in harness
- T6a - 6-Pin Connector
- W3 - Luggage compartment Light

- (50) - Ground connection, in luggage compartment, left
- (86) - Ground connection -1-, in rear wiring harness
- (98) - Ground connection, in rear lid wiring harness
- (A6) - Plus connection (left turn signal), in instrument panel wiring harness
- (B182) - Connection (RF), in passenger compartment wiring harness
- (W1) - Plus connection -1- (54), in rear wiring harness
- (W28) - Plus connection -2- (54), in wiring harness taillight assembly



Back-up light switch, brake light switch, right rear turn signal light, right back-up light, right brake/tail light

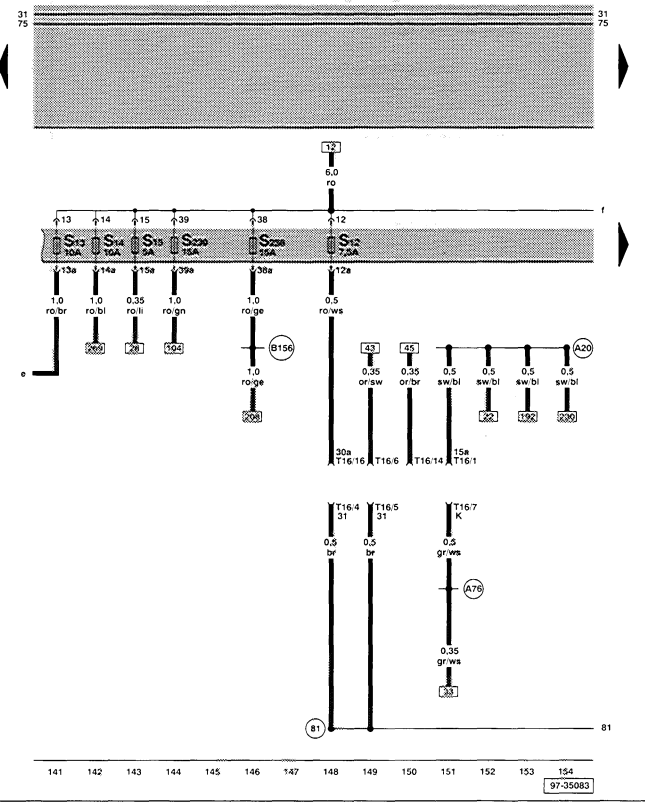
- F - Brake Light Switch
- F4 - Back-Up Light Switch
- J226 - Park/Neutral Position (PNP) Relay
- M2 - Right Tail Light
- M8 - Right Rear Turn Signal Light
- M10 - Right Brake Light
- M17 - Right Back-Up Light
- T5h - 5-Pin Connector, near left A-pillar, lower part, in harness
- T5i - 5-Pin Connector, near left A-pillar, lower part, in harness
- T6b - 6-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left

- (86) - Ground connection -1-, in rear wiring harness
- (A5) - Plus connection (right turn signal), in instrument panel wiring harness
- (A18) - Wire connection (54), in instrument panel wiring harness
- (A87) - Connection (reverse lamp), in instrument panel wiring harness
- (B182) - Connection (RF), in passenger compartment wiring harness
- (W1) - Plus connection -1- (54), in rear wiring harness

** - Manual transmission only

--- Automatic transmission only

ws = white
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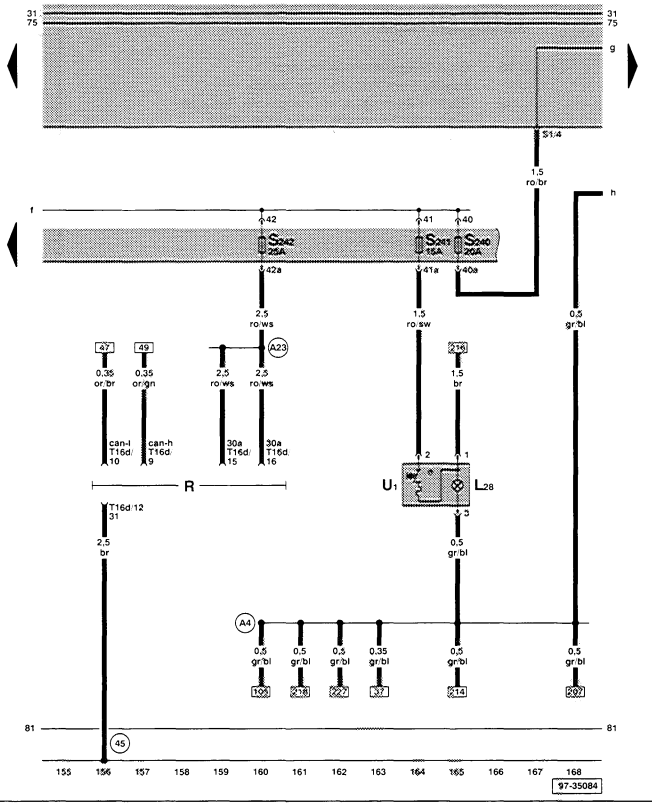


Data Link Connector (DLC)

- S12 - Fuse 12 in fuse holder
- S13 - Fuse 13 in fuse holder
- S14 - Fuse 14 in fuse holder
- S15 - Fuse 15 in fuse holder
- S238 - Fuse 38 in fuse holder
- S239 - Fuse 39 in fuse holder
- T16 - Data Link Connector (DLC), below instrument panel, left

- (81) - Ground connection -1-, in instrument panel wiring harness
- (A20) - Wire connection (15a), in instrument panel wiring harness
- (A76) - Connection (K-diagnosis wire) in instrument panel wiring harness
- (B156) - Plus connector (30a), in wiring harness interior

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
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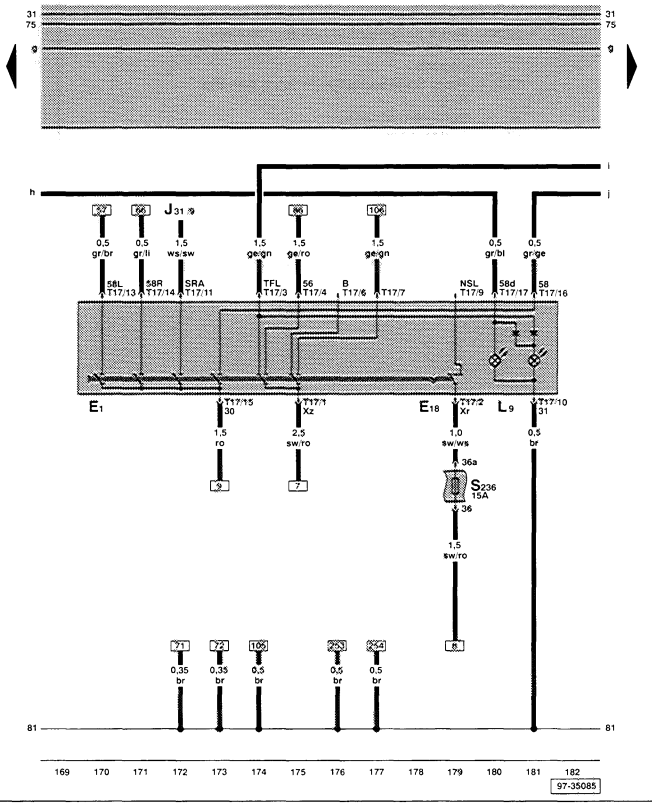
ws = white
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ro = red
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li = lilac
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or = orange

Radio connection, cigarette lighter

L28 - Cigarette Lighter Light
R - Radio
S240 - Fuse 40 in fuse holder
S241 - Fuse 41 in fuse holder
S242 - Fuse 42 in fuse holder
T16d - 16-Pin Connector
U1 - Cigarette Lighter

(45) - Ground connection, behind instrument panel, center
(A4) - Plus connection (58b), in instrument panel wiring harness
(A23) - Wire connection (30a), in instrument panel wiring harness

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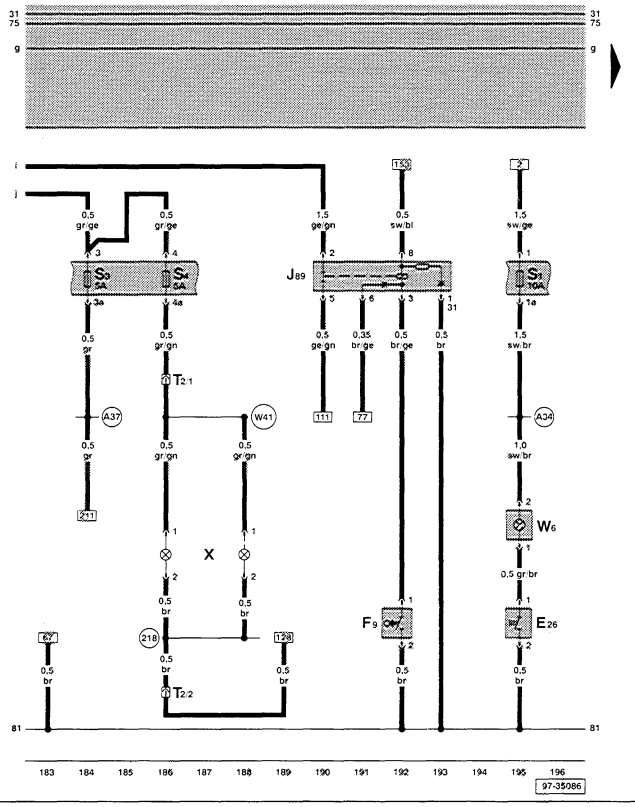


ws = white
sw = black
ro = red
br = brown
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bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Light switch

E1 - Light switch
E18 - Rear Fog Light Switch
J31 - Wiper/Washer Intermittent Relay
L9 - Headlight Switch Light
S236 - Fuse 36 in fuse holder
T17 - 17-Pin Connector

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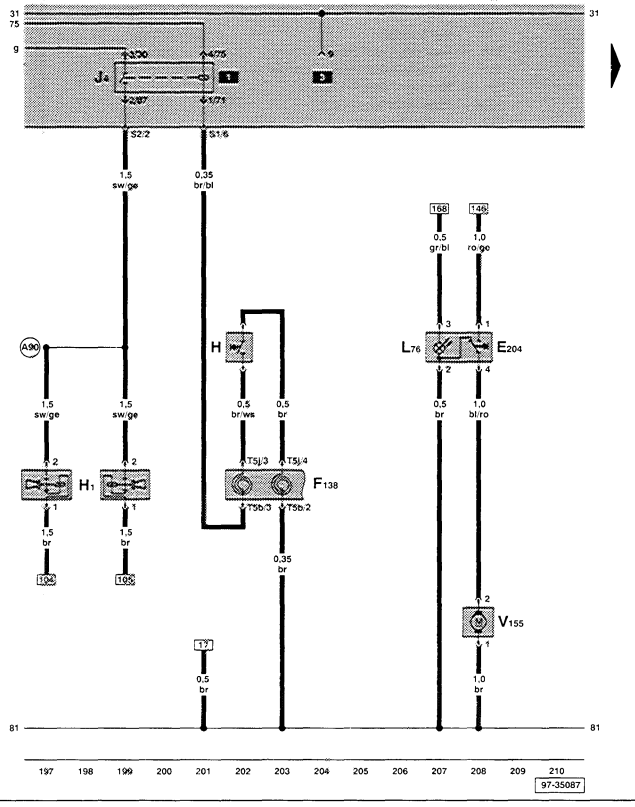


ws = white
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ge = yellow
or = orange

Daytime running lights change-over relay, License plate light, glove compartment light, parking brake warning light switch

- E26 - Glove compartment light switch
- F9 - Parking Brake Warning Light Switch
- J89 - Daytime Running Lights Change-over Relay, on the thirteenfold auxiliary relay panel, above relay panel
- S1 - Fuse 1 in fuse holder
- S3 - Fuse 3 in fuse holder
- S4 - Fuse 4 in fuse holder
- T2 - Double Connector, in luggage compartment, left
- W6 - Glove Compartment Light
- X - License Plate Light

- (218) - Ground connection -1-, in rear lid wiring harness
- (A34) - Wire connection (75x), in instrument panel wiring harness
- (A37) - Wire connection (58a), in instrument panel wiring harness
- (W41) - Plus connection (58), in wiring harness

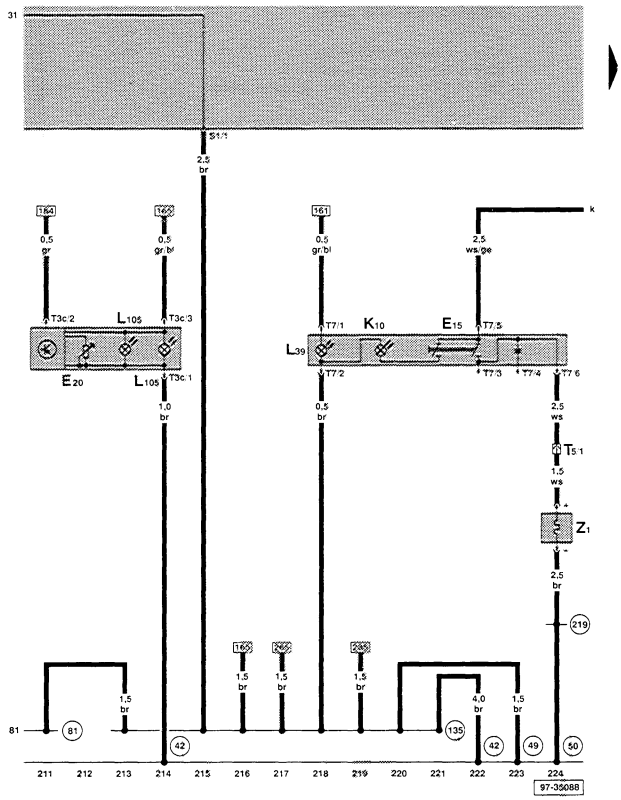


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Dual tone horn, fuel tank door remote

- E204 - Switch for remote/fuel tank door (also see Comfort System with power windows wiring diagram)
- F138 - Airbag Spiral Spring/Return Spring with Slip Ring
- H - Signal horn activation
- H1 - Dual tone horn
- J4 - Dual Horn Relay
- L76 - Push Button Light
- T5b - 5-Pin Connector
- T5j - 5-Pin Connector
- V155 - Motor for fuel tank lid unlock

- (A90) - Connection (dual tone horn), in instrument panel wiring harness



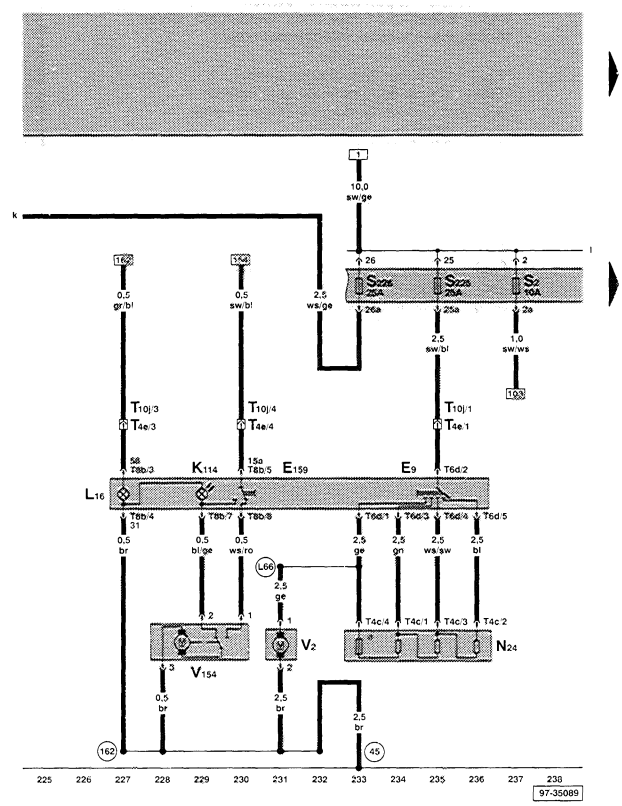
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Instrument panel light dimmer switch, rear window defogger switch, heated rear window

- E15 - Rear window defogger switch
- E20 - Instrument Panel Light Dimmer Switch
- K10 - Indicator light for heated rear windshield
- L39 - Rear Window Defogger Switch Light
- L105 - Illumination for lighting controller
- T3c - 3-Pin Connector
- T5 - 5-Pin Connector, black, connector station C-pillar, left
- T7 - 7-Pin Connector
- Z1 - Heated rear window

- (42) - Ground connection, beside steering column
- (49) - Ground connection, on steering column
- (50) - Ground connection, in luggage compartment, left
- (81) - Ground connection -1-, in instrument panel wiring harness
- (135) - Ground connection -2-, in instrument panel wiring harness
- (219) - Ground connection -2-, in rear lid wiring harness

Edition 04.03



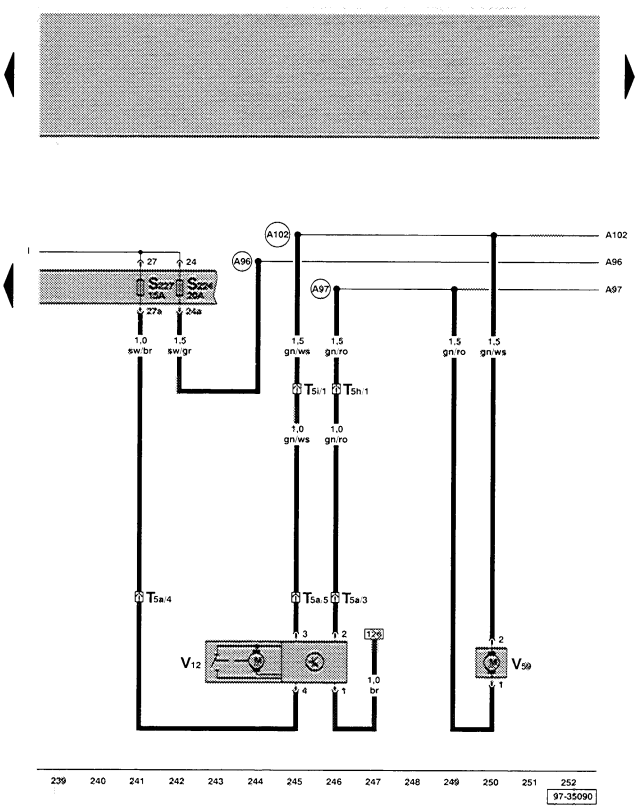
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Fresh air blower switch, fresh air/recirculating flap switch, fresh air blower

- E9 - Fresh Air Blower Switch
- E159 - Fresh Air/Recirculating Flap Switch
- K114 - Fresh Air and Recirculating Air Mode Indicator Light
- L16 - Fresh Air Control Lever Light
- N24 - Fresh Air Blower Series Resistance with Fuse
- S2 - Fuse 2 in fuse holder
- S225 - Fuse 25 in fuse holder
- S226 - Fuse 26 in fuse holder
- T4c - 4-Pin Connector
- T4e - 4-Pin Connector, behind instrument panel, center (in vehicles without air conditioning)
- T6d - 6-Pin Connector
- T8b - 8-Pin Connector
- T10j - 10-Pin Connector, behind instrument panel, center (in vehicles with air conditioning)
- V2 - Fresh Air Blower
- V154 - Servo motor for fresh-/recirculating air door

- (45) - Ground connection, behind instrument panel, center
- (162) - Ground connection, in blower motor wiring harness
- (L66) - Connection, in wiring harness heater blower

Edition 04.03

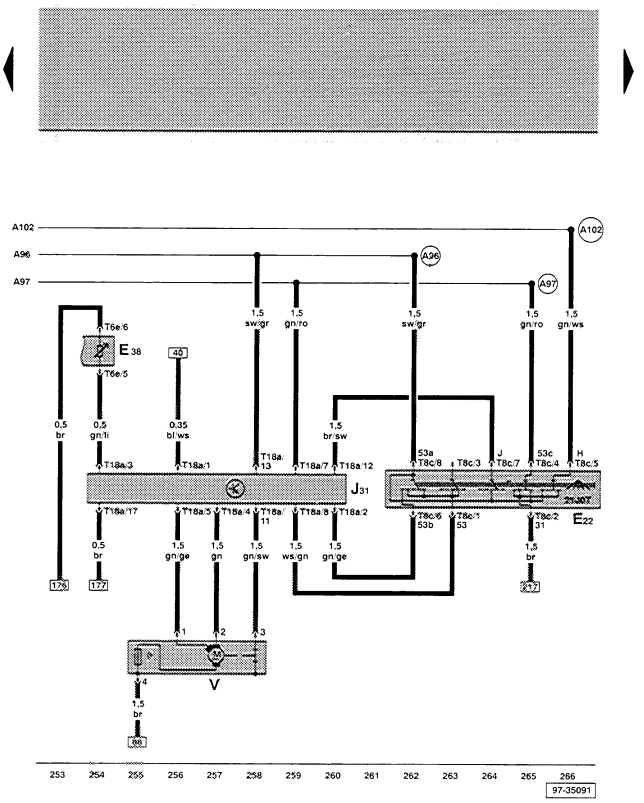


Motor for rear windshield wiper, windshield and rear window washer pump

S224 - Fuse 24 in fuse holder
S227 - Fuse 27 in fuse holder
T5a - 5-Pin Connector, pink, connector station C-pillar, left
T5h - 5-Pin Connector, near left A-pillar, lower part, in harness
T5i - 5-Pin Connector, near left A-pillar, lower part, in harness
V12 - Motor for rear windshield wiper
V59 - Windshield and Rear Window Washer Pump

(A96) - Connection (53a), in instrument panel wiring harness
(A97) - Connection (53), in instrument panel wiring harness
(A102) - Connection (windshield wiper), in instrument panel wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

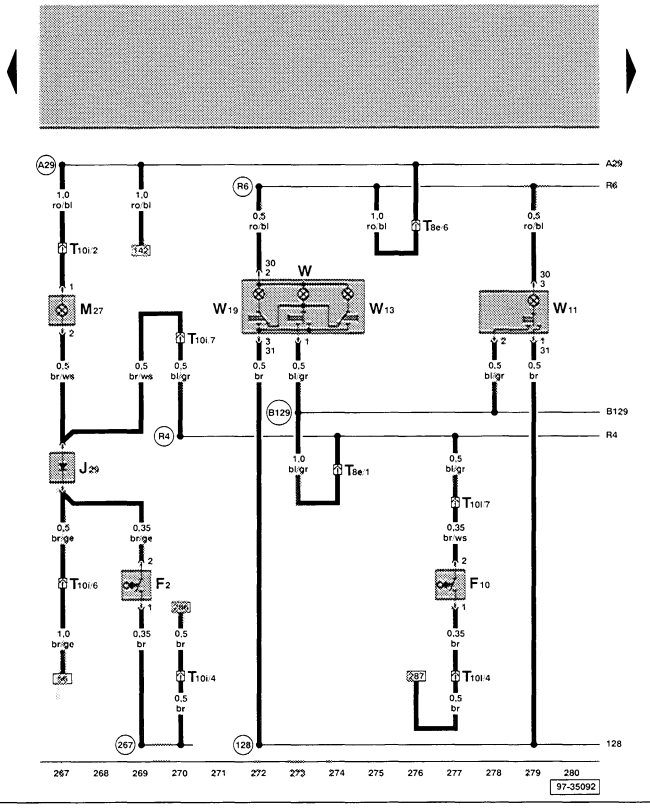


Windshield wiper/washer switch, windshield wiper intermittent regulator, windshield wiper motor, wiper/washer intermittent relay

E22 - Windshield Wiper/Washer Switch
E38 - Windshield Wiper Intermittent Regulator
J31 - Wiper/Washer Intermittent Relay, on relais panel
T6e - 6-Pin Connector
T8c - 8-Pin Connector
T18a - 18-Pin Connector
V - Windshield Wiper Motor

(A96) - Connection (53a), in instrument panel wiring harness
(A97) - Connection (53), in instrument panel wiring harness
(A102) - Connection (windshield wiper), in instrument panel wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



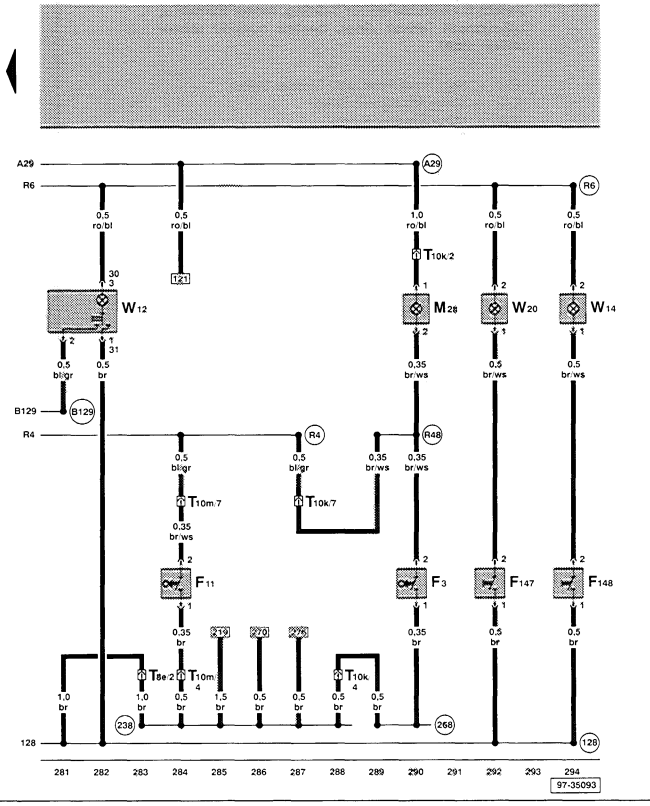
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Front Interior lights, left rear reading light, left door warning light, Door contact switch - driver's side, left rear door contact switch

- F2 - Door contact Switch - Driver's side
- F10 - Left Rear Door Contact Switch
- J29 - Blocking Diode
- M27 - Left Door Warning Light
- T8e - 8-Pin Connector, behind left A-pillar trim, center
- T10l - 10-Pin Connector, black, connector station A-pillar, left
- T10l - 10-Pin Connector, black, connector station B-pillar, left
- W - Front Interior Light
- W11 - Left Rear Reading Light
- W13 - Passenger's Map/Reading Light
- W19 - Left Front Reading Light

- (128) - Ground connection -1-, in interior light wiring harness
- (A29) - Wire connection (interior light), in instrument panel wiring harness
- (B129) - Connector (interior light, 31) in wiring harness interior
- (R4) - Wire connection -1-, in interior light/door contact switch wiring harness
- (R6) - Plus connection -1-, in interior light wiring harness
- (267) - Ground connector -2-, in wiring harness door cable - driver side

Edition 04.03



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Right Rear Reading Light, right door warning light, make-up mirror lights

- F3 - Door contact switch-Passenger side
- F11 - Right Rear Door Contact Switch
- F147 - Left Make-Up Mirror Light Switch
- F148 - Right Make-Up Mirror Light Switch
- M28 - Right Door Warning Light
- T8e - 8-Pin Connector, behind left A-pillar trim, center
- T10k - 10-Pin Connector, black, connector station A-pillar, right
- T10m - 10-Pin Connector, black, connector station B-pillar, right
- W12 - Right Rear Reading Light
- W14 - Right Make-up Mirror Light
- W20 - Left Make-up Mirror Light

- (128) - Ground connection -1-, in interior light wiring harness
- (238) - Ground connection -1-, in wiring harness interior
- (268) - Ground connection -2-, in wiring harness door cable - passenger side
- (A29) - Wire connection (interior light), in instrument panel wiring harness
- (B129) - Connector (interior light, 31) in wiring harness interior
- (R4) - Wire connection -1-, in interior light/door contact switch wiring harness
- (R6) - Plus connection -1-, in interior light wiring harness
- (R48) - Connection in door wiring harness, passenger side

Edition 04.03

Repair Manual page number 97-805

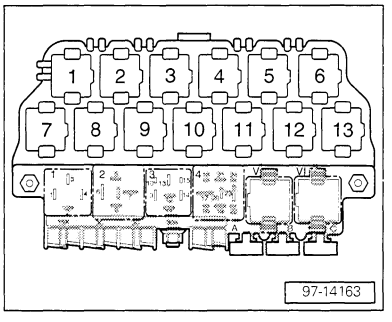
Repair Manual page number 97-804

Repair Manual page number 97-807

Heated power mirrors (Canada),

from May 2002

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations"



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

3 J207- Starting Interlock Relay (53)

7 J89 - Daytime Running Lights Change-over Relay (173)

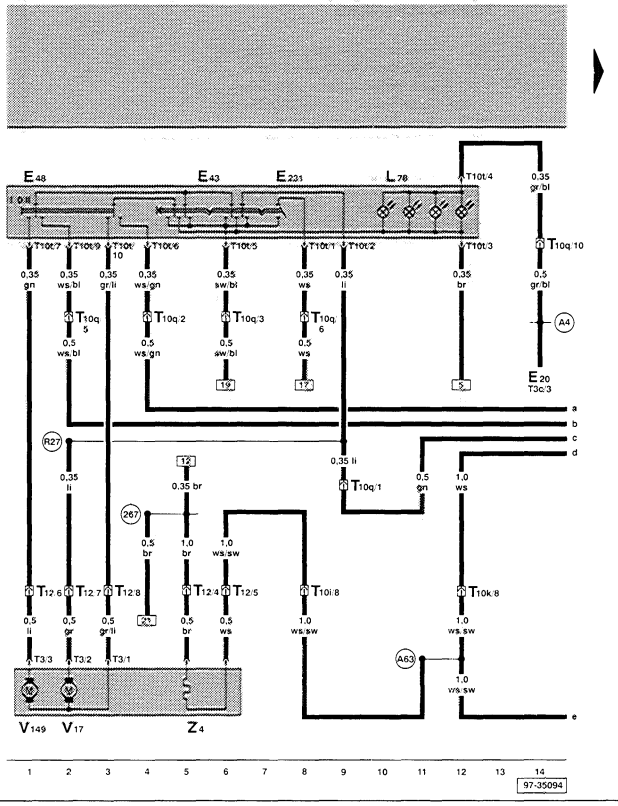
Relay panel:

1 J4 - Dual Horn Relay (53)

2 J52 - Load Reduction Relay (100)

V J31 - Wiper/Washer Intermittent Relay (377)

VI J31 - Wiper/Washer Intermittent Relay (377)



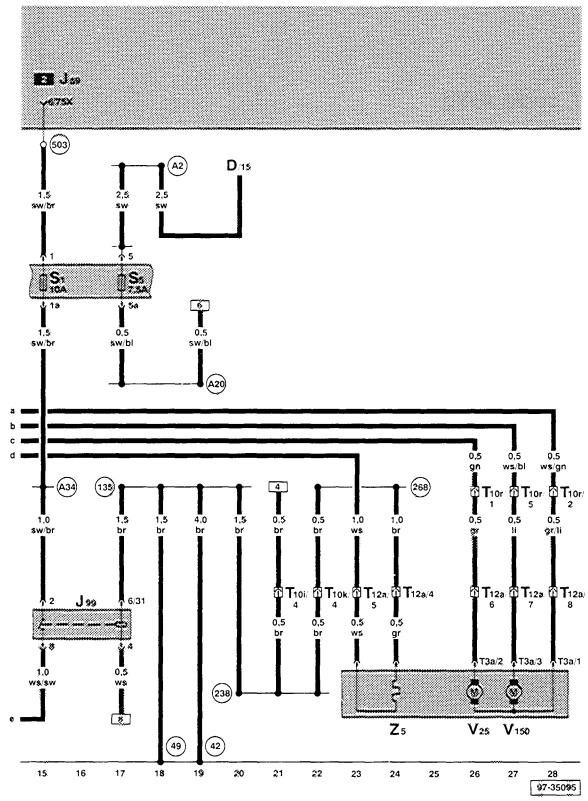
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Mirror adjustment switch, mirror selector switch, switch for outside mirror heating, motor for mirror adjustment (driver side), heated outside mirror (driver side)

E20 - Instrument Panel Light Dimmer Switch
E43 - Mirror Adjustment Switch
E48 - Mirror Selector Switch
E231 - Switch for outside mirror heating
L78 - Mirror Adjusting Switch Light
T3 - 3-Pin Connector
T3c - 3-Pin Connector
T10i - 10-Pin Connector, black, connector station A-pillar, left
T10k - 10-Pin Connector, black, connector station A-pillar, right
T10q - 10-Pin Connector, blue, connector station A-pillar, left
T10t - 10-Pin Connector
T12 - 12-Pin Connector, in driver's door
V17 - Driver's Side Mirror Adjustment Motor
V149 - Motor for mirror adjustment, driver side
Z4 - Heated outside mirror, driver side

(267) - Ground connector -2-, in wiring harness door cable - driver side
(A4) - Plus connection (58b), in instrument panel wiring harness
(A63) - Connector (mirror adjustment/-heated) in instrument panel wiring harness
(R27) - Wire connection (power mirror), in driver's door wiring harness

Repair Manual page number 97-806



Heated mirror relay, motor for mirror adjustment (passenger side), heated outside mirror (passenger side)

- D - Ignition/Starter Switch
- J59 - Load Reduction Relay
- J99 - Heated Mirror Relay, on the thirteenfold auxiliary relay panel, above relay panel
- S1 - Fuse 1 in fuse holder
- S5 - Fuse 5 in fuse holder
- T3a - 3-Pin Connector
- T10i - 10-Pin Connector, black, connector station A-pillar, left
- T10k - 10-Pin Connector, black, connector station A-pillar, right
- T10r - 10-Pin Connector, blue, connector station A-pillar, right
- T12a - 12-Pin Connector, in front passenger's door
- V25 - Passenger's Side Mirror Adjustment Motor
- V150 - Motor for mirror adjustment, passenger side
- Z5 - Heated outside mirror, passenger side

- (42) - Ground connection, beside steering column
- (49) - Ground connection, on steering column
- (135) - Ground connection -2-, in instrument panel wiring harness
- (238) - Ground connection -1-, in wiring harness interior
- (268) - Ground connection -2-, in wiring harness door cable - passenger side
- (503) - Threaded connection -2- (75x) on the relay plate
- (A2) - Plus connection (15), in instrument panel wiring harness
- (A20) - Wire connection (15a), in instrument panel wiring harness
- (A34) - Wire connection (75x), in instrument panel wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03

Repair Manual page number 97-809

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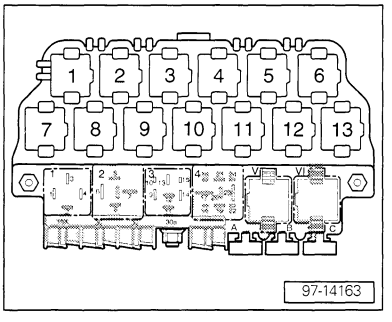
Repair Manual page number 97-808

1.8L - Engine - Motronic Multiport Fuel Injection (MFI)/132 kW, code AWP,

from May 2002

Additional Fuse, Relay, Control Module and Connector locations ⇒ Compontent Locations

Troubleshooting Procedures ⇒ Guided Fault Finding using VAS 5051/5052

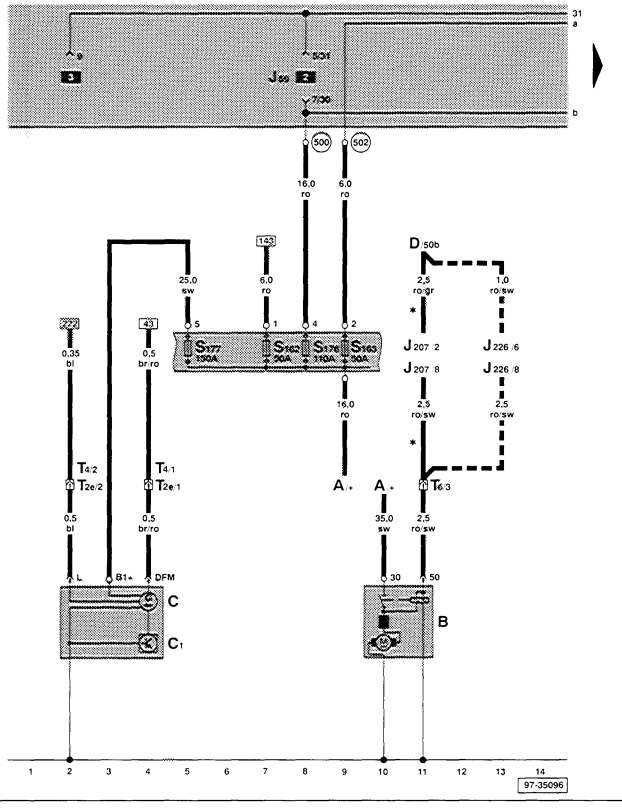


Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

2 J52 - Load Reduction Relay (100)

4 J17 - Fuel Pump (FP) Relay (409)



Generator (GEN), starter

A - Battery
B - Starter
C - Generator (GEN)
C1 - Voltage Regulator (VR)
D - Ignition/Starter Switch
J59 - Load Reduction Relay
J207 - Starting Interlock Relay
J226 - Park/Neutral Position (PNP) Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
T2e - Double Connector, near starter (vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left

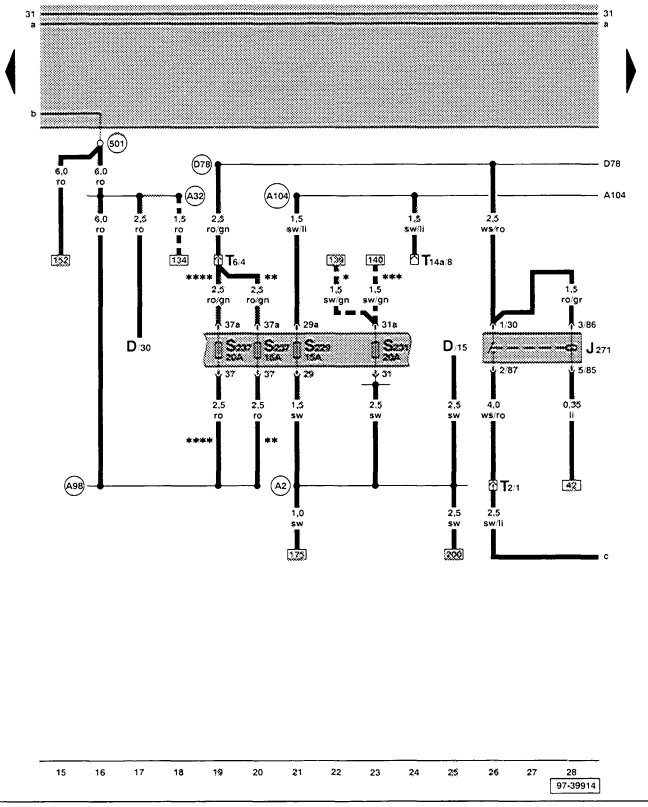
(500) - Threaded connection -1- (30) on the relay plate

(502) - Threaded connection -1- (30a) on the relay plate

* - Manual transmission only

--- Automatic transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



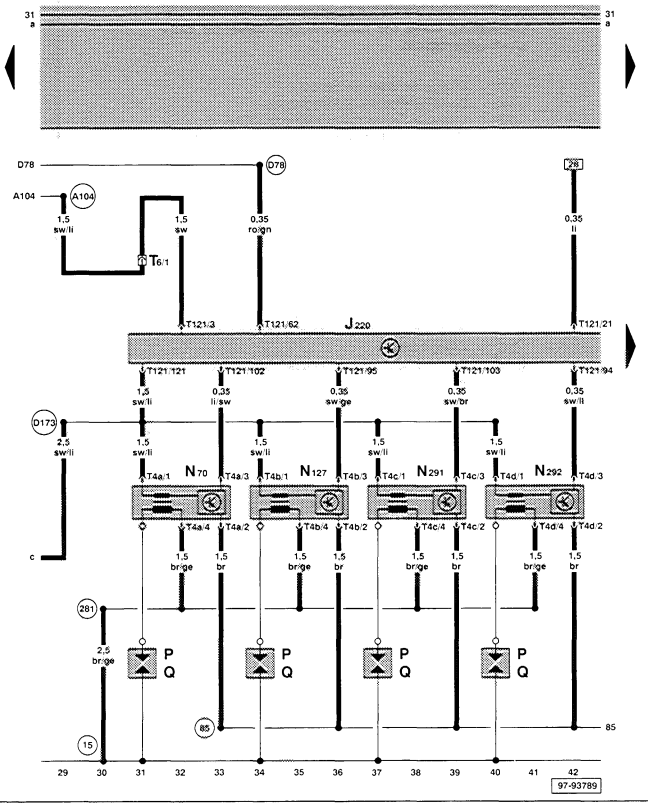
Power supply relay

D - Ignition/Starter Switch
J271 - Motronic Engine Control Module (ECM) Power Supply Relay, in protective housing, in engine compartment, left, production control number (428)
S229 - Fuse 29 in fuse holder
S231 - Fuse 31 in fuse holder
S237 - Fuse 37 in fuse holder
T2 - 2-Pin Connector, in engine compartment, left
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, near battery

(501) - Threaded connection -2- (30) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connection -4- (30), in instrument panel wiring harness
(A104) - Plus connection -2- (15), in instrument panel wiring harness
(D78) - Plus connection -1- (30a), in engine compartment wiring harness

* - Beginning December 2002
*** - Through November 2002
--- Automatic transmission only
** - Through April 2003
**** - Beginning May 2003

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



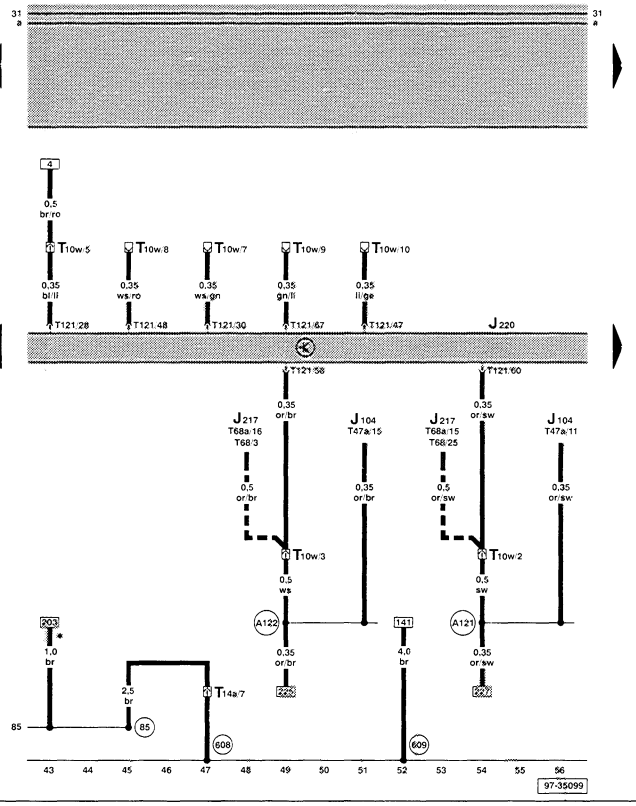
Motronic engine control module (ECM), ignition system

J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N70 - Ignition Coil 1 with Power Output Stage
N127 - Ignition Coil 2 with Power Output Stage
N291 - Ignition Coil 3 with Power Output Stage
N292 - Ignition Coil 4 with Power Output Stage
P - Spark Plug Connectors
Q - Spark Plugs
T4a - 4-Pin Connector
T4b - 4-Pin Connector
T4c - 4-Pin Connector
T4d - 4-Pin Connector
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T121 - 121-Pin Connector

(15) - Ground connection, on cylinder head
(85) - Ground connection -1-, in engine compartment wiring harness
(281) - Ground connection -1-, in wiring harness engine pre-wiring
(A104) - Plus connection -2- (15), in instrument panel wiring harness
(D78) - Plus connection -1- (30a), in engine compartment wiring harness
(D173) - Connection (87)(in engine wiring harness)

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Golf/Jetta — Wiring diagram — No. 78/5



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM)

- J104 - ABS Control Module, in engine compartment, left
- J217 - Transmission Control Module (TCM)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- T47a - 47-Pin Connector, on ABS Control Module
- T68 - 68-Pin Connector, on Transmission Control Module (TCM) (4 speed automatic transmission)
- T68a - 68-Pin Connector, on Transmission Control Module (TCM) (5 speed automatic transmission)
- T121 - 121-Pin Connector

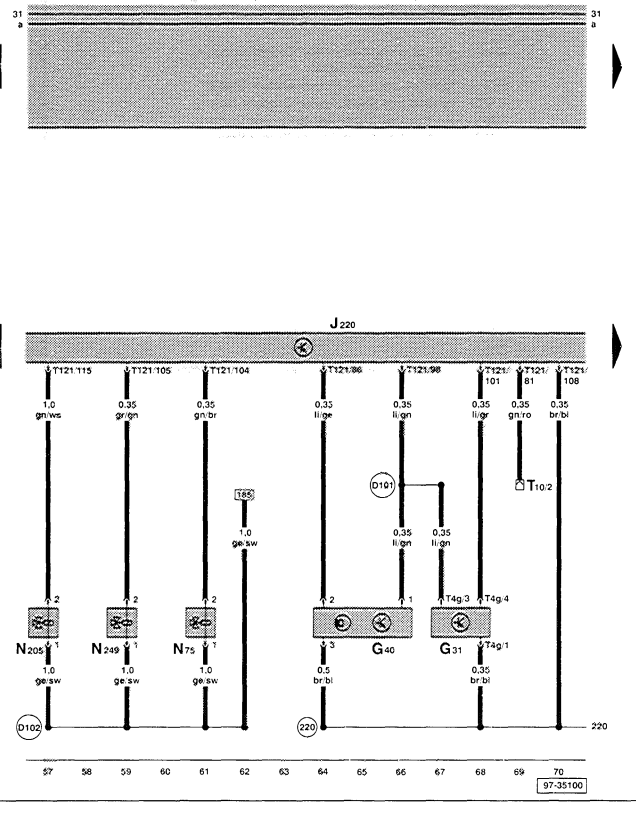
- (85) - Ground connection -1-, in engine compartment wiring harness
- (608) - Ground connection (in center plenum chamber)
- (609) - Ground connection (in right plenum chamber)
- (A121) - Connection (high bus), in instrument panel wiring harness
- (A122) - Connection (low bus), in instrument panel wiring harness

* - Manual transmission/ 4 speed automatic transmission only

--- Automatic transmission only

Edition 04.03

Golf/Jetta — Wiring diagram — No. 78/6



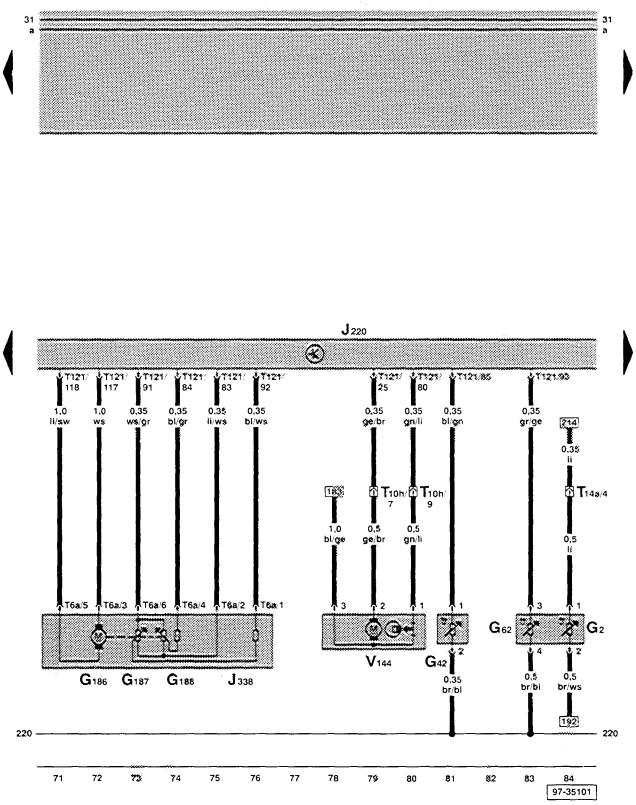
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Charge air pressure sensor, camshaft position (CMP) sensor, wastegate bypass regulator valve, re-circulating valve for turbocharger, valve for camshaft adjustment

- G31 - Charge Air Pressure Sensor
- G40 - Camshaft Position (CMP) Sensor
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- N75 - Wastegate Bypass Regulator Valve
- N205 - Valve -1- for camshaft adjustment
- N249 - Recirculating valve for turbocharger
- T4g - 4-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector

- (220) - Ground connection (sensor ground), in engine compartment wiring harness
- (D101) - Wire connection -1-, in engine compartment wiring harness
- (D102) - Wire connection -2-, in engine compartment wiring harness

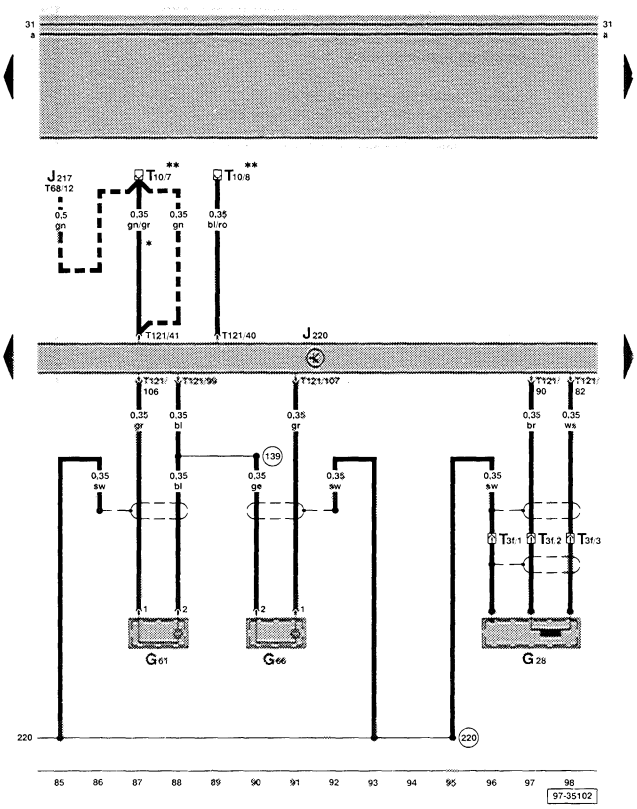
Edition 04.03



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), angle sensor for throttle drive (power accelerator actuation), intake air temperature (IAT) sensor, (ECT) sensor, leak detection pump (LDP)

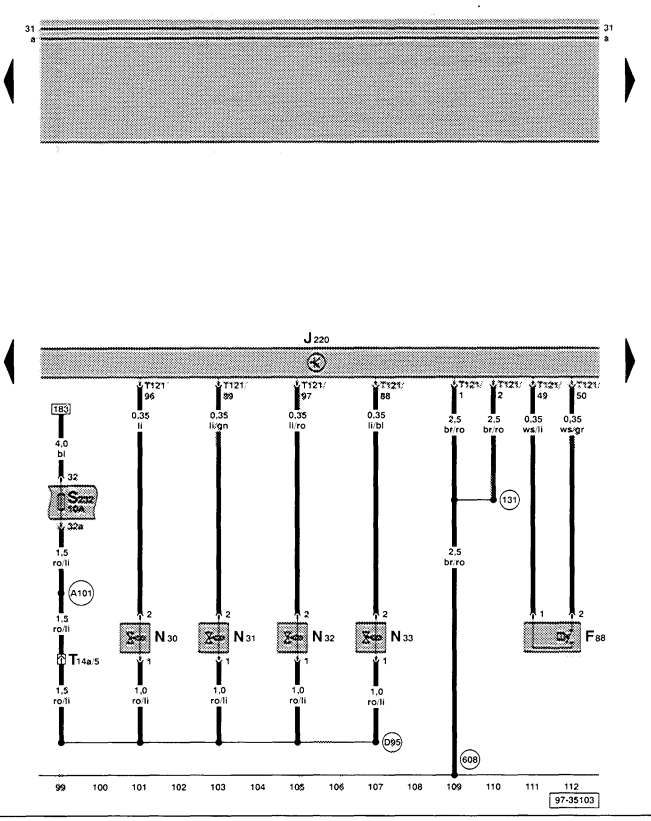
- G2 - Engine Coolant Temperature (ECT) Sensor
- G42 - Intake Air Temperature (IAT) Sensor
- G62 - Engine Coolant Temperature (ECT) Sensor
- G186 - Throttle drive (power accelerator actuation)
- G187 - Angle sensor -1- for throttle drive (power accelerator actuation)
- G188 - Angle sensor -2- for throttle drive (power accelerator actuation)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J338 - Throttle Valve Control Module
- T6a - 6-Pin Connector
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- T121 - 121-Pin Connector
- V144 - Leak Detection Pump (LDP)



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), engine speed (RPM) sensor, knock sensor (KS) 1, knock sensor (KS) 2

- G28 - Engine Speed (RPM) Sensor
- G61 - Knock Sensor (KS) 1
- G66 - Knock Sensor (KS) 2
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T3f - 3-Pin Connector, in engine compartment, front
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T68 - 68-Pin Connector, on Transmission Control Module (TCM) (4 speed automatic transmission)
- T121 - 121-Pin Connector
- (139) - Ground connection (sensor Ground), in Motronic Multiport Fuel Injection (MFI) wiring harness
- (220) - Ground connection (sensor ground), in engine compartment wiring harness
- * - Manual transmission only
- ** - A/C connection
- --- Automatic transmission only



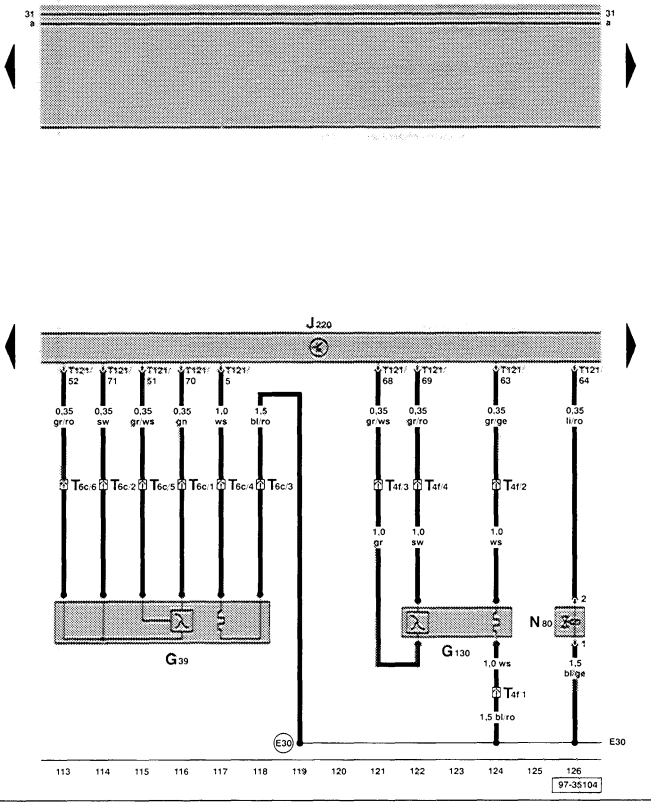
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), pressure switch/power steering, injectors

F88 - Pressure switch/power steering
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N30 - Cylinder 1 Fuel Injector
N31 - Cylinder 2 Fuel Injector
N32 - Cylinder 3 Fuel Injector
N33 - Cylinder 4 Fuel Injector
S232 - Fuse 32 in fuse holder
T14a - 14-Pin Connector, near battery
T121 - 121-Pin Connector

(131) - Ground connection -2-, in engine compartment wiring harness
(608) - Ground Connection (in center plenum chamber)
(A101) - Connection -3- (87a), in instrument panel wiring harness
(D95) - Wire connection (injectors), in engine compartment wiring harness

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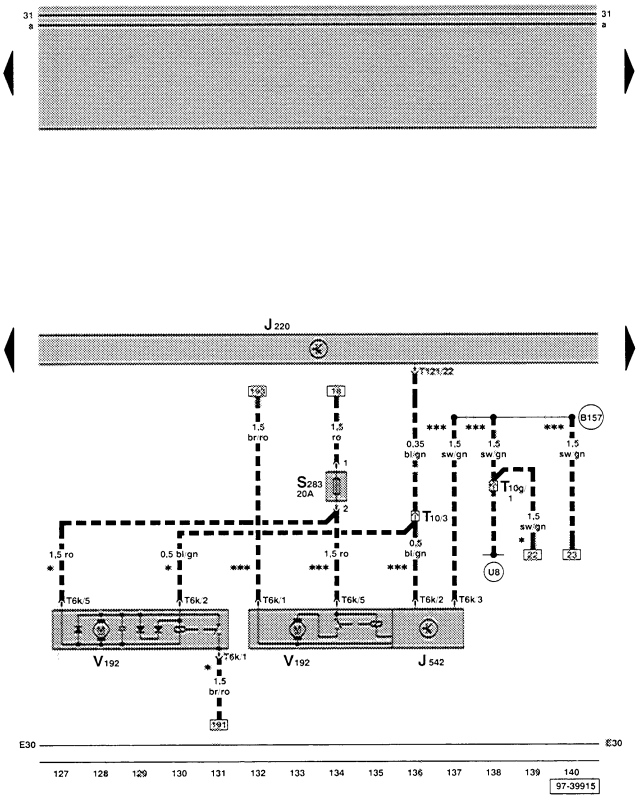
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ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), heated oxygen sensor (HO2S), oxygen sensor (O2S) behind three way catalytic converter (TWC), (EVAP) canister purge regulator valve

G39 - Heated Oxygen Sensor (HO2S)
G130 - Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC)
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N80 - Evaporative Emission (EVAP) Canister Purge Regulator Valve
T4f - 4-Pin Connector, in protective housing for connectors under right floor
T6c - 6-Pin Connector, in protective housing for connectors under right floor
T121 - 121-Pin Connector

(E30) - Connection (87a), in wiring harness engine

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Motronic engine control module (ECM), brake booster control module, brake system vacuum pump

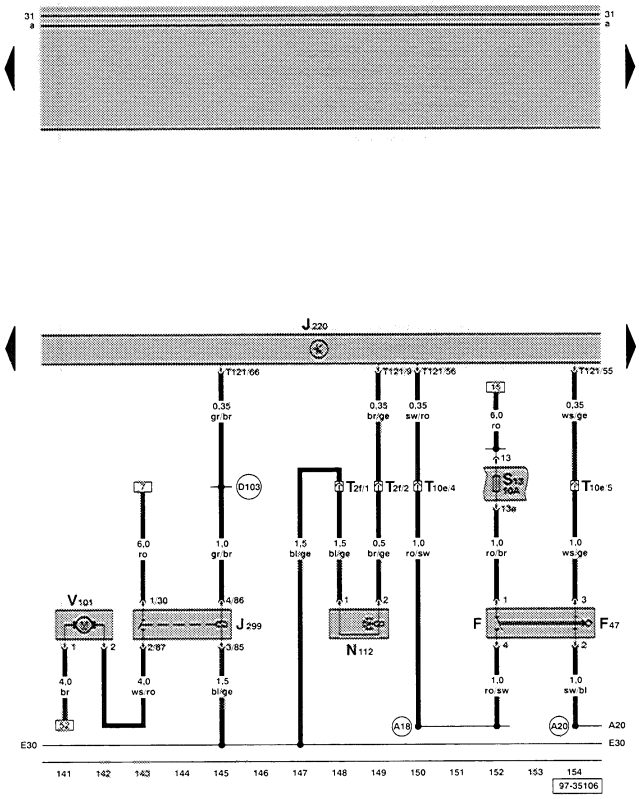
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J542 - Brake Booster Control Module
S283 - Brake Vacuum Pump Fuse, on the relay panel
T6k - 6-Pin Connector
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
T121 - 121-Pin Connector
V192 - Brake System Vacuum Pump

(B157) - Plus connection -3- (15a) in wiring harness interior
(U8) - Plus connection (15a) in automatic transmission wiring harness

* - Beginning December 2002
*** - Through November 2002
--- - Automatic transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.04



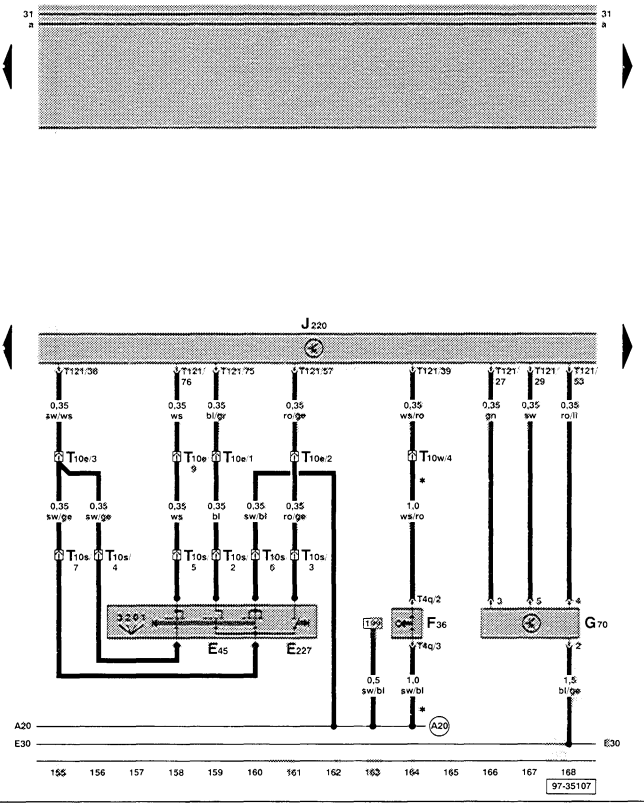
Motronic engine control module (ECM), secondary air injection (AIR) pump system, brake light switch, brake pedal switch

F - Brake Light Switch
F47 - Brake Pedal Switch
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
J299 - Secondary Air Injection (AIR) Pump Relay, in protective housing, in engine compartment, left, production control number (100)
N112 - Secondary Air Injection (AIR) Solenoid Valve
S13 - Fuse 13 in fuse holder
T2f - Double Connector, in engine compartment left
T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
T121 - 121-Pin Connector
V101 - Secondary Air Injection (AIR) Pump Motor

(A18) - Wire connection (54), in instrument panel
(A20) - Wire connection (15a), in instrument panel wiring harness
(D103) - Wire connection -3-, in engine compartment wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03



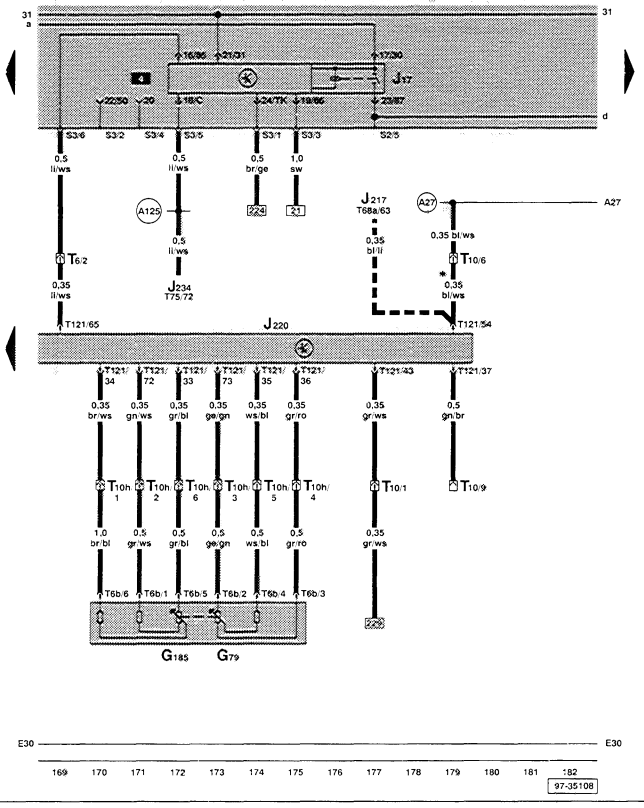
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sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), cruise control switch, mass air flow (MAF) sensor, clutch vacuum vent valve switch

- E45 - Cruise Control Switch
- E227 - Cruise Control Push Button (SET)
- F36 - Clutch Pedal Switch
- G70 - Mass Air Flow (MAF) Sensor
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T4q - 4-Pin Connector
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T10s - 10-Pin Connector, near steering column
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector

(A20) - Wire connection (15a), in instrument panel wiring harness

* - Manual transmission only



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), throttle position (TP) sensor, fuel pump (FP) relay

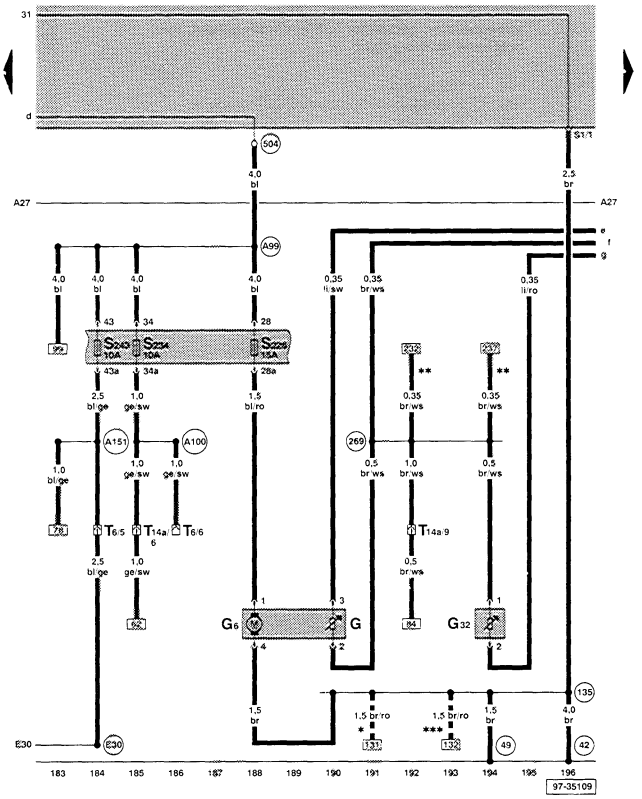
- G79 - Throttle Position (TP) Sensor
- G185 - Sender -2- for accelerator pedal position
- J17 - Fuel Pump (FP) Relay
- J217 - Transmission Control Module (TCM)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J234 - Airbag Control Module
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T6b - 6-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T68a - 68-Pin Connector, on Transmission Control Module (TCM) (5 speed automatic transmission)
- T75 - 75-Pin Connector
- T121 - 121-Pin Connector

(A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness

(A125) - Connection (crash signal) in instrument panel wiring harness

* - Manual transmission/ 4 speed automatic transmission only

--- 5 Speed automatic transmission only



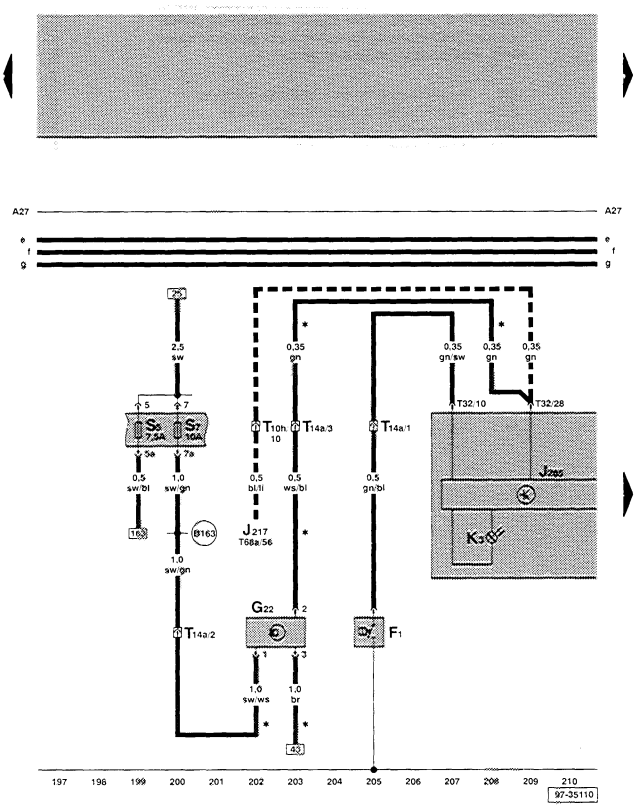
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor

- G - Fuel Level Sensor
- G6 - Fuel Pump (FP)
- G32 - Engine Coolant Level (ECL) Sensor
- S228 - Fuse 28 in fuse holder
- S234 - Fuse 34 in fuse holder
- S243 - Fuse 43 in fuse holder
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery

- (42) - Ground connection, beside steering column
- (49) - Ground connection, on steering column
- (135) - Ground connection -2-, in instrument panel wiring harnes
- (269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
- (504) - Threaded connection -1- (87) on the relay plate
- (A99) - Connection -1- (87), in instrument panel wiring harness
- (A100) - Connection -2- (87), in instrument panel wiring harness
- (A151) - Connection -4- (87), in instrument panel wiring harness
- (E30) - Connection (87a), in wiring harness engine

- * - Beginning December 2002
- ** - Vehicles with Multi-Function Indicator (MFI) only
- *** - Through November 2002
- --- Automatic transmission only



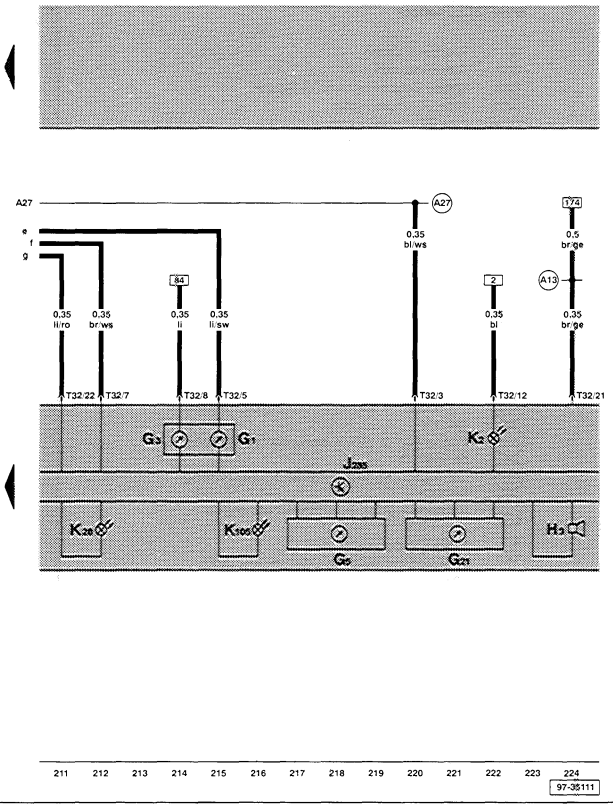
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light

- F1 - Oil Pressure Switch
- G22 - Speedometer Vehicle Speed Sensor (VSS)
- J217 - Transmission Control Module (TCM)
- J285 - Control module with indicator unit in instrument panel insert
- K3 - Oil Pressure Warning Light
- S5 - Fuse 5 in fuse holder
- S7 - Fuse 7 in fuse holder
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- T32 - 32-Pin Connector, blue
- T68a - 68-Pin Connector, on Transmission Control Module (TCM) (5 speed automatic transmission)

- (B163) - Plus connection -1- (15) in wiring harness interior

- * - Manual transmission/ 4 speed automatic transmission only
- --- 5 Speed automatic transmission only



Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light

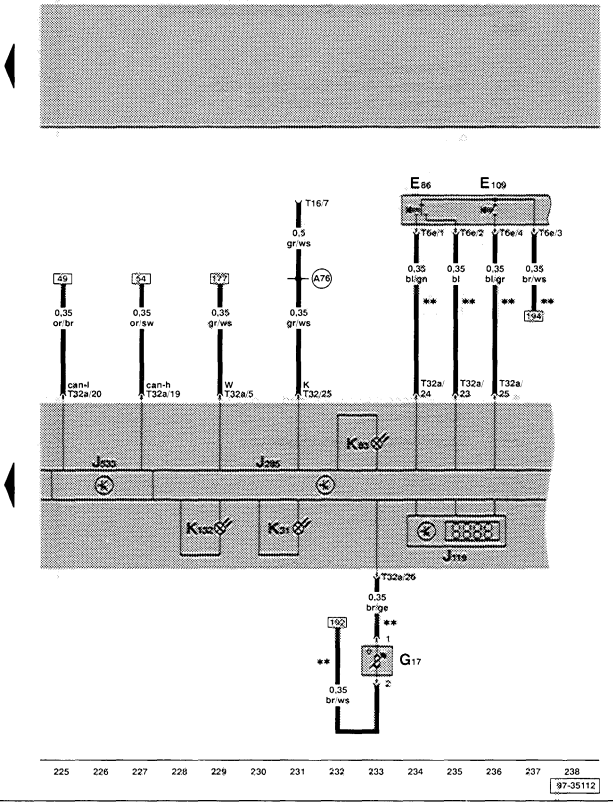
- G1 - Fuel gauge
- G3 - Engine Coolant Temperature (ECT) Gauge
- G5 - Tachometer
- G21 - Speedometer
- H3 - Warning Buzzer
- J285 - Control module with indicator unit in instrument panel insert
- K2 - Generator (GEN) Warning Light
- K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
- K105 - Low Fuel Level Warning Light
- T32 - 32-Pin Connector, blue

(A13) - Wire connection (door contact switch), in instrument panel wiring harness
(A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03

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Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp

- E86 - Multi-Function Indicator Mode Select Switch
- E109 - Multi-Function Indicator Memory Switch
- G17 - Outside Air Temperature Sensor
- J119 - Multi-function Indicator (MFI)
- J285 - Control module with indicator unit in instrument panel insert
- J533 - Data Bus On Board Diagnostic Interface
- K31 - Cruise Control Indicator Light
- K83 - Malfunction Indicator Lamp (MIL)
- K132 - Electronic Power Control (EPC) Warning Lamp
- T6e - 6-Pin Connector
- T16 - Data Link Connector (DLC), below instrument panel, left
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green

(A76) - Connection (K-diagnosis wire), in instrument panel wiring harness

** - Vehicles with Multi-Function Indicator (MFI) only

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sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03

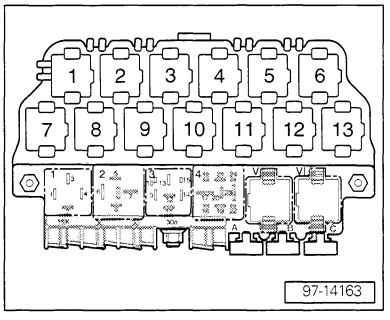
Repair Manual page number 97-826

Repair Manual page number 97-829

2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code AVH, AZG,

from November 2001

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations"

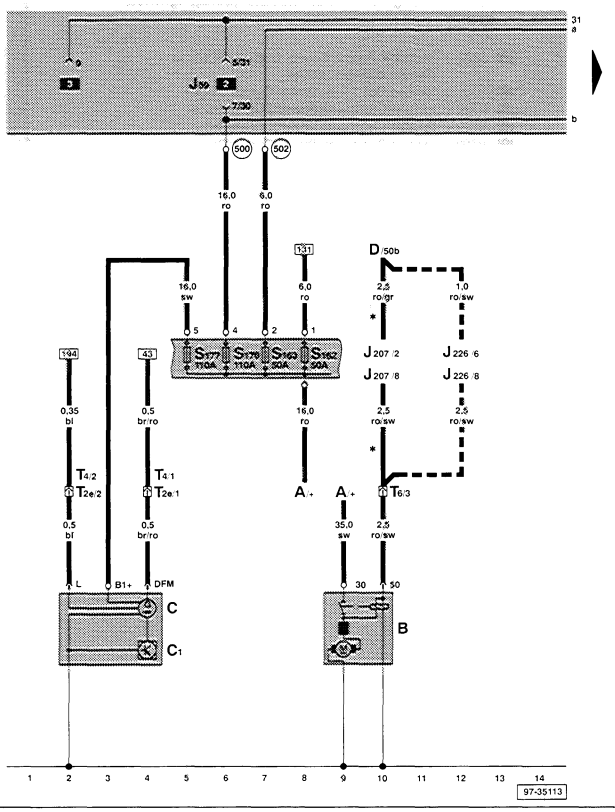


Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

2 J52 - Load Reduction Relay (100)

4 J17 - Fuel Pump (FP) Relay (409)

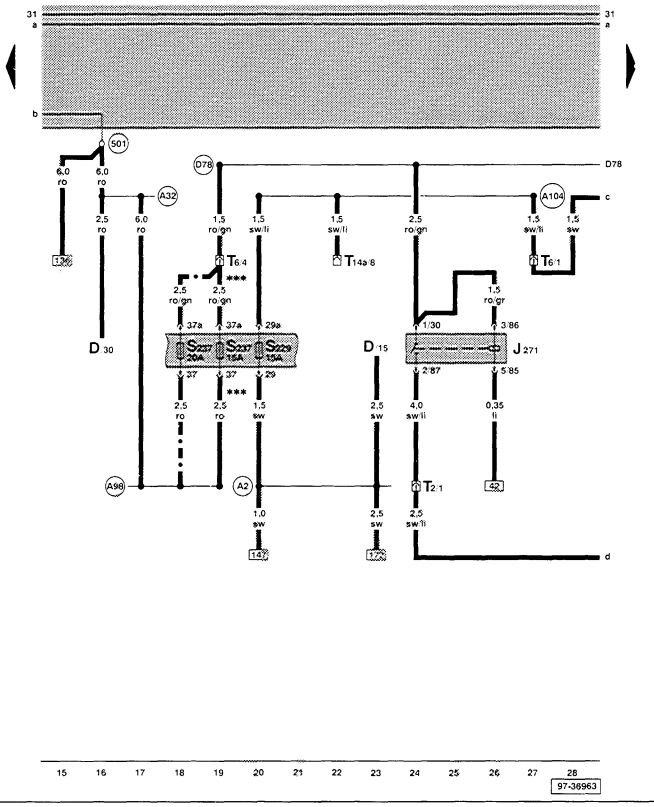


Generator (GEN), starter

- A - Battery
- B - Starter
- C - Generator (GEN)
- C1 - Voltage Regulator (VR)
- D - Ignition/Starter Switch
- J59 - Load Reduction Relay
- J207 - Starting Interlock Relay
- J226 - Park/Neutral Position (PNP) Relay
- S162 - Fuse -1- (30) in fuse bracket/battery
- S163 - Fuse -2- (30) in fuse bracket/battery
- S176 - Fuse -4- (30) in fuse bracket/battery
- S177 - Fuse -5- (30) in fuse bracket/battery
- T2e - Double Connector, near starter (vehicles without air conditioning)
- T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- (500) - Threaded connection -1- (30) on the relay plate
- (502) - Threaded connection -1- (30a) on the relay plate
- * - Manual transmission only
- --- Automatic transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

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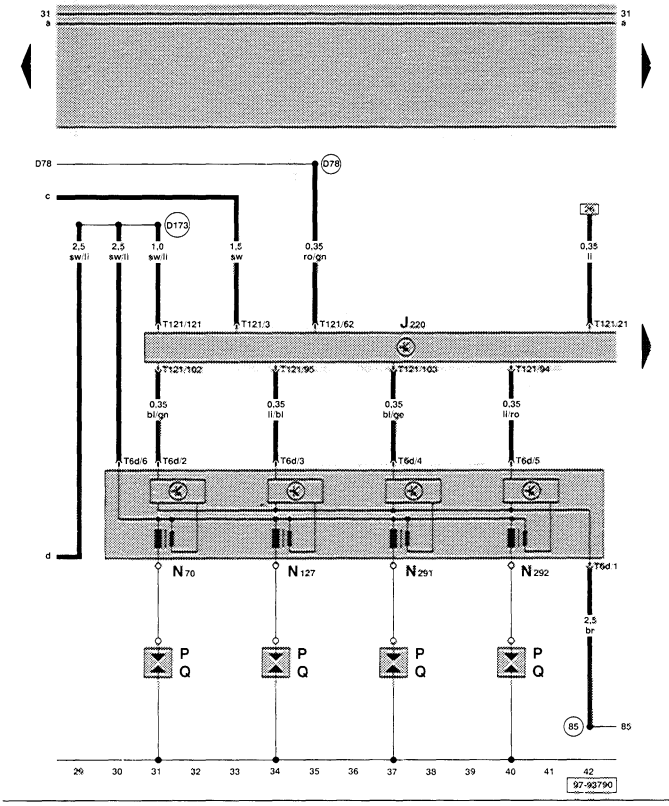
Power supply relay

- D - Ignition/Starter Switch
- J271 - Motronic engine control module (ECM) power supply relay, in protective housing, in engine compartment, left, production control number (428)
- S229 - Fuse 29 in fuse holder
- S227 - Fuse 37 in fuse holder
- T2 - 2-Pin Connector, in engine compartment, left
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- (501) - Threaded connection -2- (30) on the relay plate
- (A2) - Plus connection (15), in instrument panel wiring harness
- (A32) - Plus connection (30), in instrument panel wiring harness
- (A98) - Plus connection -4- (30), in instrument panel wiring harness
- (A104) - Plus connection -2- (15), in instrument panel wiring harness
- (D78) - Plus connection -1- (30a), in engine compartment wiring harness

*** - Through April 2003
-•- Beginning May 2003

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

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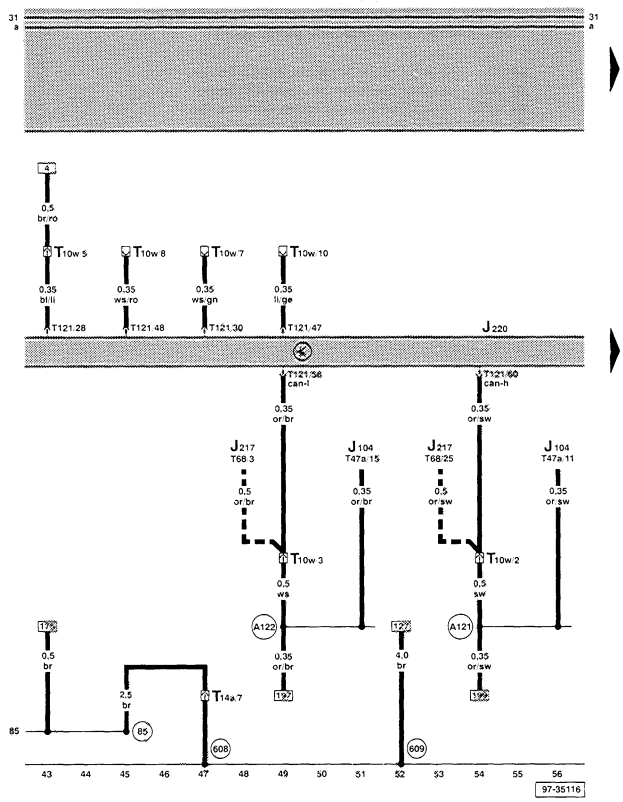


Motronic engine control module (ECM), ignition system

- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- N70 - Ignition Coil 1 with Power Output Stage
- N127 - Ignition Coil 2 with Power Output Stage
- N291 - Ignition Coil 3 with Power Output Stage
- N292 - Ignition Coil 4 with Power Output Stage
- P - Spark Plug Connectors
- Q - Spark Plugs
- T6d - 6-Pin Connector
- T121 - 121-Pin Connector
- (85) - Ground connection -1-, in engine compartment wiring harness
- (D78) - Plus connection -1- (30a), in engine compartment wiring harness
- (D173) - Connection (87)(in engine wiring harness)

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

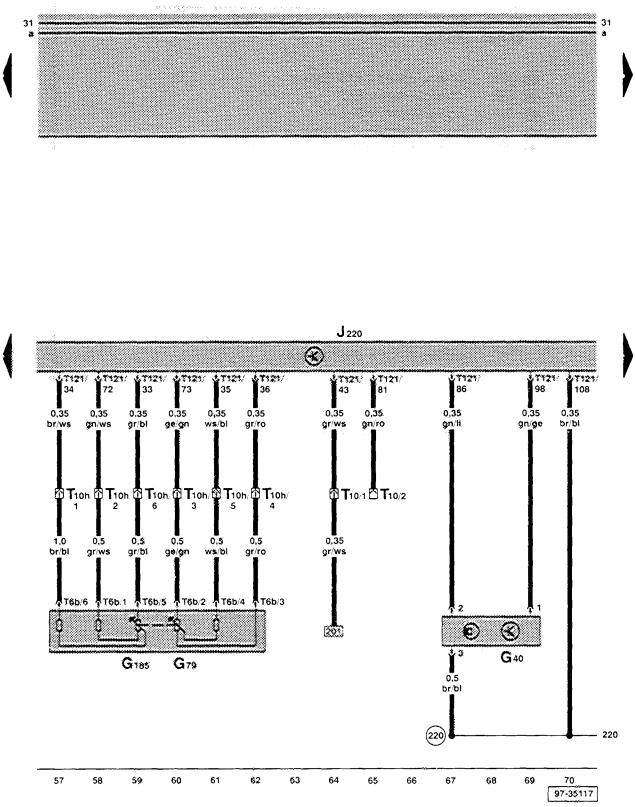
Repair Manual page number 97-830



Motronic engine control module (ECM)

- J104 - ABS Control Module (w/EDL), in engine compartment, left
- J217 - Transmission Control Module (TCM)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- T47a - 47-Pin Connector, on ABS Control Module
- T68 - 68-Pin Connector, on Transmission Control Module (TCM)
- T121 - 121-Pin Connector
- (85) - Ground connection 1-, in engine compartment wiring harness
- (608) - Ground connection (in center plenum chamber)
- (609) - Ground connection (in right plenum chamber)
- (A121) - Connection (high bus), in instrument panel wiring harness
- (A122) - Connection (low bus), in instrument panel wiring harness
- --- Automatic transmission only

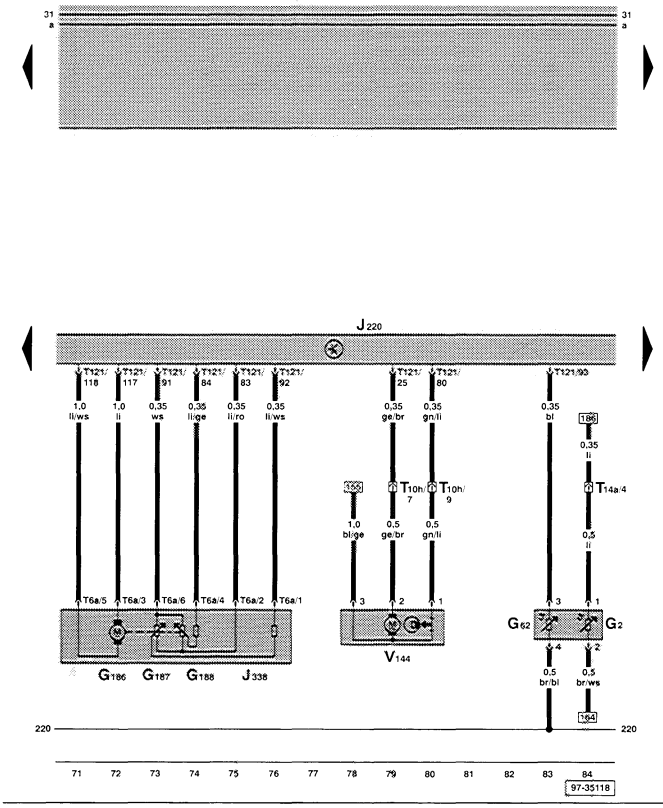
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Motronic engine control module (ECM), throttle position (TP) sensor, camshaft position (CMP) sensor

- G40 - Camshaft Position (CMP) Sensor
- G79 - Throttle Position (TP) Sensor
- G185 - Sender -2- for accelerator pedal position
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T6b - 6-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector
- (220) - Ground connection (sensor ground), in engine compartment wiring harness

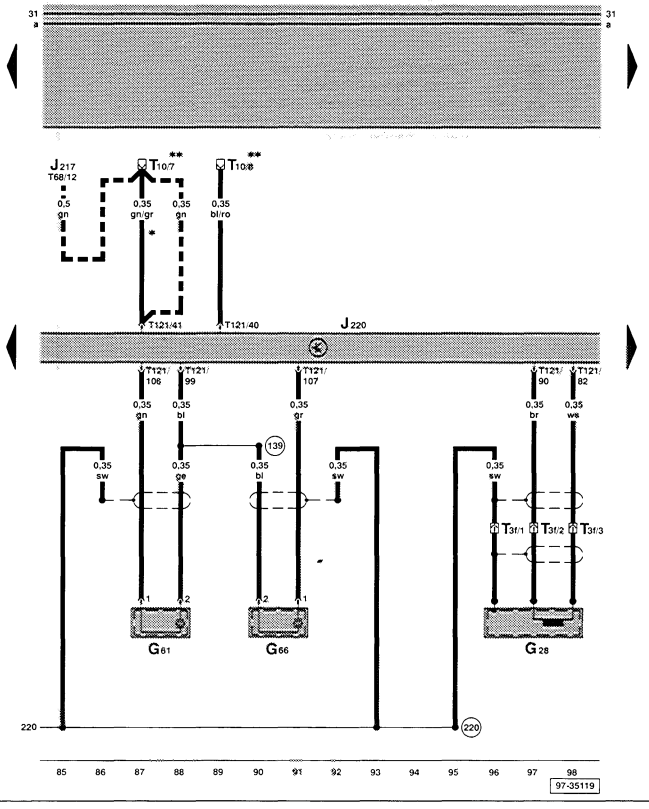
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Motronic engine control module (ECM), angle sensor for throttle drive (power accelerator actuation), (ECT) sensor, leak detection pump (LDP)

- G2 - Engine Coolant Temperature (ECT) Sensor
- G62 - Engine Coolant Temperature (ECT) Sensor
- G186 - Throttle drive (power accelerator actuation)
- G187 - Angle sensor -1- for throttle drive (power accelerator actuation)
- G188 - Angle sensor -2- for throttle drive (power accelerator actuation)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J338 - Throttle Valve Control Module
- T6a - 6-Pin Connector
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- T121 - 121-Pin Connector
- V144 - Leak detection pump (LDP)

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



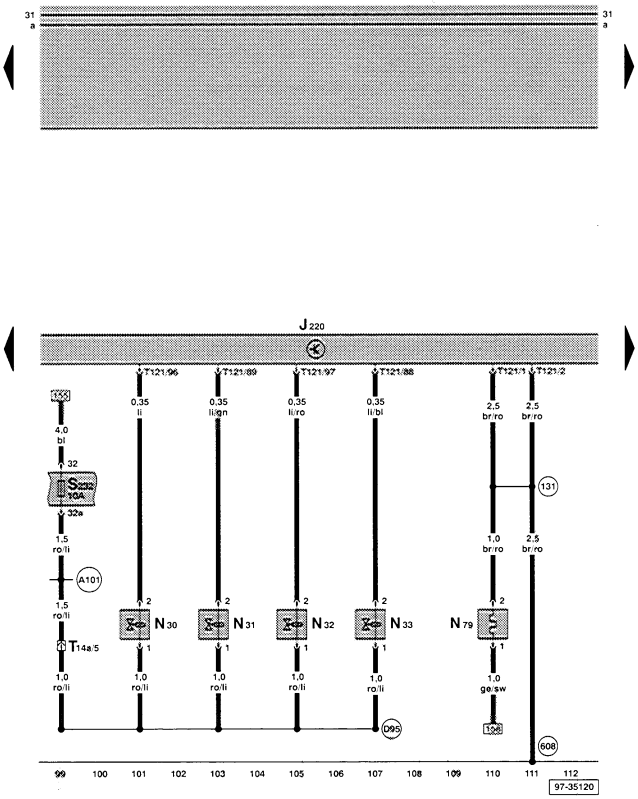
Motronic engine control module (ECM), engine speed (RPM) sensor, knock sensor (KS) 1, knock sensor (KS) 2

- G28 - Engine Speed (RPM) Sensor
- G61 - Knock Sensor (KS) 1
- G66 - Knock Sensor (KS) 2
- J217 - Transmission Control Module (TCM)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T3f - 3-Pin Connector, in engine compartment, front
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T68 - Connector, 68 point
- T121 - 121-Pin Connector
- (139) - Ground connection (sensor Ground), in Motronic Multiport Fuel Injection (MFI) wiring harness
- (220) - Ground connection (sensor ground), in engine compartment wiring harness
- * - Manual transmission only
- ** - A/C connection
- --- Automatic transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Repair Manual page number 97-835

Repair Manual page number 97-834



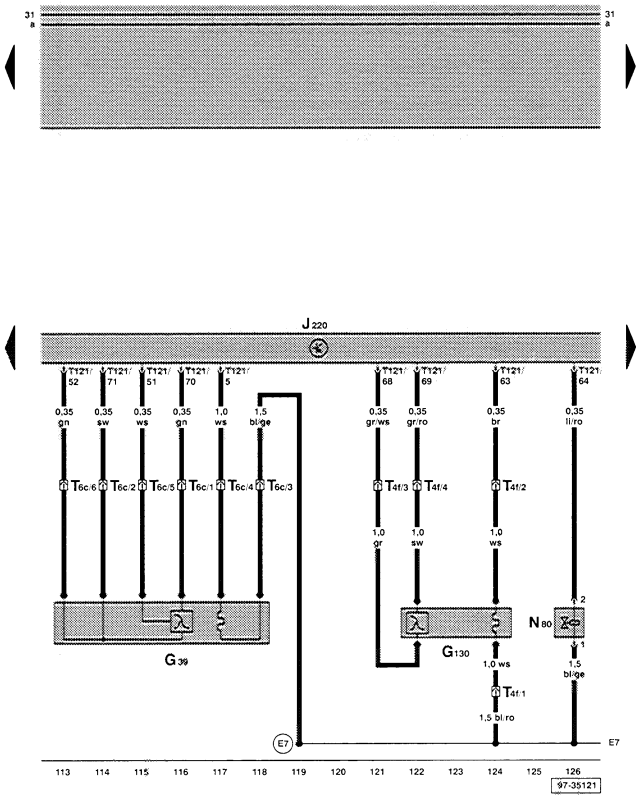
Motronic engine control module (ECM), injectors, positive crankcase ventilation (PCV) heating element

- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- N30 - Cylinder 1 Fuel Injector
- N31 - Cylinder 2 Fuel Injector
- N32 - Cylinder 3 Fuel Injector
- N33 - Cylinder 4 Fuel Injector
- N79 - Positive Crankcase Ventilation (PCV) Heating Element
- S232 - Fuse 32 in fuse holder
- T14a - 14-Pin Connector, near battery
- T121 - 121-Pin Connector

- (131) - Ground connection -2-, in engine compartment wiring harness
- (608) - Ground connection (in center plenum chamber)
- (A101) - Connection -3- (87a), in instrument panel wiring harness
- (D95) - Wire connection (injectors), in engine compartment wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03



Heated oxygen sensor (HO2S), oxygen sensor (O2S) behind three way catalytic converter (TWC), evaporative emission (EVAP) canister purge regulator valve

- G39 - Heated Oxygen Sensor (HO2S)
- G130 - Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- N80 - Evaporative Emission (EVAP) Canister Purge Regulator Valve
- T4f - 4-Pin Connector, in protective housing for connectors under right floor
- T6c - 6-Pin Connector, in protective housing for connectors under right floor
- T121 - 121-Pin Connector

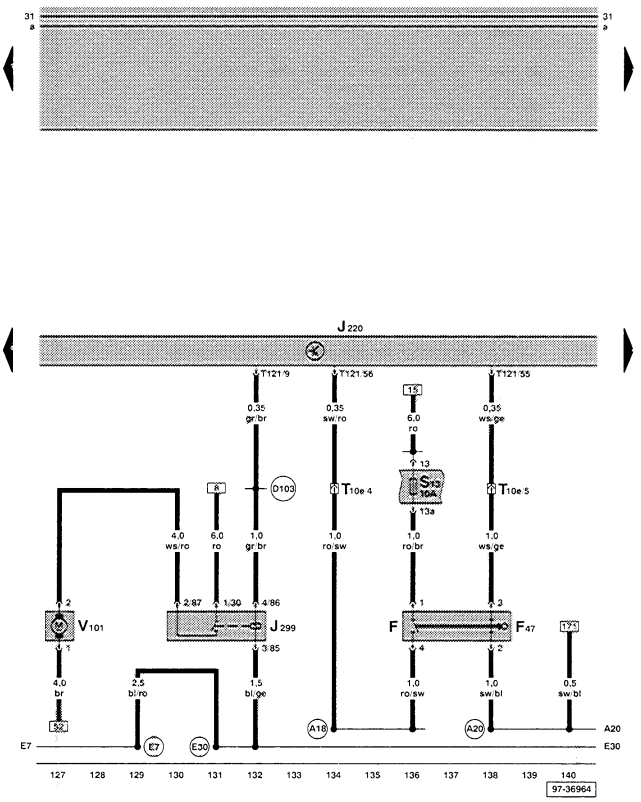
- (E7) - Plus connection (87a), in Motronic Multiport Fuel Injection (MFI) wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03

Repair Manual page number 97-837

Repair Manual page number 97-836



Motronic engine control module (ECM), secondary air injection (AIR) pump motor, secondary air injection (AIR) pump relay

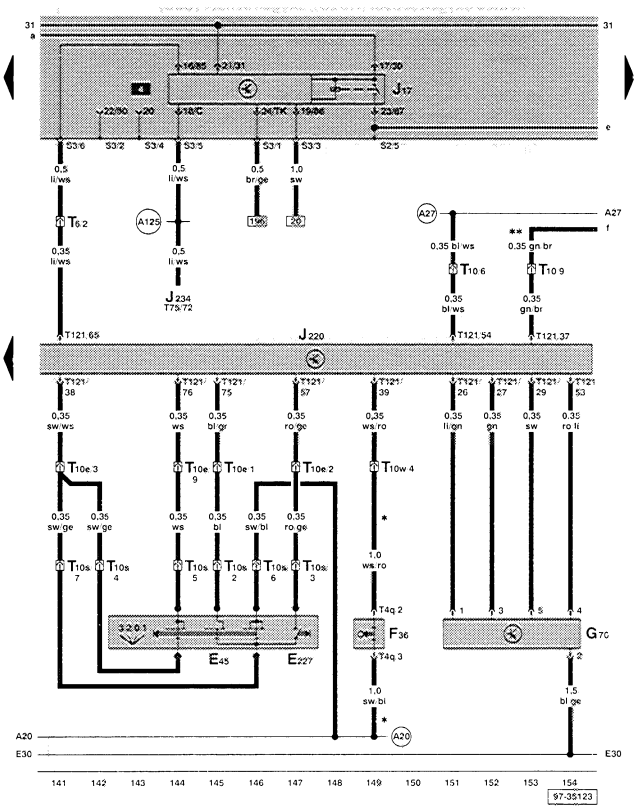
- F - Brake Light Switch
- F47 - Brake Vacuum Vent Valve Switch for cruise control
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J299 - Secondary Air Injection (AIR) Pump Relay, in protective housing, in engine compartment, left, production control number (100)
- S13 - Fuse 13 in fuse holder
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector
- V101 - Secondary Air Injection (AIR) Pump Motor

- A18 - Wire connection (54), in instrument panel
- A20 - Wire connection (15a), in instrument panel wiring harness
- D103 - Wire connection -3-, in engine compartment wiring harness
- E7 - Plus connection (87a), in Motronic Multiport Fuel Injection (MFI) wiring harness
- E30 - Connection (87a), in wiring harness engine

ws = white
sw = black
ro = red
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gn = green
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gr = grey
li = lilac
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or = orange

Edition 09.03

Repair Manual page number 97-839



Motronic engine control module (ECM), cruise control switch, mass air flow (MAF) sensor, clutch vacuum vent valve switch, fuel pump (FP) relay

- E45 - Cruise Control Switch
- E227 - Cruise Control Push Button (SET)
- F36 - Clutch Vacuum Vent Valve Switch*
- G70 - Mass Air Flow (MAF) Sensor
- J17 - Fuel Pump (FP) Relay
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J234 - Airbag Control Module
- T4q - 4-Pin Connector
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T10s - 10-Pin Connector, near steering column
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T75 - 75-Pin Connector
- T121 - 121-Pin Connector

- A20 - Wire connection (15a), in instrument panel wiring harness
- A27 - Wire connection (vehicle speed signal), in instrument panel wiring harness
- A105 - Connection (crash signal) in instrument panel wiring harness

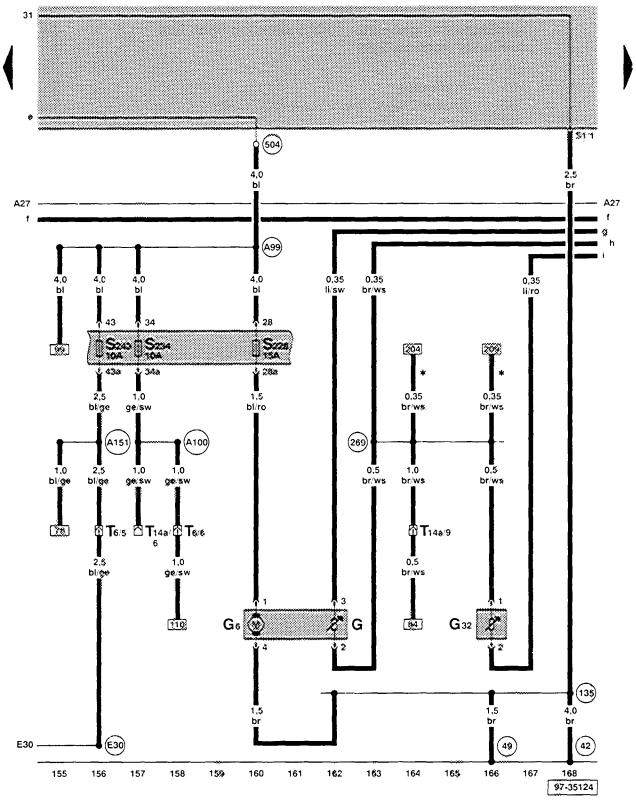
* - Manual transmission only
** - Through April 2002

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03

Repair Manual page number 97-838

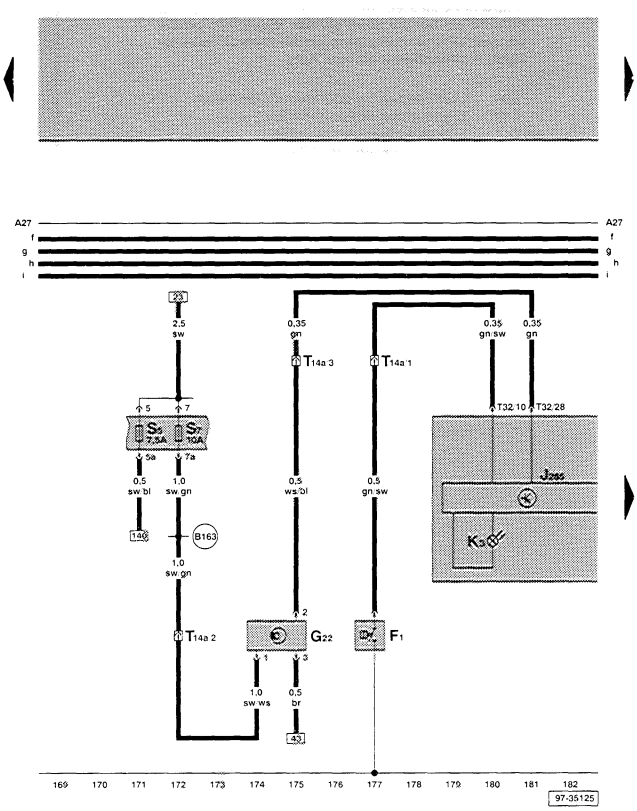
Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

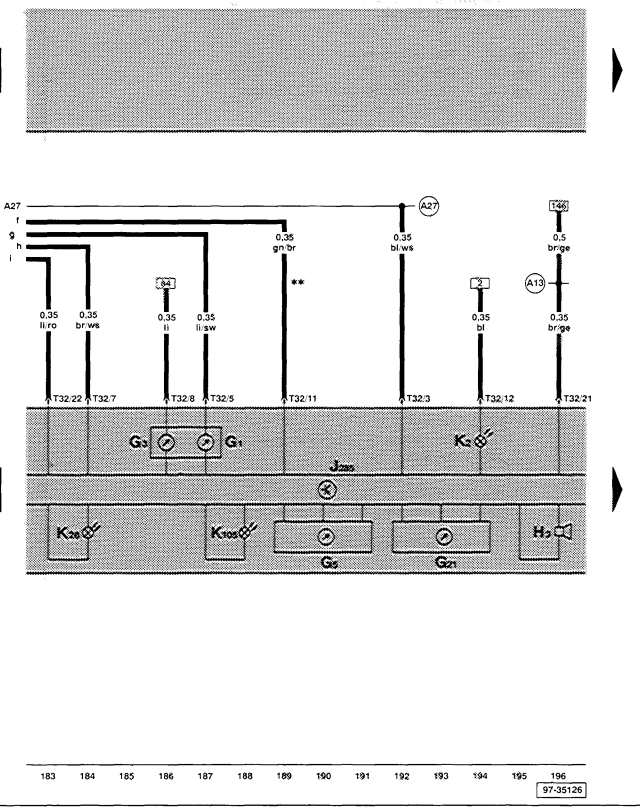
- G - Fuel Level Sensor
- G6 - Fuel Pump (FP)
- G32 - Engine Coolant Level (ECL) Sensor
- S228 - Fuse 28 in fuse holder
- S234 - Fuse 34 in fuse holder
- S243 - Fuse 43 in fuse holder
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- (42) - Ground connection, beside steering column
- (49) - Ground connection, on steering column
- (135) - Ground connection -2-, in instrument panel wiring harnes
- (269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
- (504) - Threaded connection -1- (87) on the relay plate
- (A99) - Connection -1- (87), in instrument panel wiring harness
- (A100) - Connection -2- (87), in instrument panel wiring harness
- (A151) - Connection -4- (87), in instrument panel wiring harness
- (E30) - Connection (87a), in wiring harness engine
- * - Vehicles with Multi-Function Indicator (MFI) only

Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

- F1 - Oil Pressure Switch
- G22 - Speedometer Vehicle Speed Sensor (VSS)
- J285 - Control module with indicator unit in instrument panel insert
- K3 - Oil Pressure Warning Light
- S5 - Fuse 5 in fuse holder
- S7 - Fuse 7 in fuse holder
- T14a - 14-Pin Connector, near battery
- T32 - 32-Pin Connector, blue
- (B163) - Plus connection -1- (15) in wiring harness interior



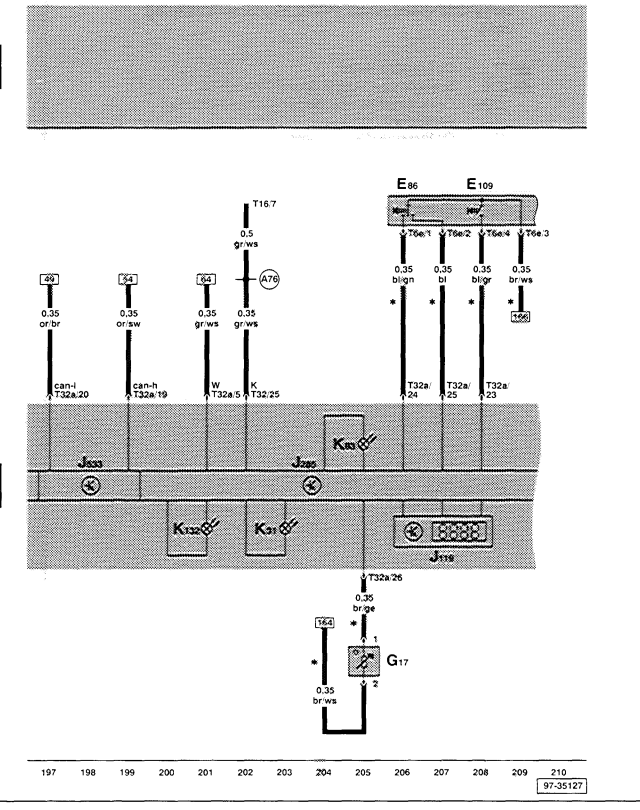
Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light

- G1 - Fuel gauge
- G3 - Engine Coolant Temperature (ECT) Gauge
- G5 - Tachometer
- G21 - Speedometer
- H3 - Warning Buzzer
- J285 - Control module with indicator unit in instrument panel insert
- K2 - Generator (GEN) Warning Light
- K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
- K105 - Low Fuel Level Warning Light
- T32 - 32-Pin Connector, blue

- (A13) - Wire connection (door contact switch), in instrument panel wiring harness
- (A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness

** - Through April 2002

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp

- E86 - Multi-Function Indicator Mode Select Switch
- E109 - Multi-Function Indicator Memory Switch
- G17 - Outside Air Temperature Sensor
- J119 - Multi-function Indicator (MFI)
- J285 - Control module with indicator unit in instrument panel insert
- J533 - Data Bus On Board Diagnostic Interface
- K31 - Cruise Control Indicator Light
- K83 - Malfunction Indicator Lamp (MIL)
- K132 - Electronic Power Control (EPC) Warning Lamp
- T6e - 6-Pin Connector
- T16 - Data Link Connector (DLC), below instrument panel, left
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green

- (A76) - Connection (K-diagnosis wire), in instrument panel wiring harness

* - Vehicles with Multi-Function Indicator (MFI) only

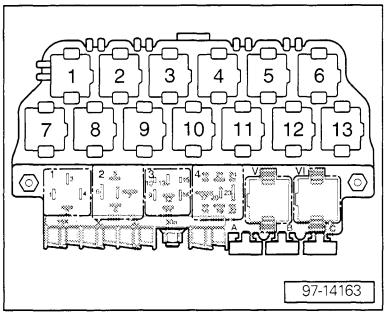
ws = white
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or = orange

2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/147 kW, code BDF,

from May 2002

Additional Fuse, Relay, Control Module and Connector locations ⇒ Compontent Locations

Troubleshooting Procedures ⇒ Guided Fault Finding using VAS 5051/5052

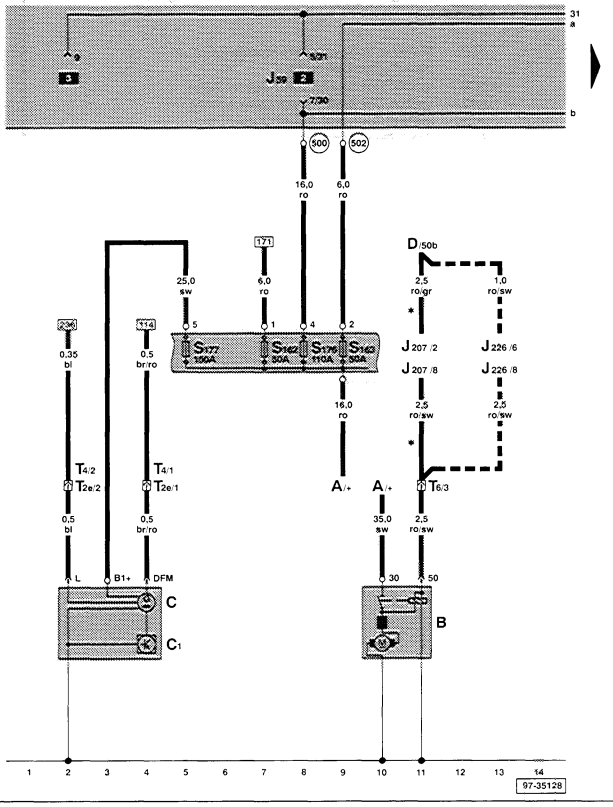


Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

2 J52 - Load Reduction Relay (100)

4 J17 - Fuel Pump (FP) Relay (409)



Generator (GEN), starter

A - Battery
B - Starter
C - Generator (GEN)
C1 - Voltage Regulator (VR)
D - Ignition/Starter Switch
J59 - Load Reduction Relay
J207 - Starting Interlock Relay
J226 - Park/Neutral Position (PNP) Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
T2e - Double Connector, near starter (vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left

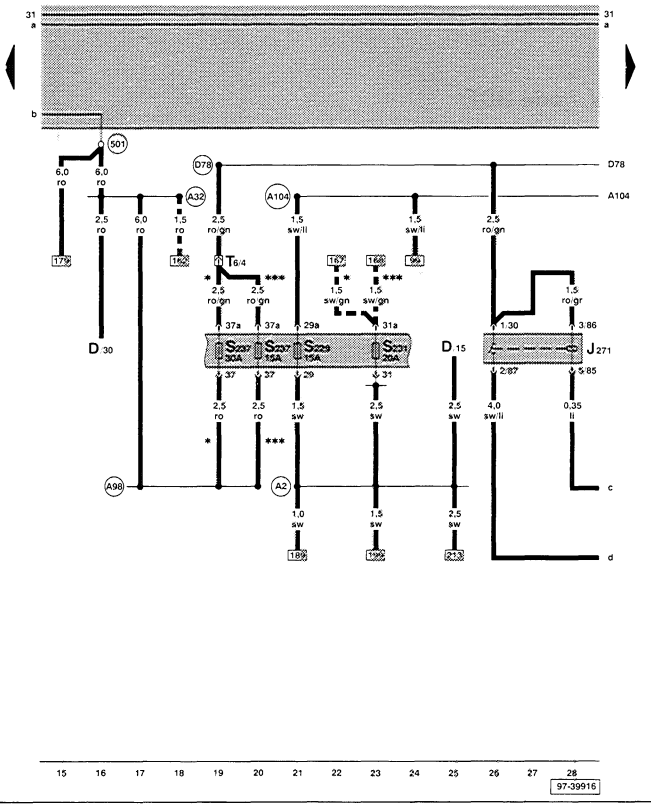
(500) - Threaded connection -1- (30) on the relay plate

(502) - Threaded connection -1- (30a) on the relay plate

* - Manual transmission only

--- Automatic transmission only

ws = white
sw = black
ro = red
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gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



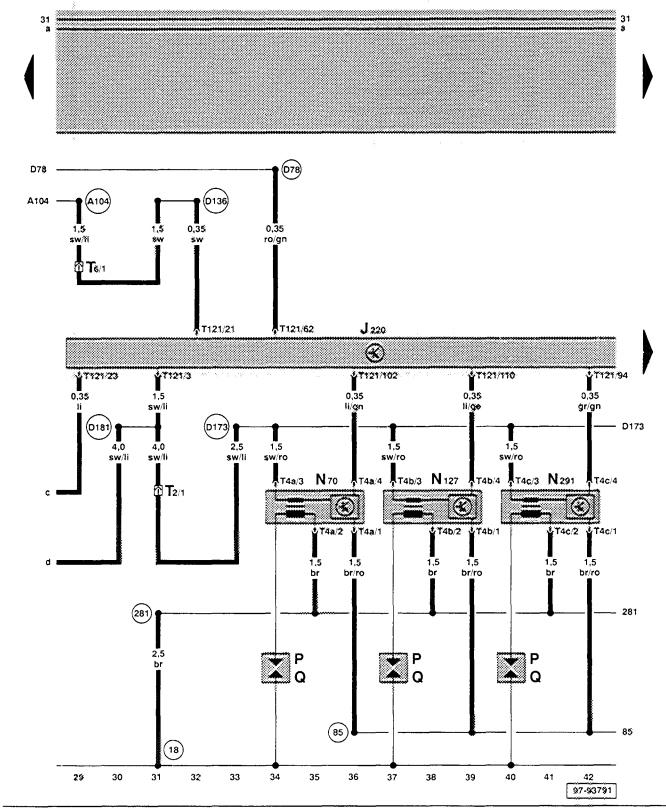
ws = white
sw = black
ro = red
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gn = green
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li = lilac
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Power supply relay

D - Ignition/Starter Switch
J271 - Motronic engine control module (ECM) power supply relay, in protective housing, in engine compartment, left, production control number (428)
S229 - Fuse 29 in fuse holder
S231 - Fuse 31 in fuse holder
S237 - Fuse 37 in fuse holder
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left

(501) - Threaded connection -2- (30) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connection -4- (30), in instrument panel wiring harness
(A104) - Plus connection -2- (15), in instrument panel wiring harness
(D78) - Plus connection -1- (30a), in engine compartment wiring harness

* - Beginning December 2002
*** - Through November 2002
--- Automatic transmission only

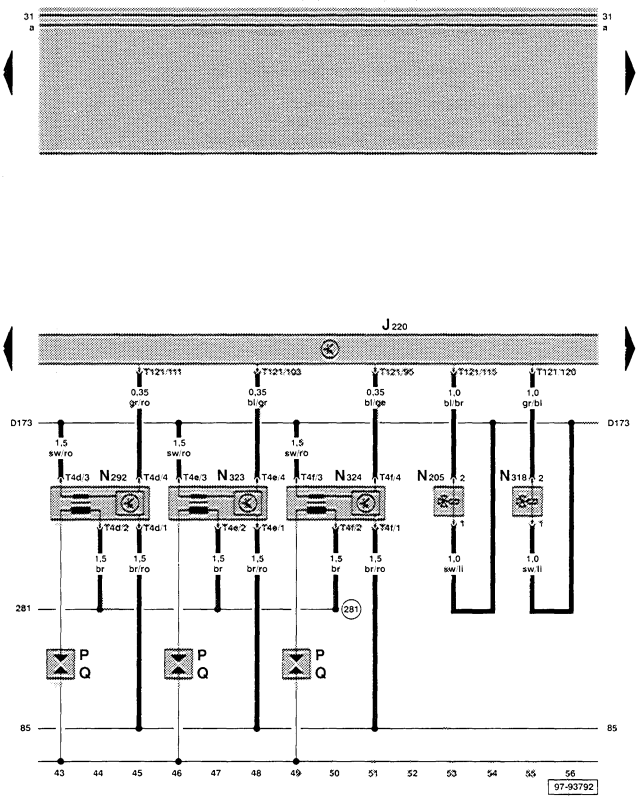


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), ignition system

J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N70 - Ignition Coil 1 with Power Output Stage
N127 - Ignition Coil 2 with Power Output Stage
N291 - Ignition Coil 3 with Power Output Stage
P - Spark Plug Connectors
Q - Spark Plugs
T2 - Double Connector, in engine compartment, in wiring duct, left
T4a - 4-Pin Connector
T4b - 4-Pin Connector
T4c - 4-Pin Connector
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T121 - 121-Pin Connector

(18) - Ground connection, on engine block
(85) - Ground connection -1-, in engine compartment wiring harness
(A104) - Plus connector -2- (15), in instrument panel wiring harness
(D78) - Plus connection -1- (30a), in engine compartment wiring harness
(D136) - Plus connection -2- (15a) in wiring harness engine compartment
(D173) - Connection (87)(in engine wiring harness)
(D181) - Connection 2 (87a) (in engine wiring harness)

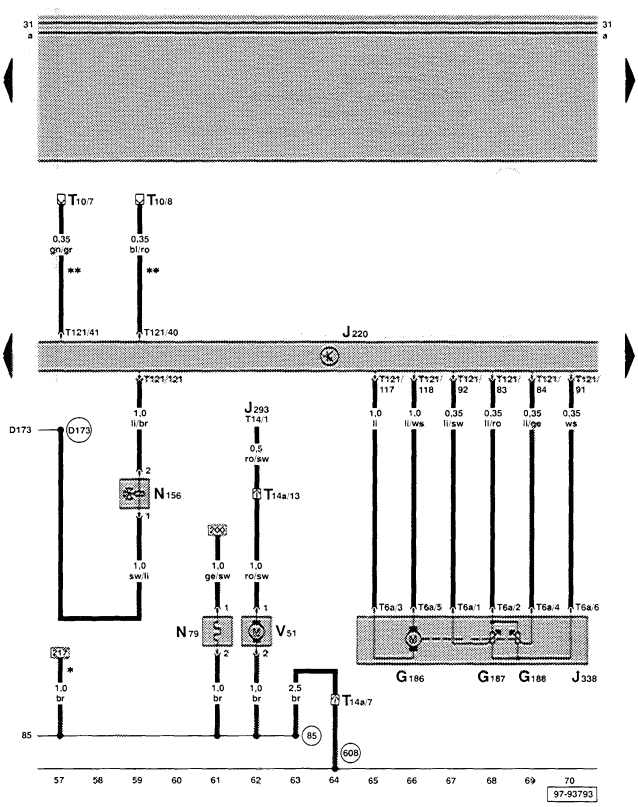


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), ignition system, camshaft adjustment valve (exhaust), valve for camshaft adjustment

- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- N205 - Valve -1- for camshaft adjustment
- N292 - Ignition Coil 4 with Power Output Stage
- N318 - Camshaft Adjustment Valve 1 (exhaust)
- N323 - Ignition Coil 5 with Power Output Stage
- N324 - Ignition Coil 6 with Power Output Stage
- P - Spark Plug Connectors
- Q - Spark Plugs
- T4d - 4-Pin Connector
- T4e - 4-Pin Connector
- T4f - 4-Pin Connector
- T121 - 121-Pin Connector

(281) - Ground connector -1-, in wiring harness engine pre-wiring



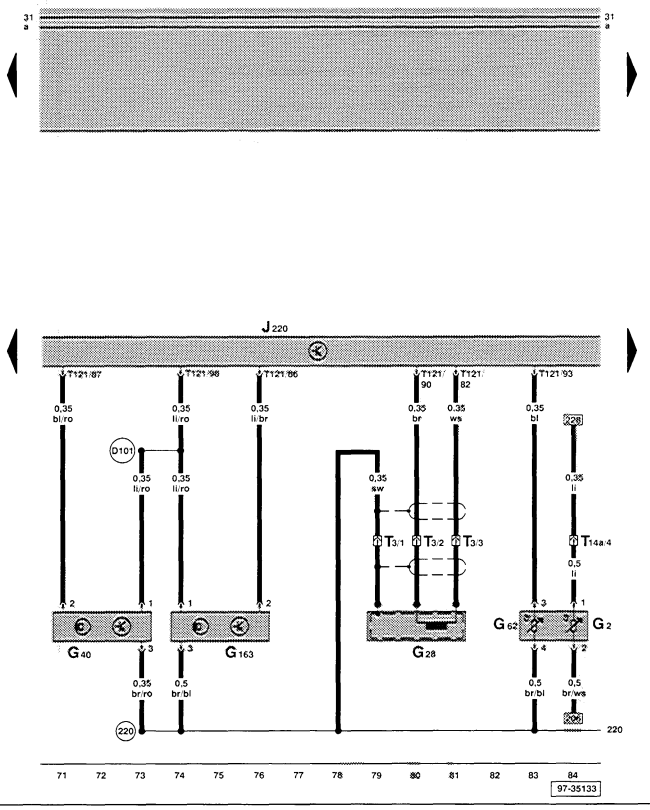
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), throttle valve control module, intake manifold change-over valve, after-run coolant pump, positive crankcase ventilation (PCV) heating element

- G186 - Throttle drive (power accelerator actuation)
- G187 - Angle sensor -1- for throttle drive (power accelerator actuation)
- G188 - Angle sensor -2- for throttle drive (power accelerator actuation)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J293 - Coolant FC (Fan Control) Control Module
- J338 - Throttle Valve Control Module
- N79 - Positive Crankcase Ventilation (PCV) Heating Element
- N156 - Intake Manifold Change-Over Valve
- T6a - 6-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T14 - 14-Pin Connector
- T14a - 14-Pin Connector, near battery
- T121 - 121-Pin Connector
- V51 - After-Run Coolant Pump

(85) - Ground connection -1-, in engine compartment wiring harness
(608) - Ground Connection (in center plenum chamber)
(D173) - Connection (87)(in engine wiring harness)

* - Manual transmission only
** - A/C connection



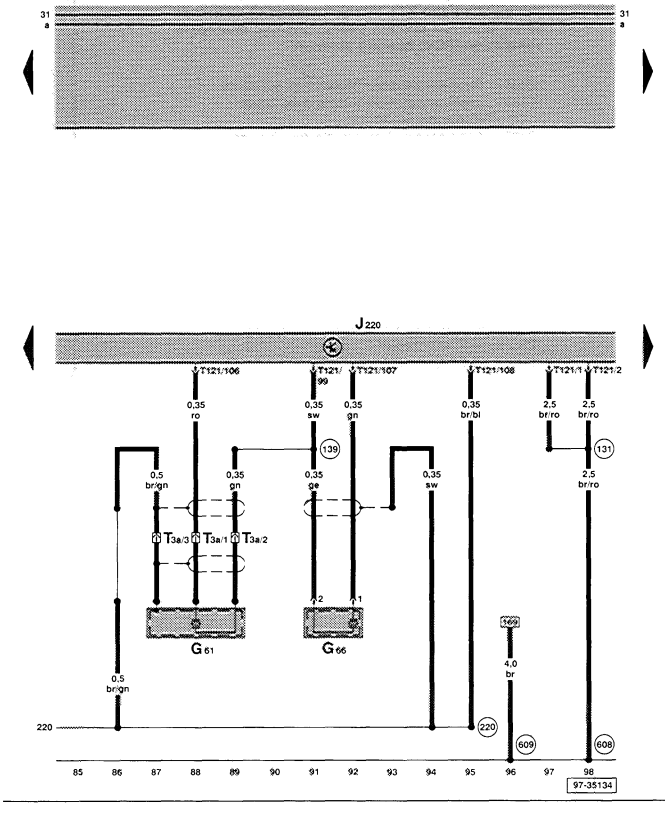
Motronic engine control module (ECM), engine coolant temperature (ECT) sensor, engine speed (RPM) sensor, camshaft position (CMP) sensor

- G2 - Engine Coolant Temperature (ECT) Gauge Sensor
- G28 - Engine Speed (RPM) Sensor
- G40 - Camshaft Position (CMP) Sensor
- G62 - Engine Coolant Temperature (ECT) Sensor
- G163 - Camshaft Position (CMP) Sensor 2
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T3 - 3-Pin Connector, in engine compartment, front
- T14a - 14-Pin Connector, near battery
- T121 - 121-Pin Connector

- (220) - Ground connection (sensor ground), in engine compartment wiring harness
- (D101) - Wire connection -1-, in engine compartment wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Repair Manual page number 97-851



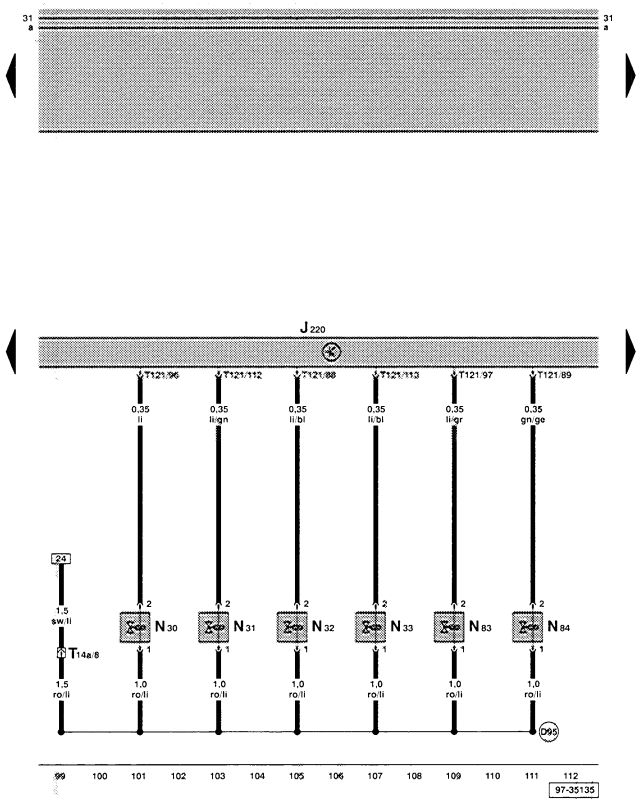
Motronic engine control module (ECM), knock sensor (KS) 1, knock sensor (KS) 2

- G61 - Knock Sensor (KS) 1
- G66 - Knock Sensor (KS) 2
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T3a - 3-Pin Connector, in engine compartment, front
- T121 - 121-Pin Connector

- (131) - Ground connection -2-, in engine compartment wiring harness
- (139) - Ground connection (sensor Ground), in Motronic Multiport Fuel Injection (MFI) wiring harness
- (220) - Ground connection (sensor ground), in engine compartment wiring harness
- (608) - Ground connection (in center plenum chamber)
- (609) - Ground connection (in right plenum chamber)

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Repair Manual page number 97-850



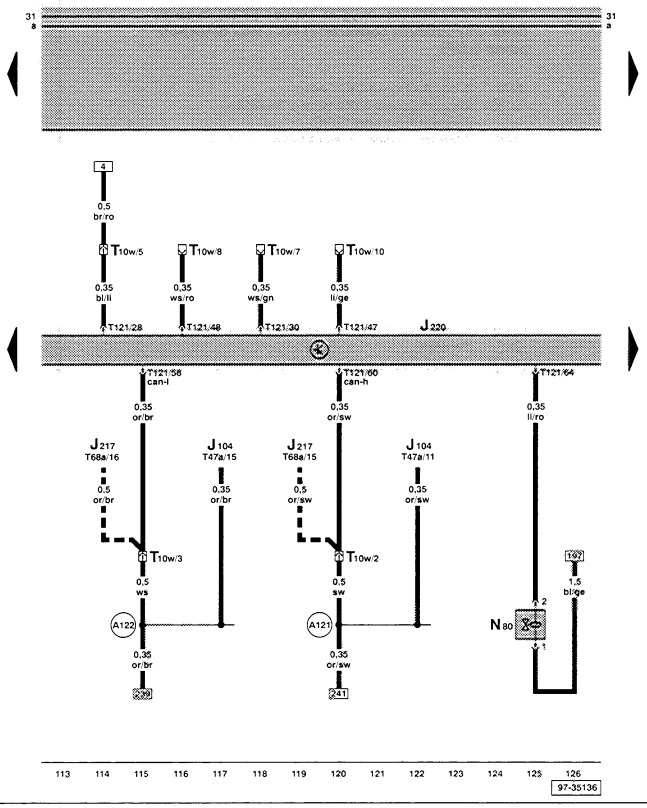
Motronic engine control module (ECM), injectors

J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N30 - Cylinder 1 Fuel Injector
N31 - Cylinder 2 Fuel Injector
N32 - Cylinder 3 Fuel Injector
N33 - Cylinder 4 Fuel Injector
N83 - Cylinder 5 Fuel Injector
N84 - Cylinder 6 Fuel Injector
T14a - 14-Pin Connector, near battery
T121 - 121-Pin Connector

(D95) - Wire connection (injectors), in engine compartment wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03



Motronic engine control module (ECM), evaporative emission (EVAP) canister purge regulator valve

J104 - ABS Control Module (w/EDL), in engine compartment, left
J217 - Transmission Control Module (TCM)
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N80 - Evaporative Emission (EVAP) Canister Purge Regulator Valve
T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
T47a - 47-Pin Connector, on ABS Control Module
T68a - 68-Pin Connector, on Transmission Control Module (TCM)
T121 - Connector, 121 point

(A121) - Connection (high bus), in instrument panel wiring harness
(A122) - Connection (low bus), in instrument panel wiring harness

--- Automatic transmission only

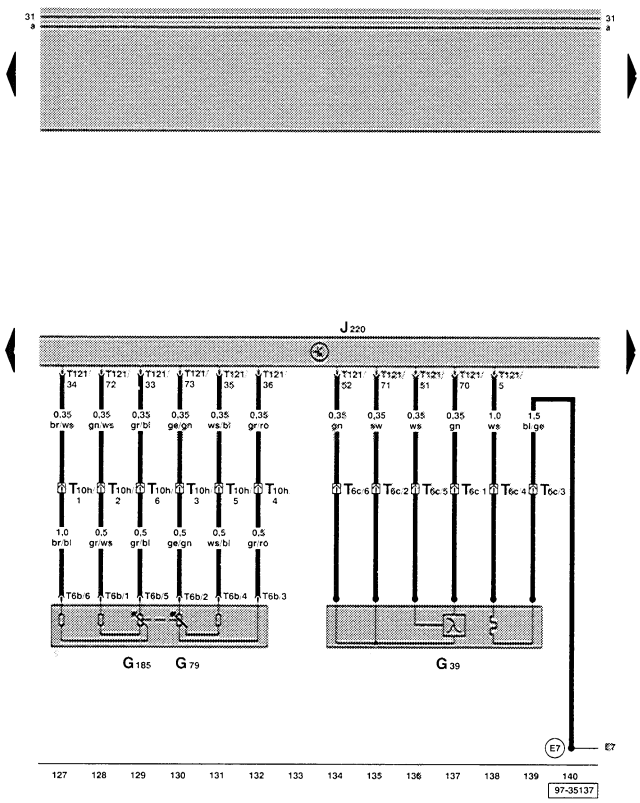
ws = white
sw = black
ro = red
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li = lilac
ge = yellow
or = orange

Edition 04.03

Motronic engine control module (ECM), throttle position (TP) sensor, heated oxygen sensor (HO2S)

G39 - Heated Oxygen Sensor (HO2S)
G79 - Throttle Position (TP) Sensor
G185 - Sender -2- for accelerator pedal position
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
T6b - 6-Pin Connector
T6c - 6-Pin Connector, in protective housing for connectors under right floor
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T121 - 121-Pin Connector

(E7) - Plus connection (87a), in Motronic Multiport Fuel Injection (MFI) wiring harness



ws = white
sw = black
ro = red
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gn = green
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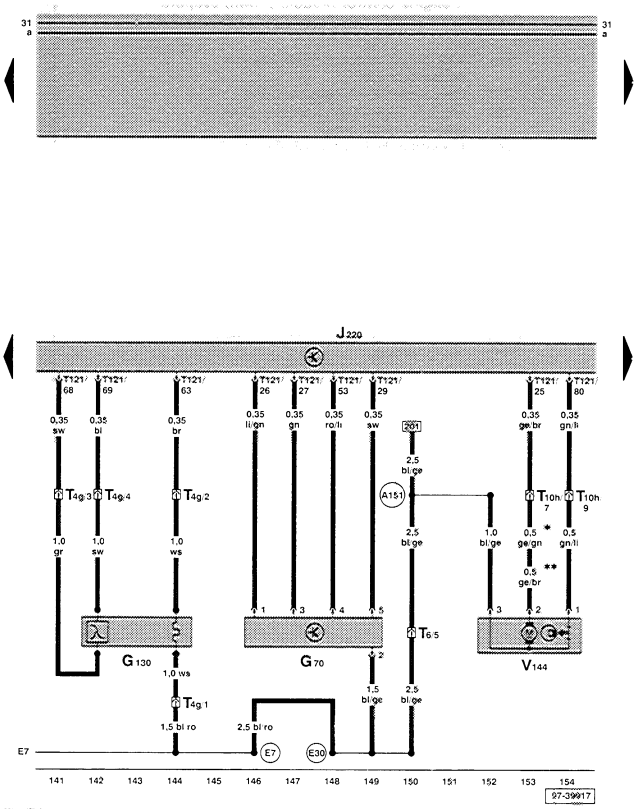
Edition 04.03

Motronic engine control module (ECM), mass air flow (MAF) sensor, oxygen sensor (O2S) behind three way catalytic converter (TWC), leak detection pump (LDP)

G70 - Mass Air Flow (MAF) Sensor
G130 - Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC)
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
T4g - 4-Pin Connector, in protective housing for connectors under right floor
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T121 - 121-Pin Connector
V144 - Leak Detection Pump (LDP)

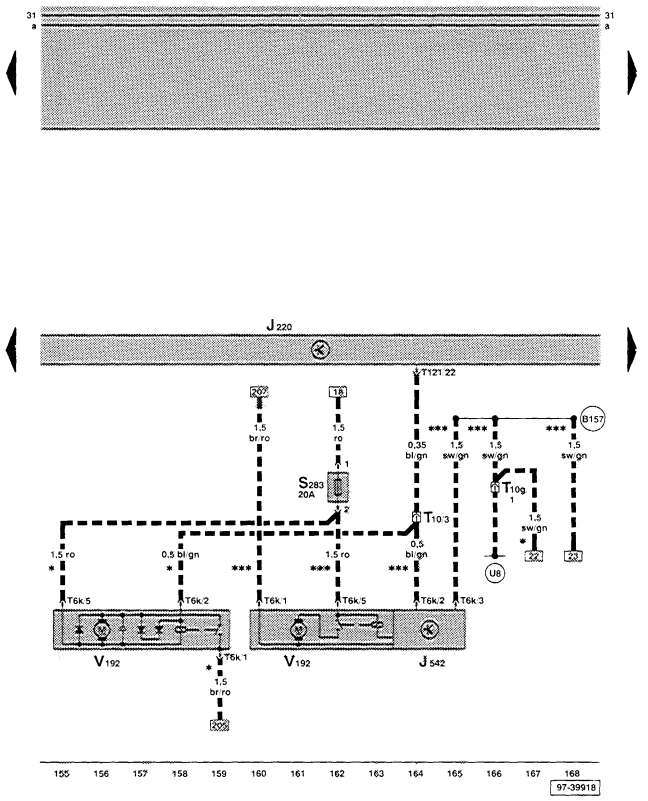
(A151) - Connection -4- (87), in instrument panel wiring harness
(E7) - Plus connection (87a), in Motronic Multiport Fuel Injection (MFI) wiring harness
(E30) - Connection (87a), in wiring harness engine

* - Jetta only
** - Golf only



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.04



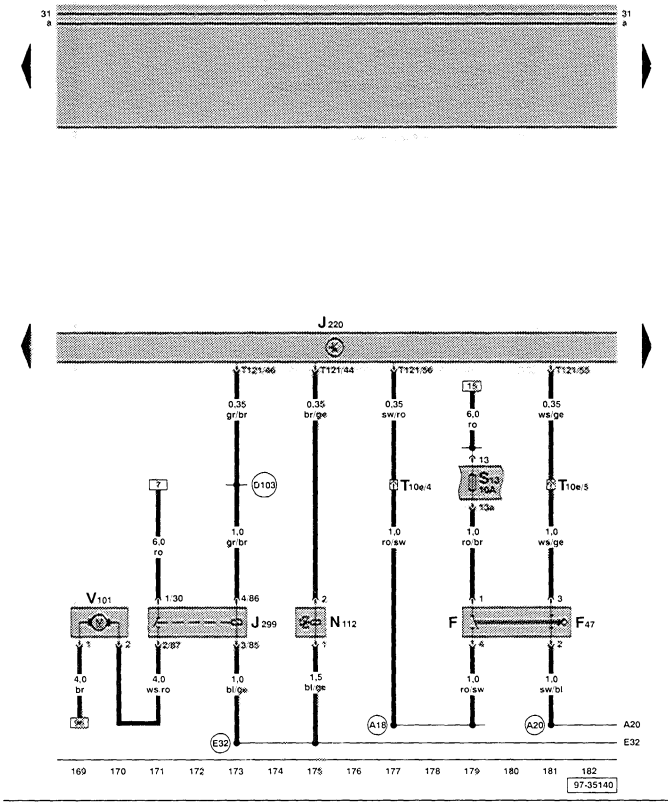
Motronic engine control module (ECM), brake booster control module, brake system vacuum pump

- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J542 - Brake Booster Control Module
- S283 - Brake Vacuum Pump Fuse, on the relay panel
- T6k - 6-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector
- V192 - Brake System Vacuum Pump

- (B157) - Plus connection -3- (15a) in wiring harness interior
- (U8) - Plus connection (15a) in automatic transmission wiring harness

- * - Beginning December 2002
- *** - Through November 2002
- --- Automatic transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

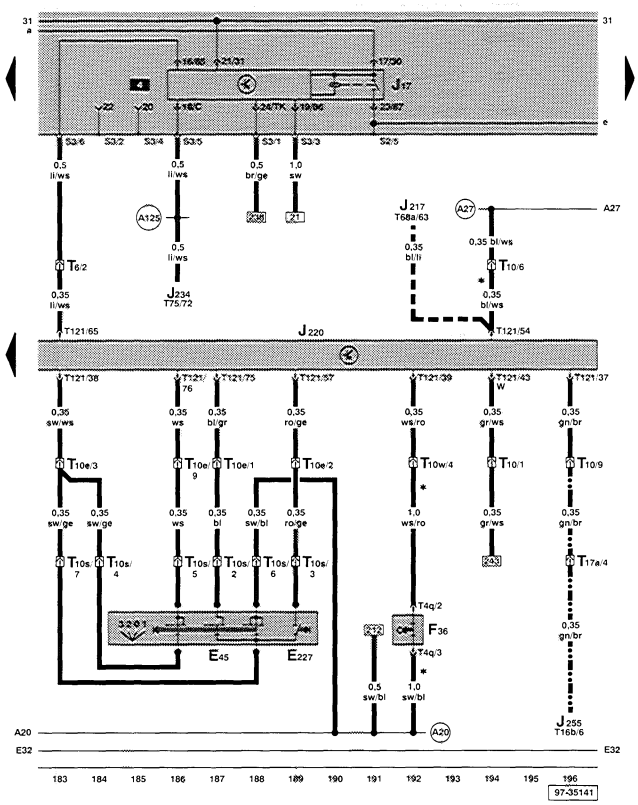


Motronic engine control module (ECM), secondary air injection (AIR) pump system, brake light switch, brake pedal switch

- F - Brake Light Switch
- F47 - Brake Pedal Switch
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J299 - Secondary Air Injection (AIR) Pump Relay, in protective housing, in engine compartment, left, production control number (100)
- N112 - Secondary Air Injection (AIR) Solenoid Valve
- S13 - Fuse 13 in fuse holder
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector
- V101 - Secondary Air Injection (AIR) Pump Motor

- (A18) - Wire connection (54), in instrument panel
- (A20) - Wire connection (15a), in instrument panel wiring harness
- (D103) - Wire connection -3-, in engine compartment wiring harness
- (E32) - Connection (87), in wiring harness Motronic

ws = white
sw = black
ro = red
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gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



ws = white
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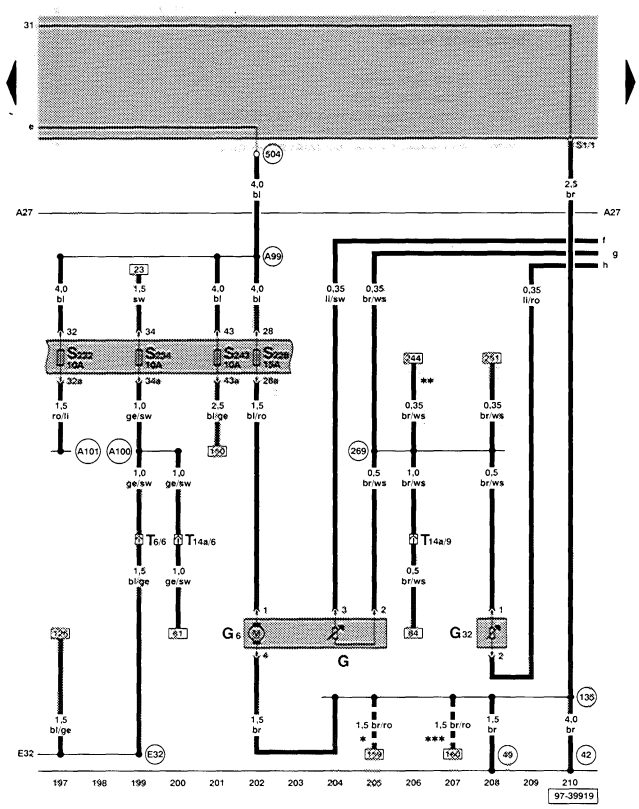
Motronic engine control module (ECM), cruise control switch, clutch vacuum vent valve switch, fuel pump (FP) relay

- E45 - Cruise Control Switch
- E227 - Cruise Control Push Button (SET)
- F36 - Clutch Pedal Switch
- J17 - Fuel Pump (FP) Relay
- J217 - Transmission Control Module (TCM)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J234 - Airbag Control Module
- J255 - Climatronic Control Module
- T4q - 4-Pin Connector
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T10s - 10-Pin Connector, near steering column
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T16b - 16-Pin Connector
- T17a - 17-Pin Connector, behind instrument panel, center
- T68a - 68-Pin Connector, on Transmission Control Module (TCM)
- T75 - 75-Pin Connector
- T121 - 121-Pin Connector

- (A20) - Wire connection (15a), in instrument panel wiring harness
- (A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness
- (A125) - Connection (crash signal) in instrument panel wiring harness

* - Manual transmission only
--- Automatic transmission only
-••- Vehicles with Climatronic only

Edition 04.03



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor

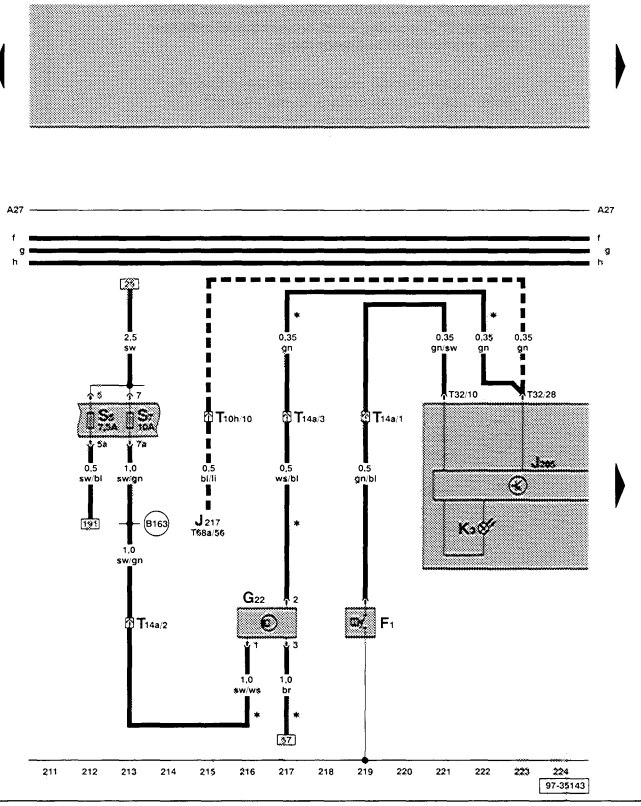
- G - Fuel Level Sensor
- G6 - Fuel Pump (FP)
- G32 - Engine Coolant Level (ECL) Sensor
- S228 - Fuse 28 in fuse holder
- S232 - Fuse 32 in fuse holder
- S234 - Fuse 34 in fuse holder
- S243 - Fuse 43 in fuse holder
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery

- (42) - Ground connection, beside steering column
- (49) - Ground connection, on steering column
- (135) - Ground connection -2-, in instrument panel wiring harnes
- (269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
- (504) - Threaded connection -1- (87) on the relay plate
- (A99) - Connection -1- (87), in instrument panel wiring harness
- (A100) - Connection -2- (87), in instrument panel wiring harness
- (A101) - Connection -3- (87a), in instrument panel wiring harness
- (E32) - Connection (87), in wiring harness Motronic

* - Beginning December 2002
** - Vehicles with Multi-Function Indicator (MFI) only (without Climatronic)
*** - Through November 2002
--- Automatic transmission only

Edition 04.04

Repair Manual page number 97-859
Repair Manual page number 97-858



Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light

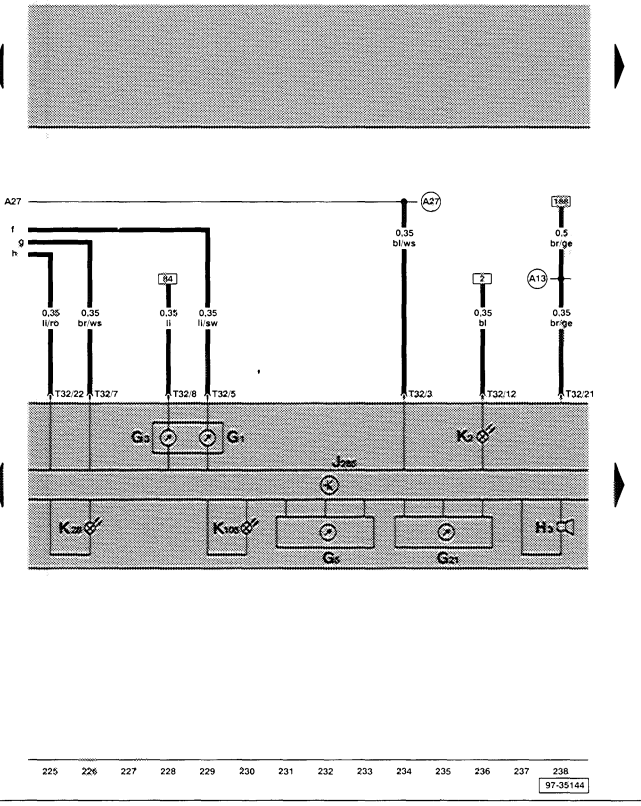
- F1 - Oil Pressure Switch
- G22 - Speedometer Vehicle Speed Sensor (VSS)
- J217 - Transmission Control Module (TCM)
- J285 - Control module with indicator unit in instrument panel insert
- K3 - Oil Pressure Warning Light
- S5 - Fuse 5 in fuse holder
- S7 - Fuse 7 in fuse holder
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- T32 - 32-Pin Connector, blue
- T68a - 68-Pin Connector, on Transmission Control Module (TCM)

(B163) - Plus connection -1- (15) in wiring harness interior

* - Manual transmission only

--- Automatic transmission only

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sw = black
ro = red
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gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



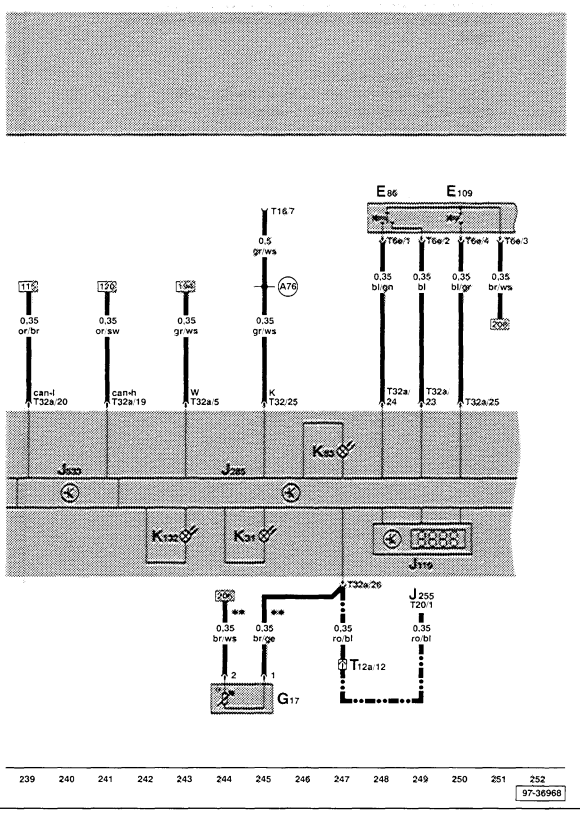
Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light

- G1 - Fuel gauge
- G3 - Engine Coolant Temperature (ECT) Gauge
- G5 - Tachometer
- G21 - Speedometer
- H3 - Warning Buzzer
- J285 - Control module with indicator unit in instrument panel insert
- K2 - Generator (GEN) Warning Light
- K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
- K105 - Low Fuel Level Warning Light
- T32 - 32-Pin Connector, blue

(A13) - Wire connection (door contact switch), in instrument panel wiring harness

(A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness

ws = white
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Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp

- E86 - Multi-Function Indicator Mode Select Switch*
- E109 - Multi-Function Indicator Memory Switch*
- G17 - Outside Air Temperature Sensor
- J119 - Multi-function Indicator (MFI)
- J255 - Climatronic Control Module
- J285 - Control module with indicator unit in instrument panel insert
- J533 - Data Bus On Board Diagnostic Interface
- K31 - Cruise Control Indicator Light
- K83 - Malfunction Indicator Lamp (MIL)
- K132 - Electronic Power Control (EPC) Warning Lamp
- T6e - 6-Pin Connector
- T12a - 12-Pin Connector, behind instrument panel, center
- T16 - Data Link Connector (DLC), below instrument panel, left
- T20 - 20-Pin Connector
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green
- (A76) - Connection (K-diagnosis wire), in instrument panel wiring harness
- ** - Vehicles with Multi-Function Indicator (MFI) only (without Climatronic)
- -•••- Vehicles with Climatronic only

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li = lilac
ge = yellow
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Edition 09.03

Repair Manual page number 97-863

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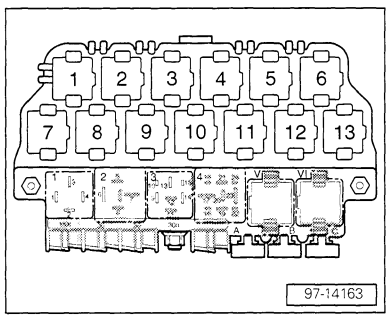
Repair Manual page number 97-865

1.9L - Engine - Turbo Diesel PD Fuel Injection (DFI)/74 kW, code BEW, (with manual transmission),

from May 2003

Additional Fuse, Relay, Control Module and Connector locations ⇒ Compontent Locations

Troubleshooting Procedures ⇒ Guided Fault Finding using VAS 5051/5052



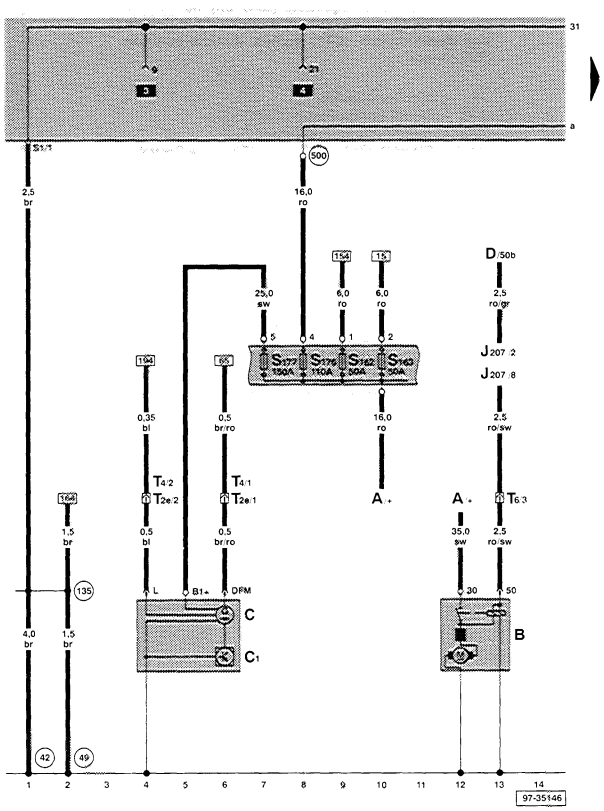
Relay location on thirteen position auxiliary relay panel, above relay panel:

12 J317 - Power Supply (Terminal 30, B+) Relay (109)

Relay panel:

1 J4 - Dual Horn Relay (53)

2 J59 - Load Reduction Relay (100)



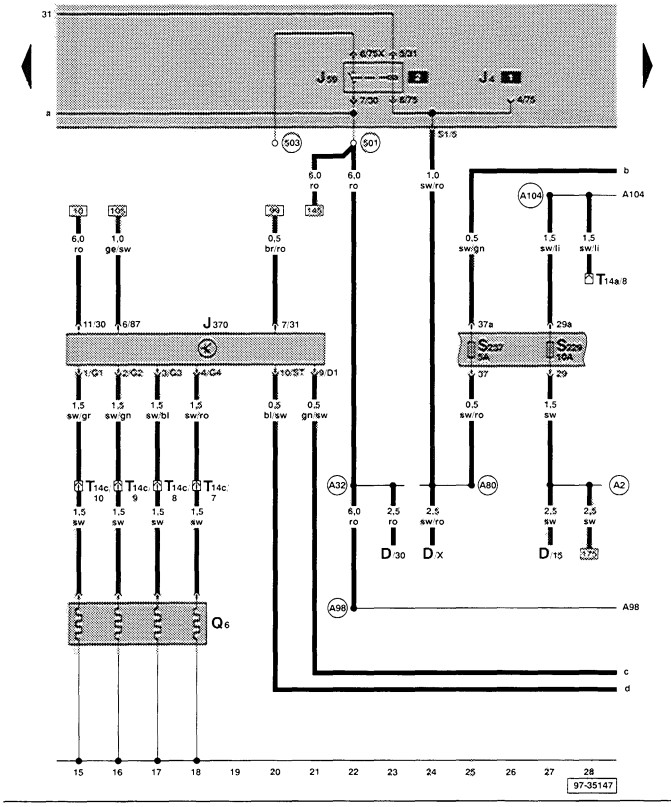
Generator (GEN), starter

A - Battery
B - Starter
C - Generator (GEN)
C1 - Voltage Regulator (VR)
D - Ignition/Starter Switch
J207 - Starting Interlock Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
T2e - Double Connector, near starter (vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left

(42) - Ground connection, beside steering column
(49) - Ground connection, on steering column
(135) - Ground connection -2-, in instrument panel wiring harness
(500) - Threaded connection -1- (30) on the relay plate

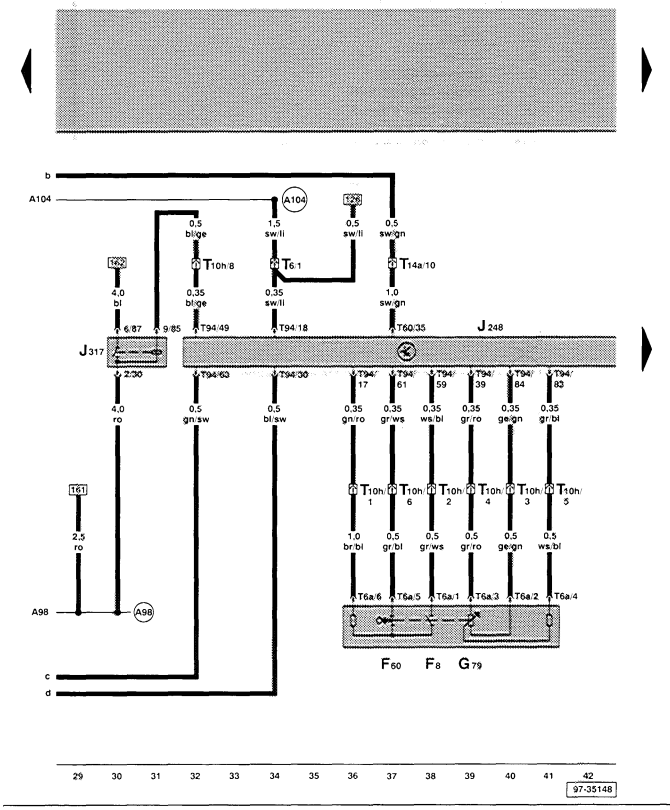
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sw = black
ro = red
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gr = grey
li = lilac
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Repair Manual page number 97-864



Glow plug activation control module, engine glow plugs

- D - Ignition/Starter Switch
- J4 - Dual Horn Relay
- J59 - Load Reduction Relay
- J370 - Glow Plug Activation Control Module, in plenum chamber, center
- Q6 - Engine Glow Plugs
- S229 - Fuse 29 (in fuse panel)
- S237 - Fuse 37 (in fuse panel)
- T14a - 14-Pin Connector, near battery
- T14c - 14-Pin Connector, in engine compartment, left
- (501) - Threaded connection -2- (30) on the relay plate
- (503) - Threaded connection -2- (75x) on the relay plate
- (A2) - Plus connection (15), in instrument panel wiring harness
- (A32) - Plus connection (30), in instrument panel wiring harness
- (A80) - Connection -1- (X) in instrument panel wiring harness
- (A98) - Plus connection -4- (30), in instrument panel wiring harness
- (A104) - Plus connection -2- (15), in instrument panel wiring harness

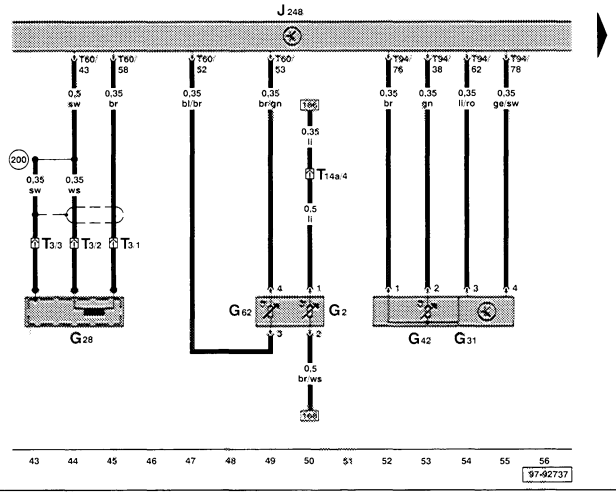


Diesel direct fuel injection (DFI) engine control module (ECM), power supply (terminal 30, B+) relay, kick down switch, (CTP) switch, throttle position (TP) sensor

- F8 - Kick Down Switch
- F60 - Closed Throttle Position (CTP) Switch
- G79 - Throttle Position (TP) Sensor
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- J317 - Power Supply (Terminal 30, B+) Relay, on thirteen position auxiliary relay panel, above relay panel
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T6a - 6-Pin Connector
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- T60 - 60-Pin Connector
- T94 - 94-Pin Connector
- (A98) - Plus connection -4- (30), in instrument panel wiring harness
- (A104) - Plus connection -2- (15), in instrument panel wiring harness

Diesel direct fuel injection (DFI) engine control module (ECM), engine speed (RPM) sensor, engine coolant temperature (ECT) sensor, intake air temperature (IAT) sensor, charge air pressure sensor

- G2 - Engine Coolant Temperature (ECT) Gauge Sensor
- G28 - Engine Speed (RPM) Sensor
- G31 - Charge Air Pressure Sensor
- G42 - Intake Air Temperature (IAT) Sensor
- G62 - Engine Coolant Temperature (ECT) Sensor
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- T3 - 3-Pin Connector, in engine compartment, front
- T14a - 14-Pin Connector, near battery
- T60 - 60-Pin Connector
- T94 - 94-Pin Connector



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 10.04

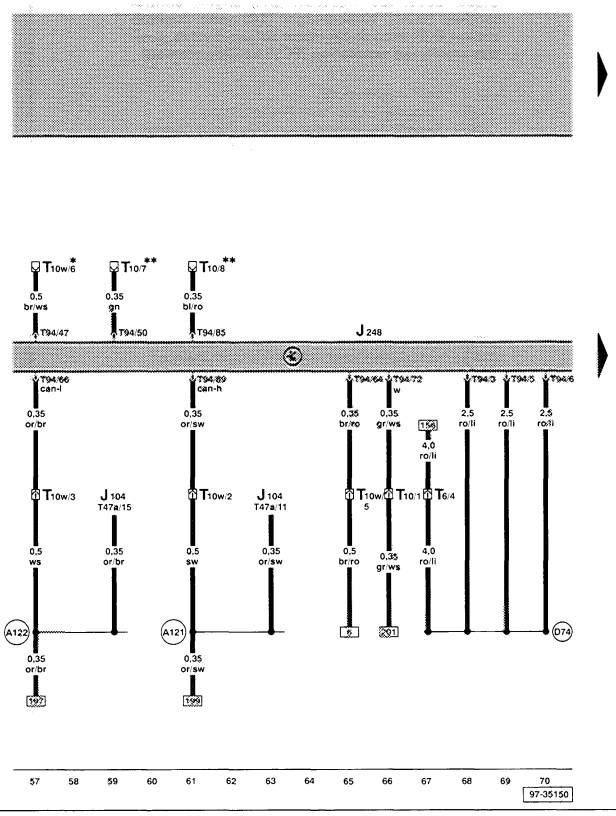
Repair Manual page number 97-869

Diesel direct fuel injection (DFI) engine control module (ECM)

- J104 - ABS Control Module, in engine compartment, left
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T47a - 47-Pin Connector, on ABS Control Module
- T94 - 94-Pin Connector

- (A121) - Connection (high bus), in instrument panel wiring harness
- (A122) - Connection (low bus), in instrument panel wiring harness
- (D74) - Wire connection (86), in engine compartment wiring harness

- * - Coolant Fan Control (FC) Control Module connection
- ** - A/C connection

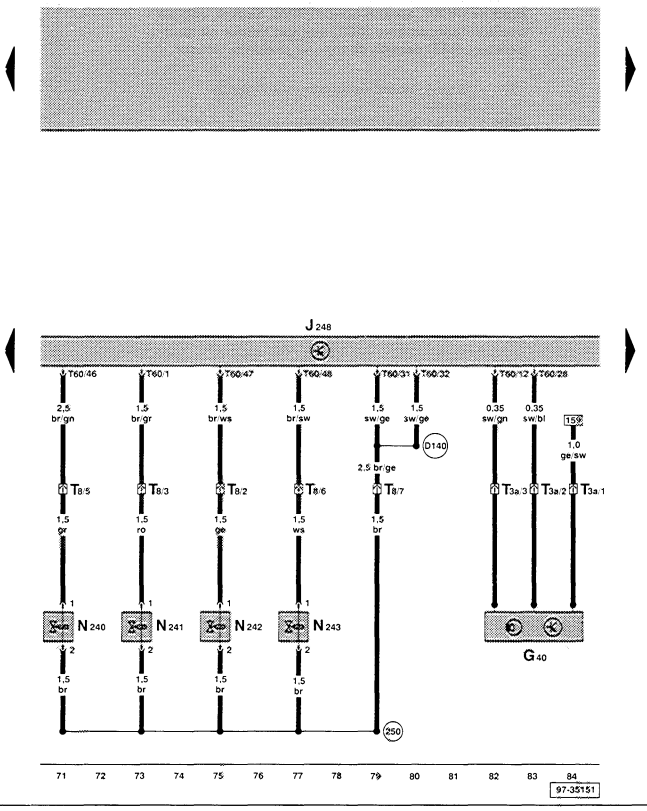


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gr = grey
li = lilac
ge = yellow
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Edition 04.03

Repair Manual page number 97-868

Diesel direct fuel injection (DFI) engine control module (ECM), pump/injector valves, camshaft position (CMP) sensor



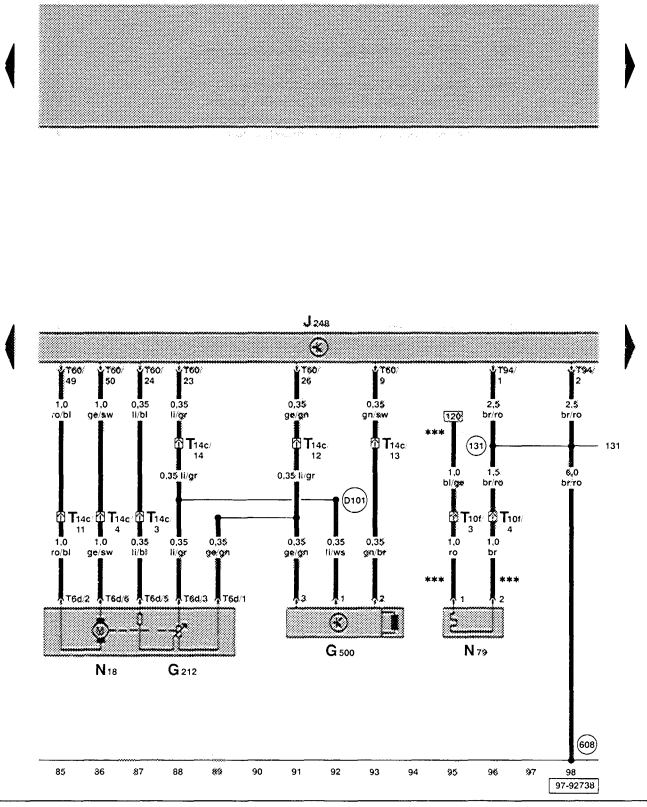
- G40 - Camshaft Position (CMP) Sensor
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- N240 - Pump/Injector Valve (cylinder 1)
- N241 - Pump/Injector Valve (cylinder 2)
- N242 - Pump/Injector Valve (cylinder 3)
- N243 - Pump/Injector Valve (cylinder 4)
- T3a - 3-Pin Connector, in engine compartment, front
- T8 - 8-Pin Connector, on left cylinder head
- T60 - 60-Pin Connector

- (250) - Ground connection in wiring harness engine pre-wiring - Diesel
- (D140) - Connection (injectors), in wiring harness, engine pre-wiring

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sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03

Diesel direct fuel injection (DFI) engine control module (ECM), turbocharger (TC) vane position sensor, EGR vacuum regulator solenoid valve, positive crankcase ventilation (PCV) heating element



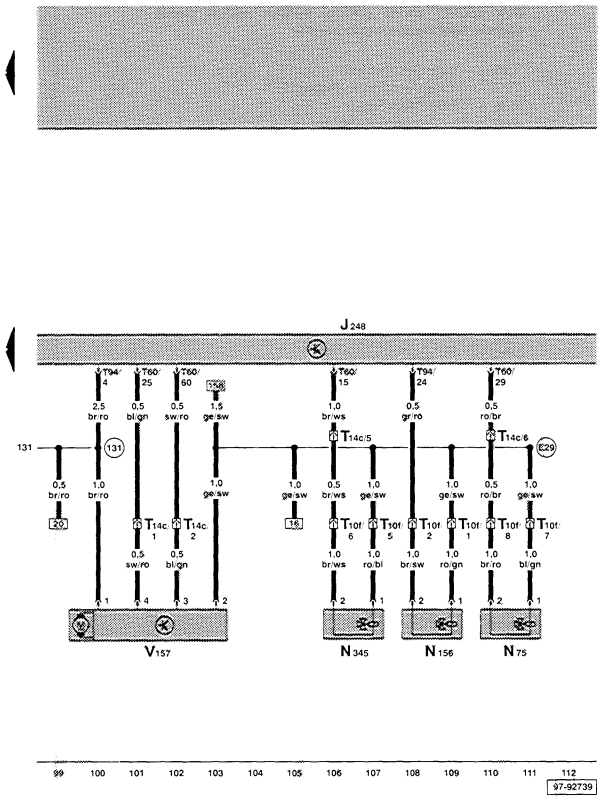
- G212 - EGR Potentiometer
- G500 - Turbocharger (TC) Vane Position Sensor
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- N18 - EGR Vacuum Regulator Solenoid Valve
- N79 - Positive Crankcase Ventilation (PCV) Heating Element***
- T6d - 6-Pin Connector
- T10f - 10-Pin Connector, in engine compartment, front
- T14c - 14-Pin Connector, in engine compartment, left
- T60 - 60-Pin Connector
- T94 - 94-Pin Connector

- (131) - Ground connection -2-, in engine compartment wiring harness
- (608) - Ground connection (in center plenum chamber)
- (D101) - Wire connection -1-, in engine compartment wiring harness

*** - Vehicles with positive crankcase ventilation (PCV) heating element

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br = brown
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or = orange

Edition 10.04

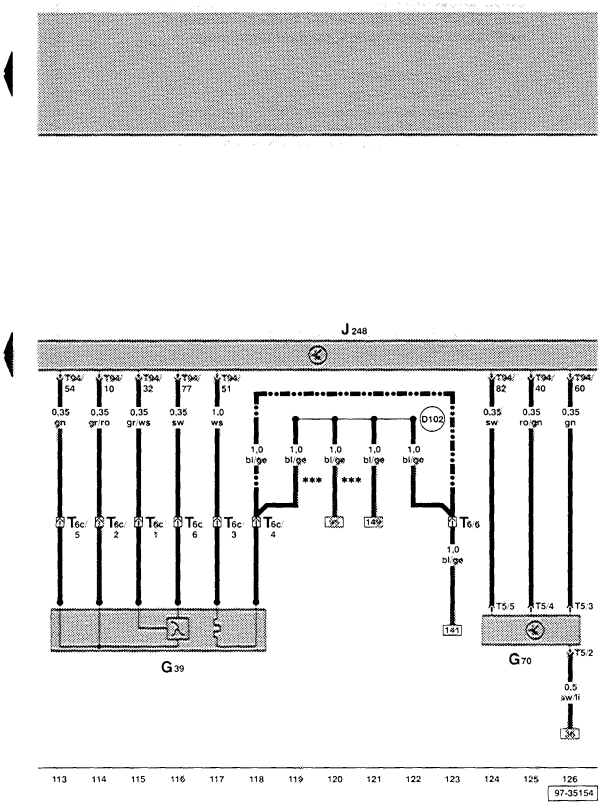


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ge = yellow
or = orange

Diesel direct fuel injection (DFI) engine control module (ECM), intake flap motor, intake manifold change-over valve, exhaust gas recirculation (EGR) cooler switch-over valve, wastegate bypass regulator valve

- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- N75 - Wastegate Bypass Regulator Valve
- N156 - Intake Manifold Change-Over Valve
- N345 - Exhaust Gas Recirculation (EGR) Cooler Switch-over Valve
- T10f - 10-Pin Connector, in engine compartment, front
- T14c - 14-Pin Connector, in engine compartment, left
- T60 - 60-Pin Connector
- T94 - 94-Pin Connector
- V157 - Intake Flap Motor

- (131) - Ground connection -2-, in engine compartment wiring harness
- (E29) - Connection, in wiring harness engine



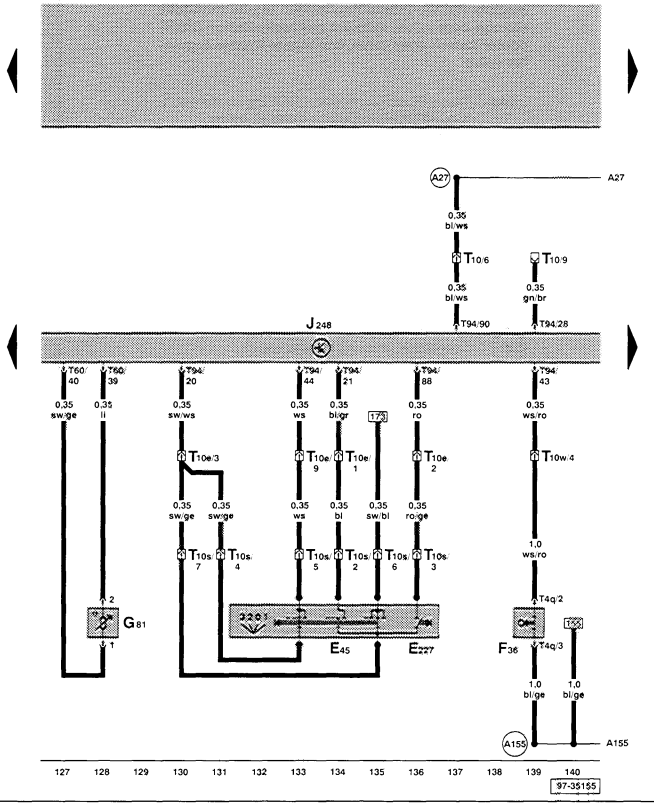
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ge = yellow
or = orange

Diesel direct fuel injection (DFI) engine control module (ECM), heated oxygen sensor (HO2S), mass air flow (MAF) sensor

- G39 - Heated Oxygen Sensor (HO2S)
- G70 - Mass Air Flow (MAF) Sensor
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- T5 - 5-Pin Connector
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T6c - 6-Pin Connector, in protective housing for connectors under right floor
- T94 - 94-Pin Connector

- (D102) - Wire connection -2-, in engine compartment wiring harness

- *** - Vehicles with positive crankcase ventilation (PCV) heating element
- -•••- Vehicles without positive crankcase ventilation (PCV) heating element



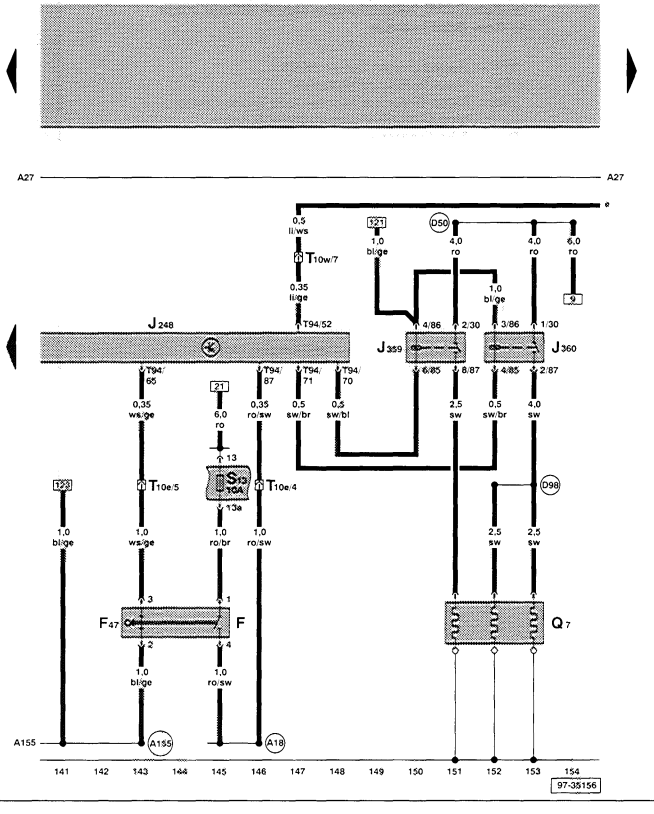
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ge = yellow
or = orange

Diesel direct fuel injection (DFI) engine control module (ECM), cruise control switch, clutch pedal switch, fuel temperature sensor

- E45 - Cruise Control Switch
- E227 - Cruise Control Push Button (SET)
- F36 - Clutch Pedal Switch
- G81 - Fuel Temperature Sensor
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- T4q - 4-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T10s - 10-Pin Connector, near steering column
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T60 - 60-Pin Connector
- T94 - 94-Pin Connector

- (A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness
- (A155) - Connection -2- (86), in instrument panel wiring harness

Edition 04.03



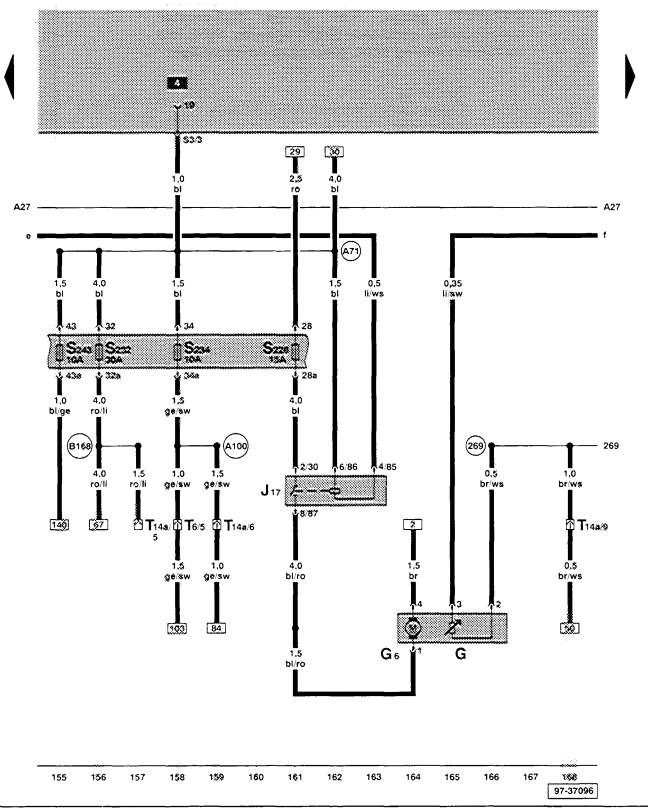
ws = white
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Diesel direct fuel injection (DFI) engine control module (ECM), brake light switch, brake pedal switch, preheating coolant relays, coolant glow plugs

- F - Brake Light Switch
- F47 - Brake Pedal Switch
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- J359 - Preheating Coolant, Low Heat Output Relay , in protective housing, in engine compartment, left, production control number (53)
- J360 - Preheating Coolant, High Heat Output Relay, in protective housing, in engine compartment, left, production control number (53)
- Q7 - Coolant Glow Plugs
- S13 - Fuse 13 in fuse holder
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T94 - 94-Pin Connector

- (A18) - Wire connection (54), in instrument panel wiring harness
- (A155) - Connection -2- (86), in instrument panel wiring harness
- (D50) - Plus connection (30), in engine compartment wiring harness
- (D98) - Wire connection (glow plugs), in engine compartment wiring harness

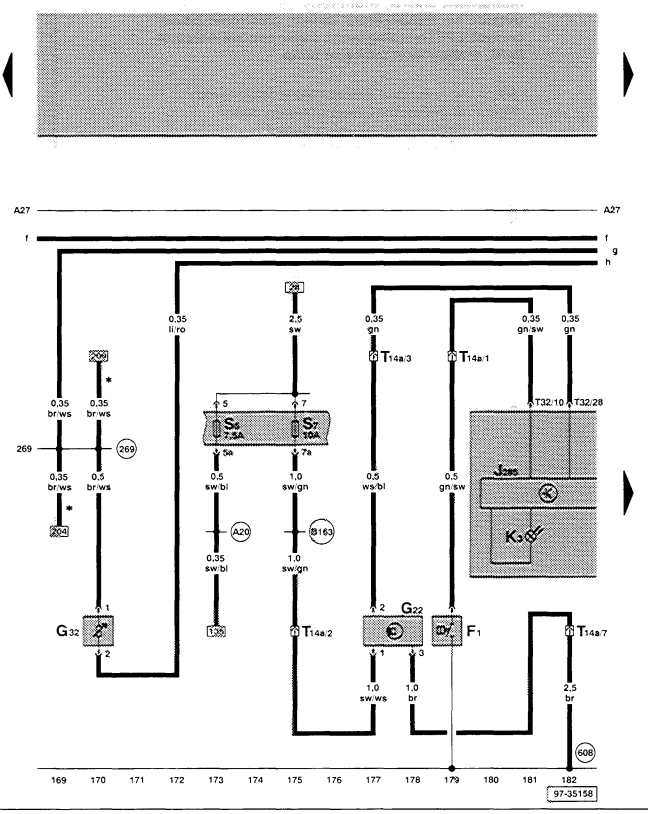
Edition 04.03



Fuel pump (FP) relay, fuel pump (FP), Fuel level Sensor

- G - Fuel Level Sensor
- G6 - Fuel Pump (FP)
- J17 - Fuel Pump (FP) Relay
- S228 - Fuse 28 (in fuse panel)
- S232 - Fuse 32 (in fuse panel)
- S234 - Fuse 34 (in fuse panel)
- S243 - Fuse 43 (in fuse panel)
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery

- (269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
- (A71) - Connection (86), in instrument panel wiring harness
- (A100) - Connection -2- (87), in instrument panel wiring harness
- (B168) - Connection (86) in passenger compartment wiring harness

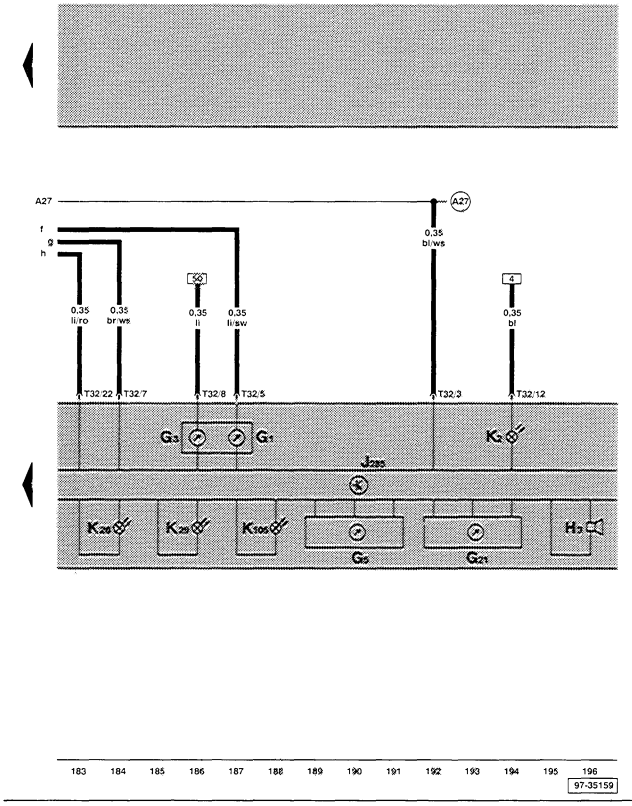


Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light, engine coolant level (ECL) sensor

- F1 - Oil Pressure Switch
- G22 - Speedometer Vehicle Speed Sensor (VSS)
- G32 - Engine Coolant Level (ECL) Sensor
- J285 - Instrument Cluster Control Module
- K3 - Oil Pressure Warning Light
- S5 - Fuse 5 (in fuse panel)
- S7 - Fuse 7 (in fuse panel)
- T14a - 14-Pin Connector, near battery
- T32 - 32-Pin Connector, blue

- (269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
- (608) - Ground connection (in center plenum chamber)
- (A20) - Wire connection (15a), in instrument panel wiring harness
- (B163) - Plus connection -1- (15) in wiring harness interior

* - Vehicles with Multi-Function Indicator (MFI) only



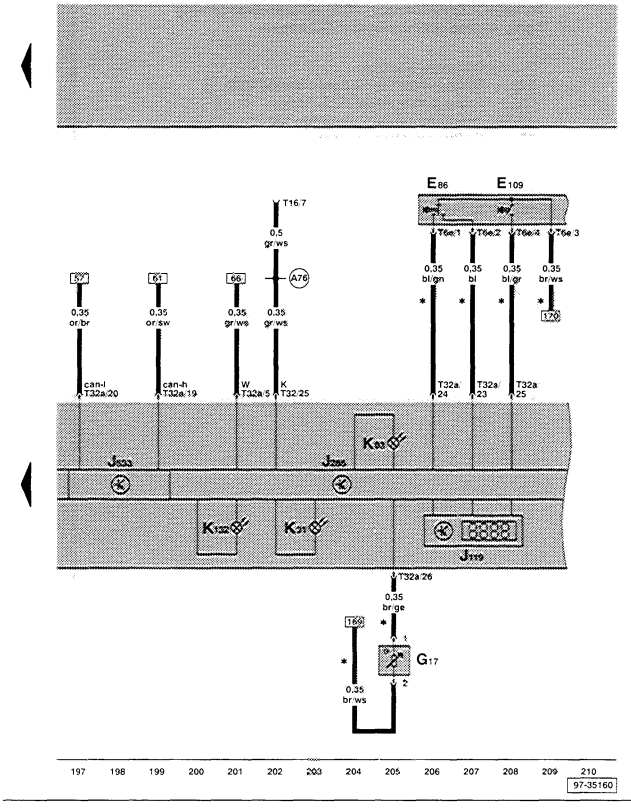
Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light, glow plug indicator light

- G1 - Fuel Gauge
- G3 - Engine Coolant Temperature (ECT) Gauge
- G5 - Tachometer
- G21 - Speedometer
- H3 - Warning Buzzer
- J285 - Instrument Cluster Control Module
- K2 - Generator (GEN) Warning Light
- K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
- K29 - Glow Plug Indicator Light
- K105 - Low Fuel Level Warning Light
- T32 - 32-Pin Connector, blue

(A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03



Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp

- E86 - Multi-Function Indicator Mode Select Switch
- E109 - Multi-Function Indicator Memory Switch
- G17 - Outside Air Temperature Sensor
- J119 - Multi-function Indicator (MFI)
- J285 - Instrument Cluster Control Module
- J533 - Data Bus On Board Diagnostic Interface
- K31 - Cruise Control Indicator Light
- K83 - Malfunction Indicator Lamp (MIL)
- K132 - Electronic Power Control (EPC) Warning Lamp
- T6e - 6-Pin Connector
- T16 - 16-Pin Connector, black, Data Link Connector (DLC), below instrument panel, left
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green

(A76) - Connection (K-diagnosis wire), in instrument panel wiring harness

* - Vehicles with Multi-Function Indicator (MFI) only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

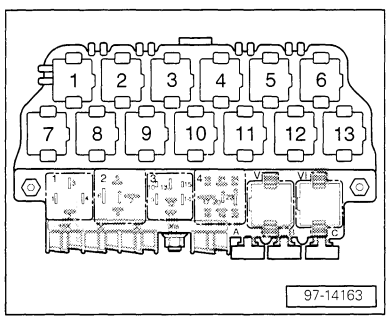
Edition 04.03

1.9L - Engine - Turbo Diesel PD Fuel Injection (DFI)/74 kW, code BEW, (with automatic transmission),

from May 2003

Additional Fuse, Relay, Control Module and Connector locations ⇒ Compontent Locations

Troubleshooting Procedures ⇒ Guided Fault Finding using VAS 5051/5052



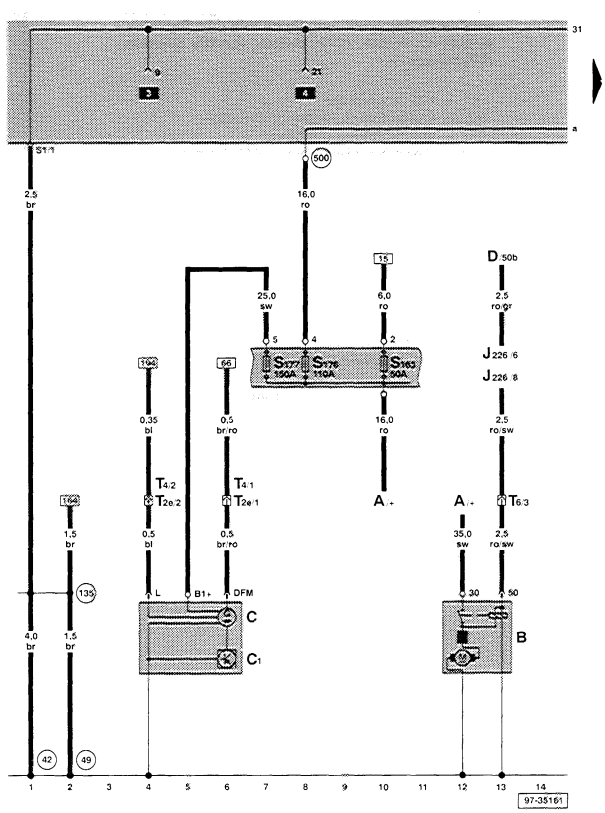
Relay location on the thirteenfold auxiliary relay panel, above relay panel:

12 J317 - Power Supply (Terminal 30, B+) Relay (109)

Relay panel:

1 J4 - Dual Horn Relay (53)

2 J59 - Load Reduction Relay (100)

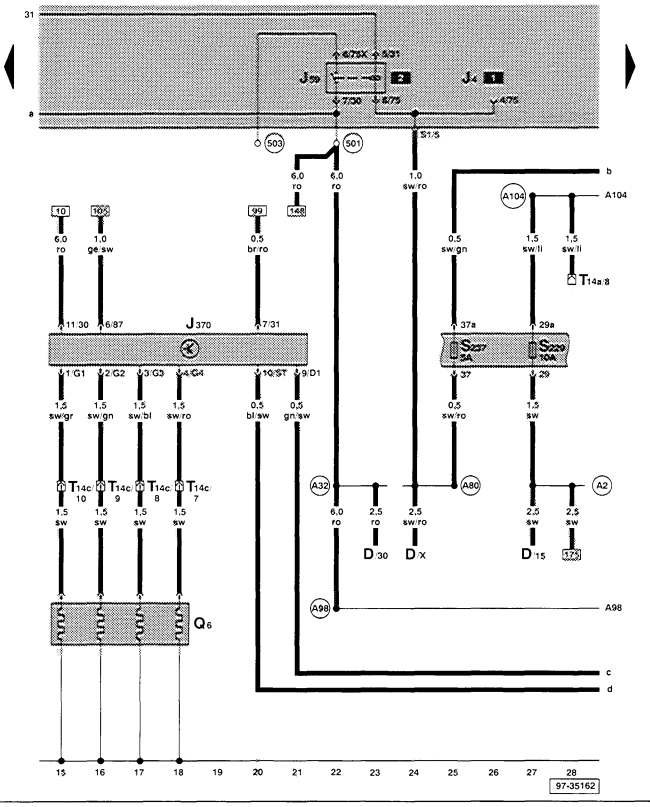


Generator (GEN), starter

A - Battery
B - Starter
C - Generator (GEN)
C1 - Voltage Regulator (VR)
D - Ignition/Starter Switch
J226 - Park/Neutral Position (PNP) Relay
S163 - Fuse -2- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
T2e - Double Connector, near starter (vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left

(42) - Ground connection, beside steering column
(49) - Ground connection, on steering column
(135) - Ground connection -2-, in instrument panel wiring harness
(500) - Threaded connection -1- (30) on the relay plate

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

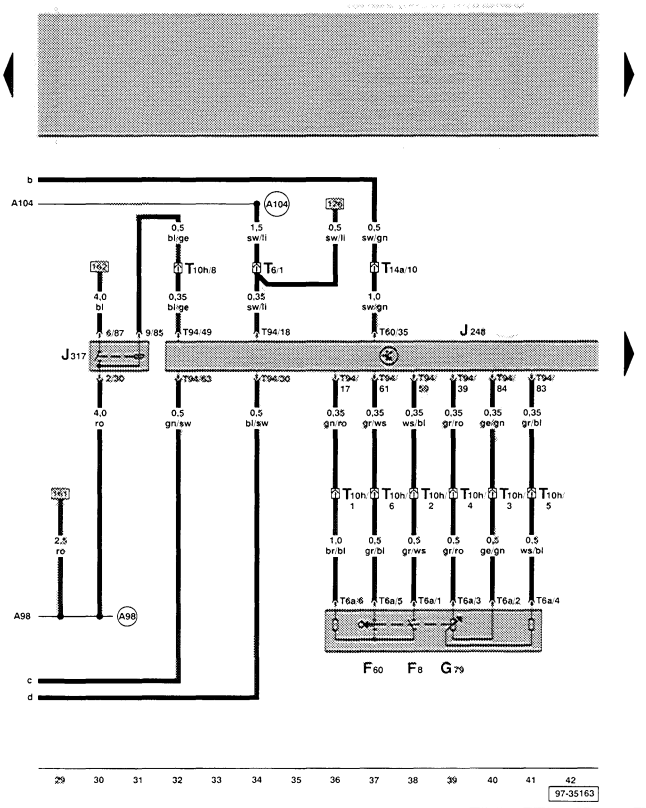


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Glow plug activation control module, engine glow plugs

- D - Ignition/Starter Switch
- J4 - Dual Horn Relay
- J59 - Load Reduction Relay
- J370 - Glow Plug Activation Control Module, in plenum chamber, center
- Q6 - Engine Glow Plugs
- S229 - Fuse 29 (in fuse panel)
- S237 - Fuse 37 (in fuse panel)
- T14a - 14-Pin Connector, near battery
- T14c - 14-Pin Connector, in engine compartment, left

- (501) - Threaded connection -2- (30) on the relay plate
- (503) - Threaded connection -2- (75x) on the relay plate
- (A2) - Plus connection (15), in instrument panel wiring harness
- (A32) - Plus connection (30), in instrument panel wiring harness
- (A80) - Connection -1- (X) in instrument panel wiring harness
- (A98) - Plus connection -4- (30), in instrument panel wiring harness
- (A104) - Plus connection -2- (15), in instrument panel wiring harness



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

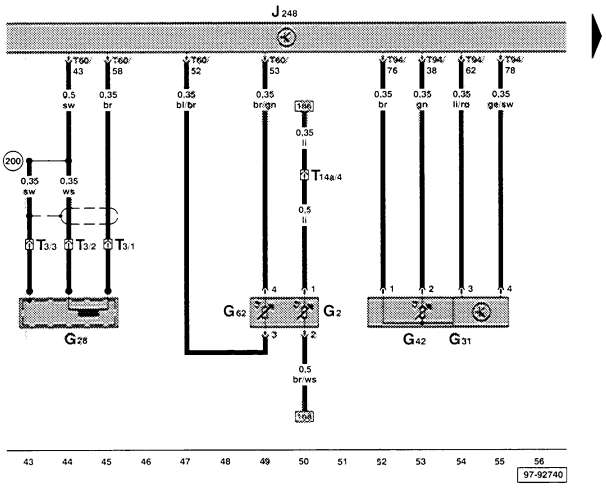
Diesel direct fuel injection (DFI) engine control module (ECM), power supply (terminal 30, B+) relay, kick down switch, (CTP) switch, throttle position (TP) sensor

- F8 - Kick Down Switch
- F60 - Closed Throttle Position (CTP) Switch
- G79 - Throttle Position (TP) Sensor
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- J317 - Power Supply (Terminal 30, B+) Relay, on the thirteenfold auxiliary relay panel, above relay panel
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T6a - 6-Pin Connector
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- T60 - 60-Pin Connector
- T94 - 94-Pin Connector

- (A98) - Plus connection -4- (30), in instrument panel wiring harness
- (A104) - Plus connection -2- (15), in instrument panel wiring harness

Diesel direct fuel injection (DFI) engine control module (ECM), engine speed (RPM) sensor, engine coolant temperature (ECT) sensor, intake air temperature (IAT) sensor, charge air pressure sensor

- G2 - Engine Coolant Temperature (ECT) Gauge Sensor
- G28 - Engine Speed (RPM) Sensor
- G31 - Charge Air Pressure Sensor
- G42 - Intake Air Temperature (IAT) Sensor
- G62 - Engine Coolant Temperature (ECT) Sensor
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- T3 - 3-Pin Connector, in engine compartment, front
- T14a - 14-Pin Connector, near battery
- T60 - 60-Pin Connector
- T94 - 94-Pin Connector



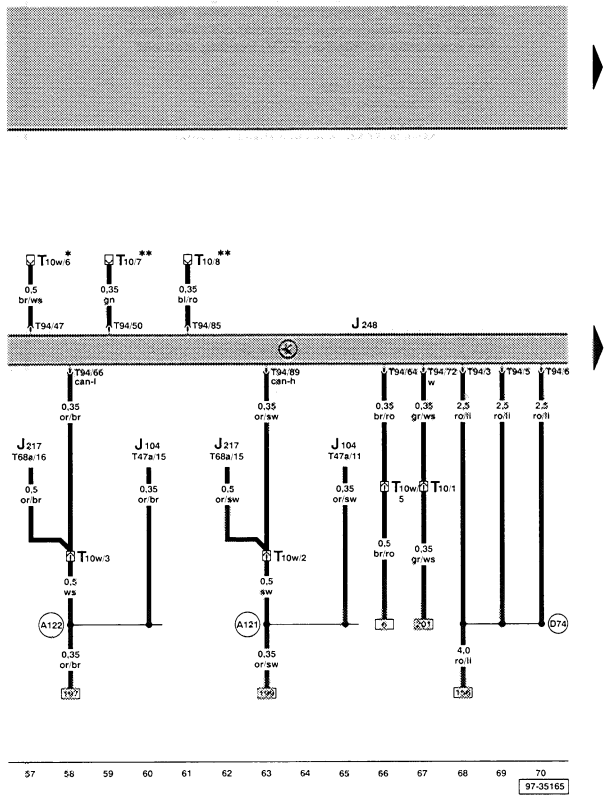
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Diesel direct fuel injection (DFI) engine control module (ECM)

- J104 - ABS Control Module, in engine compartment, left
- J217 - Transmission Control Module (TCM)
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T47a - 47-Pin Connector, on ABS Control Module
- T68a - 68-Pin Connector, on Transmission Control Module (TCM)
- T94 - 94-Pin Connector

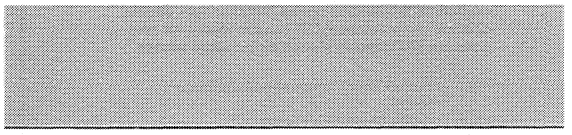
- (A121) - Connection (high bus), in instrument panel wiring harness
- (A122) - Connection (low bus), in instrument panel wiring harness
- (D74) - Wire connection (86), in engine compartment wiring harness

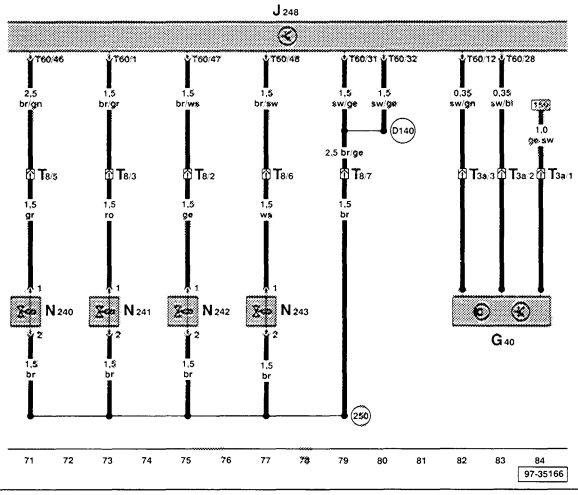
* - Coolant Fan Control (FC) Control Module connection
** - A/C connection



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Diesel direct fuel injection (DFI) engine control module (ECM), pump/injector valves, camshaft position (CMP) sensor



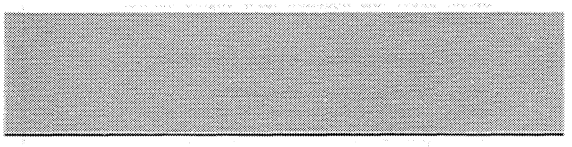


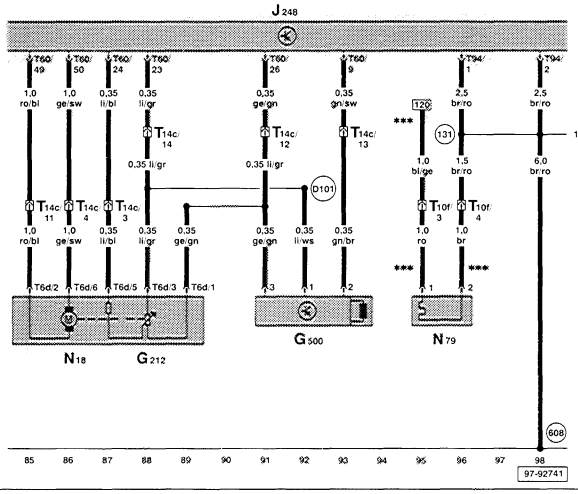
- G40 - Camshaft Position (CMP) Sensor
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- N240 - Pump/Injector Valve (cylinder 1)
- N241 - Pump/Injector Valve (cylinder 2)
- N242 - Pump/Injector Valve (cylinder 3)
- N243 - Pump/Injector Valve (cylinder 4)
- T3a - 3-Pin Connector, in engine compartment, front
- T8 - 8-Pin Connector, on left cylinder head
- T60 - 60-Pin Connector

- (250) - Ground connection in wiring harness engine pre-wiring - Diesel
- (D140) - Connection (injectors), in wiring harness, engine pre-wiring

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Diesel direct fuel injection (DFI) engine control module (ECM), turbocharger (TC) vane position sensor, EGR vacuum regulator solenoid valve, positive crankcase ventilation (PCV) heating element





- G212 - EGR Potentiometer
- G500 - Turbocharger (TC) Vane Position Sensor
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- N18 - EGR Vacuum Regulator Solenoid Valve
- N79 - Positive Crankcase Ventilation (PCV) Heating Element***
- T6d - 6-Pin Connector
- T10f - 10-Pin Connector, in engine compartment, front
- T14c - 14-Pin Connector, in engine compartment, left
- T60 - 60-Pin Connector
- T94 - 94-Pin Connector

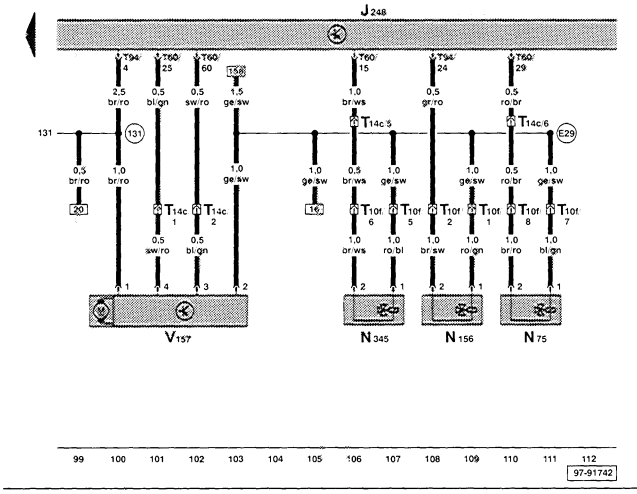
- (131) - Ground connection -2-, in engine compartment wiring harness
- (608) - Ground connection (in center plenum chamber)
- (D101) - Wire connection -1-, in engine compartment wiring harness
- *** - Vehicles with positive crankcase ventilation (PCV) heating element

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Diesel direct fuel injection (DFI) engine control module (ECM), intake flap motor, intake manifold change-over valve, exhaust gas recirculation (EGR) cooler switch-over valve, wastegate bypass regulator valve

J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
N75 - Wastegate Bypass Regulator Valve
N156 - Intake Manifold Change-Over Valve
N345 - Exhaust Gas Recirculation (EGR) Cooler Switch-over Valve
T10f - 10-Pin Connector, in engine compartment, front
T14c - 14-Pin Connector, in engine compartment, left
T60 - 60-Pin Connector
T94 - 94-Pin Connector
V157 - Intake Flap Motor

(131) - Ground connection -2-, in engine compartment wiring harness
(E29) - Connection, in wiring harness engine



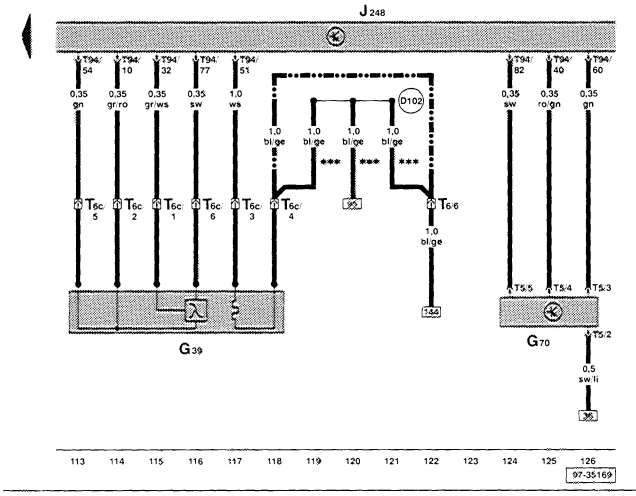
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Diesel direct fuel injection (DFI) engine control module (ECM), heated oxygen sensor (HO2S), mass air flow (MAF) sensor

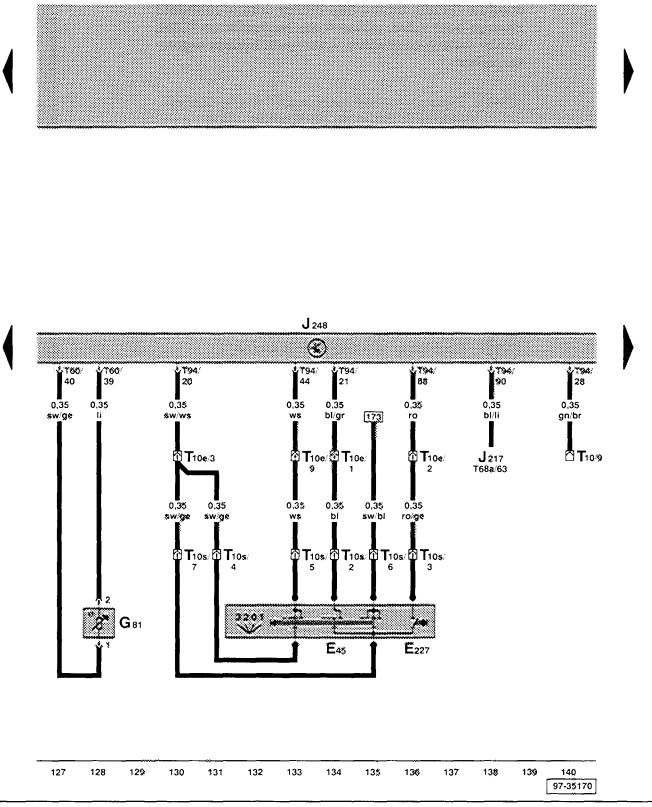
G39 - Heated Oxygen Sensor (HO2S)
G70 - Mass Air Flow (MAF) Sensor
J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
T5 - 5-Pin Connector
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T6c - 6-Pin Connector, in protective housing for connectors under right floor
T94 - 94-Pin Connector

(D102) - Wire connection -2-, in engine compartment wiring harness

*** - Vehicles with positive crankcase ventilation (PCV) heating element
---*** Vehicles without positive crankcase ventilation (PCV) heating element



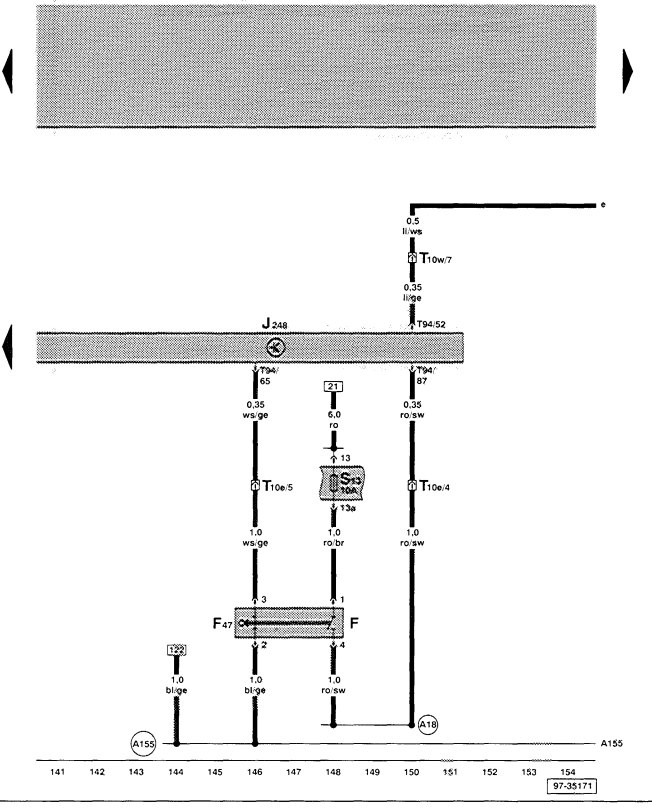
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Diesel direct fuel injection (DFI) engine control module (ECM), cruise control switch, fuel temperature sensor

- E45 - Cruise Control Switch
- E227 - Cruise Control Push Button (SET)
- G81 - Fuel Temperature Sensor
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T10s - 10-Pin Connector, near steering column
- T60 - Connector, 60 point
- T68a - 68-Pin Connector, on Transmission Control Module (TCM)
- T60 - 60-Pin Connector
- T94 - 94-Pin Connector

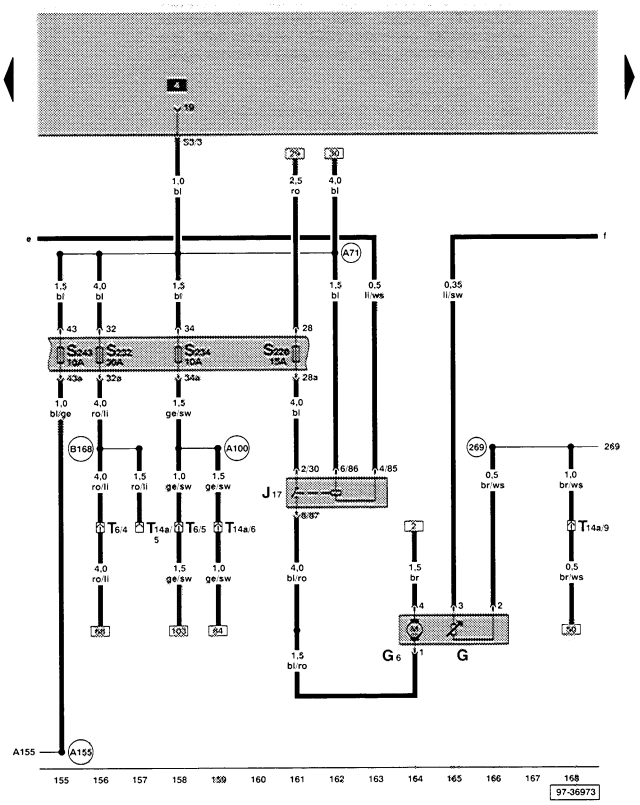
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Diesel direct fuel injection (DFI) engine control module (ECM), brake light switch, brake pedal switch

- F - Brake Light Switch
- F47 - Brake Pedal Switch
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM), in plenum chamber, center
- S13 - Fuse 13 (in fuse panel)
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T94 - 94-Pin Connector
- (A18) - Wire connection (54), in instrument panel wiring harness
- (A155) - Connection -2- (86), in instrument panel wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

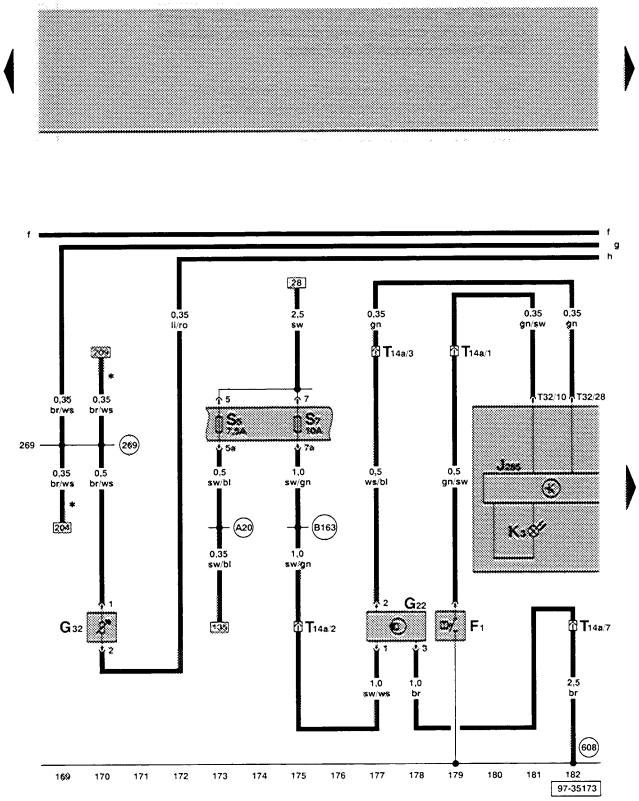


Fuel pump (FP) relay, fuel pump (FP), Fuel level Sensor

- G - Fuel Level Sensor
- G6 - Fuel Pump (FP)
- J17 - Fuel Pump (FP) Relay
- S228 - Fuse 28 (in fuse panel)
- S232 - Fuse 32 (in fuse panel)
- S234 - Fuse 34 (in fuse panel)
- S243 - Fuse 43 (in fuse panel)
- T6 - 6-Pin Connector, brown, (in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery

- (269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
- (A71) - Connection (86), in instrument panel wiring harness
- (A100) - Connection -2- (87), in instrument panel wiring harness
- (A155) - Connection -2- (86), in instrument panel wiring harness
- (B168) - Connection (86) in passenger compartment wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



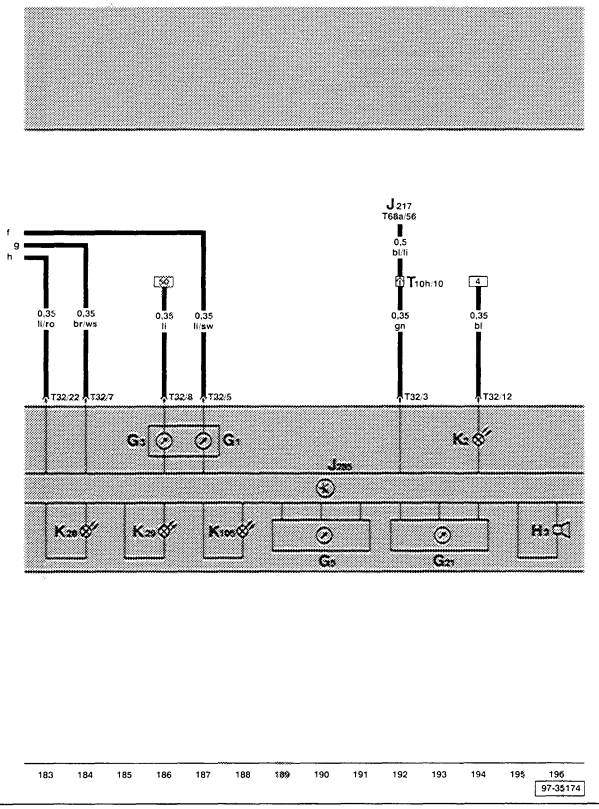
Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light, engine coolant level (ECL) sensor

- F1 - Oil Pressure Swtch
- G22 - Speedometer Vehicle Speed Sensor (VSS)
- G32 - Engine Coolant Level (ECL) Sensor
- J285 - Instrument Cluster Control Module
- K3 - Oil Pressure Warning Light
- S5 - Fuse 5 in fuse holder
- S7 - Fuse 7 in fuse holder
- T14a - 14-Pin Connector, near battery
- T32 - 32-Pin Connector, blue

- (269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
- (608) - Ground Connection (in center plenum chamber)
- (A20) - Wire connection (15a), in instrument panel wiring harness
- (B163) - Plus connection -1- (15) in wiring harness interior

* - Vehicles with Multi-Function Indicator (MFI) only

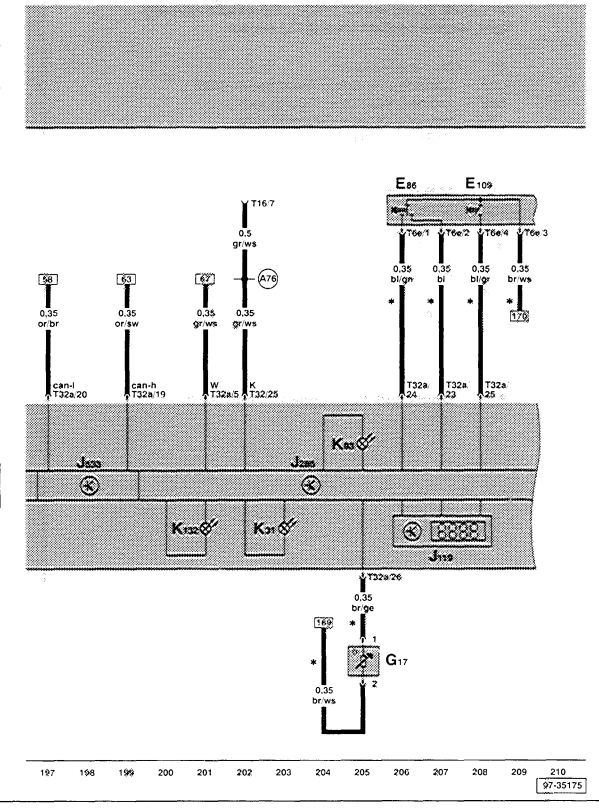
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light, glow plug indicator light

- G1 - Fuel Gauge
- G3 - Engine Coolant Temperature (ECT) Gauge
- G5 - Tachometer
- G21 - Speedometer
- H3 - Warning Buzzer
- J217 - Transmission Control Module (TCM)
- J285 - Instrument Cluster Control Module
- K2 - Generator (GEN) Warning Light
- K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
- K29 - Glow Plug Indicator Light
- K105 - Low Fuel Level Warning Light
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T32 - 32-Pin Connector, blue
- T68a - 68-Pin Connector, on Transmission Control Module (TCM)

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp

- E86 - Multi-Function Indicator Mode Select Switch
- E109 - Multi-Function Indicator Memory Switch
- G17 - Outside Air Temperature Sensor
- J119 - Multi-function Indicator (MFI)
- J285 - Instrument Cluster Control Module
- J533 - Data Bus On Board Diagnostic Interface
- K31 - Cruise Control Indicator Light
- K83 - Malfunction Indicator Lamp (MIL)
- K132 - Electronic Power Control (EPC) Warning Lamp
- T6e - 6-Pin Connector
- T16 - 16-Pin Connector, black, Data Link Connector (DLC), below instrument panel, left
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green
- (A76) - Connection (K-diagnosis wire), in instrument panel wiring harness
- * - Vehicles with Multi-Function Indicator (MFI) only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

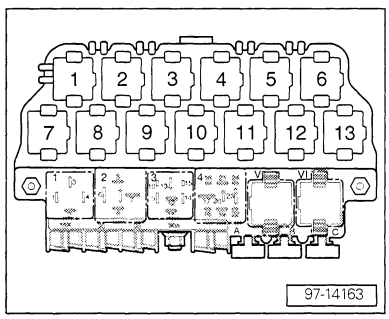
Automatic transmission, 4 speed automatic,

from December 2002

● **2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code AVH, AZG, BBW, BEV**

Additional Fuse, Relay, Control Module and Connector locations ⇒ Compontent Locations

Troubleshooting Procedures ⇒ Guided Fault Finding using VAS 5051/5052

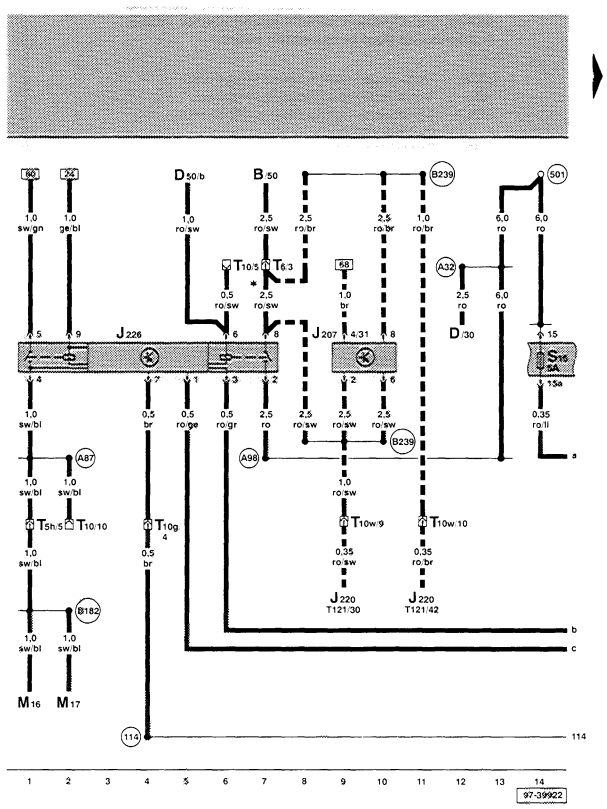


Relay location on the thirteenfold auxiliary relay panel, above relay panel:

3 J207 - Starting Interlock Relay (465)

11 J317 - Park/Neutral Position (PNP) Relay (175)

Relay panel:

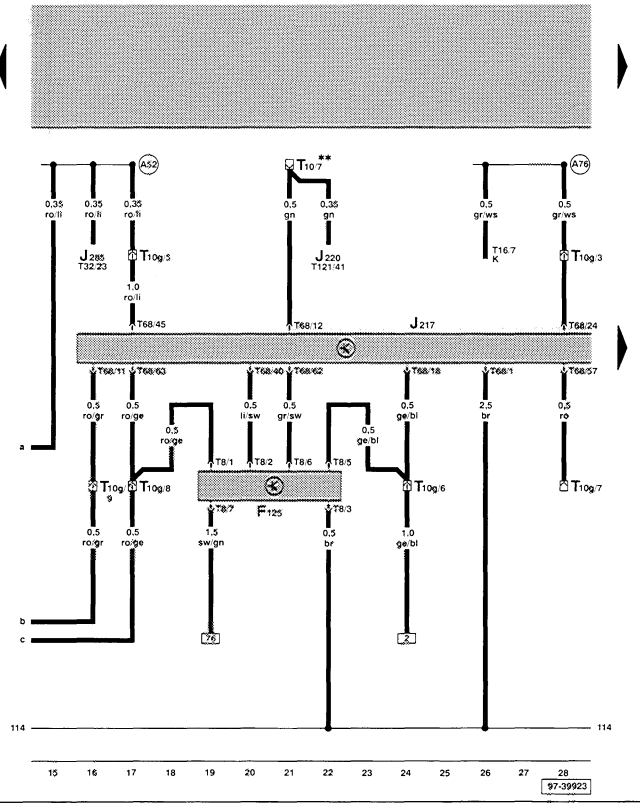


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Park/neutral position (PNP) relay, starting interlock relay

B - Starter
D - Ignition/Starter Switch
J207 - Starting Interlock Relay, on the thirteenfold auxiliary relay panel, above relay panel
J220 - Motronic Engine Control Module (ECM)
J226 - Park/Neutral Position (PNP) Relay, on the thirteenfold auxiliary relay panel, above relay panel
M16 - Left Back-Up Light
M17 - Right Back-Up Light
S15 - Fuse 15 in fuse holder
T5h - 5-Pin Connector, near left A-pillar, lower part, in harness
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
T121 - 121-Pin Connector

(114) - Ground connection, in automatic transmission wiring harness
(501) - Threaded connection 2 (30) on the relay plate
(A32) - Plus connection (30), in instrument panel wiring harness
(A87) - Connection (RF), in instrument panel wiring harness
(A98) - Plus connection 4 (30), in instrument panel wiring harness
(B182) - Connection (RF) in passenger compartment wiring harness
(B239) - Plus connection 1 (50) (in interior wiring harness)
(B240) - Plus connection 2 (50) (in interior wiring harness)
* - Not for 2.0L-Engine - code BBW
--- 2.0L-Engine - code BBW only



Transmission control module (TCM), multi-function transmission range (TR) switch

- F125 - Multi-Function Transmission Range (TR) Switch
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J285 - Control module with indicator unit in instrument panel insert
- T8 - 8-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
- T16 - Data Link Connector (DLC), below instrument panel, left
- T32 - 32-Pin Connector, blue
- T68 - 68-Pin Connector
- T121 - 121-Pin Connector

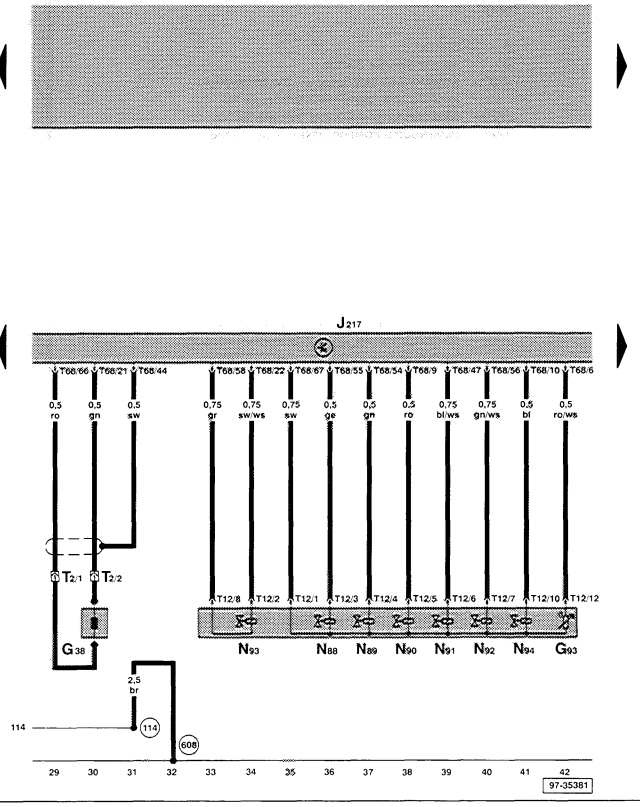
- (A52) - Plus connection (30a), in instrument panel wiring harness
- (A76) - Connection (K-diagnosis wire) in instrument panel wiring harness

** - A/C connection

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.04

Repair Manual page number 97-899



Transmission control module (TCM), solenoid valves, transmission vehicle speed sensor (VSS), transmission fluid temperature sensor

- G38 - Transmission Vehicle Speed Sensor (VSS)
- G93 - Transmission Fluid Temperature Sensor
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- N88 - Solenoid Valve 1
- N89 - Solenoid Valve 2
- N90 - Solenoid Valve 3
- N91 - Solenoid Valve 4
- N92 - Solenoid Valve 5
- N93 - Solenoid Valve 6
- N94 - Solenoid Valve 7
- T2 - Double Connector, on transmission
- T12 - 12-Pin Connector
- T68 - 68-Pin Connector

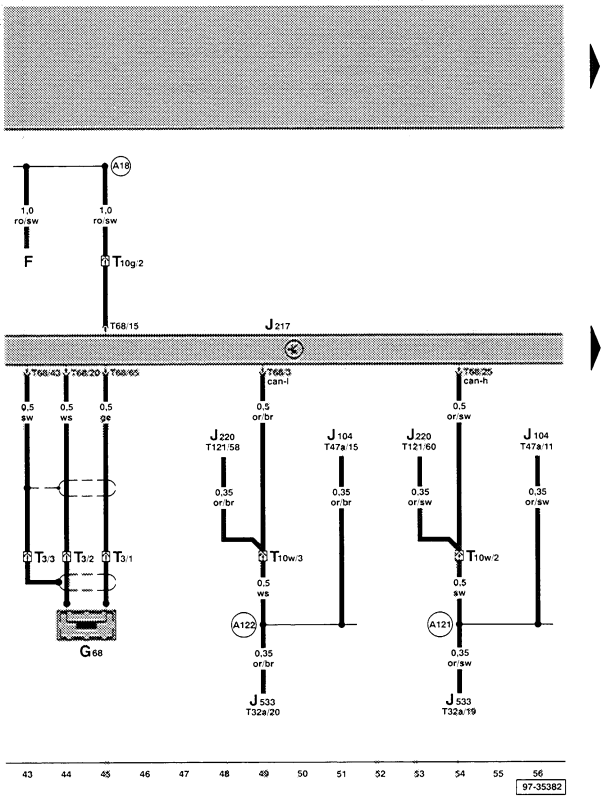
- (114) - Ground connection, in automatic transmission wiring harness
- (608) - Ground connection (in center plenum chamber)

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03

Repair Manual page number 97-898

Transmission control module (TCM), vehicle speed sensor (VSS)



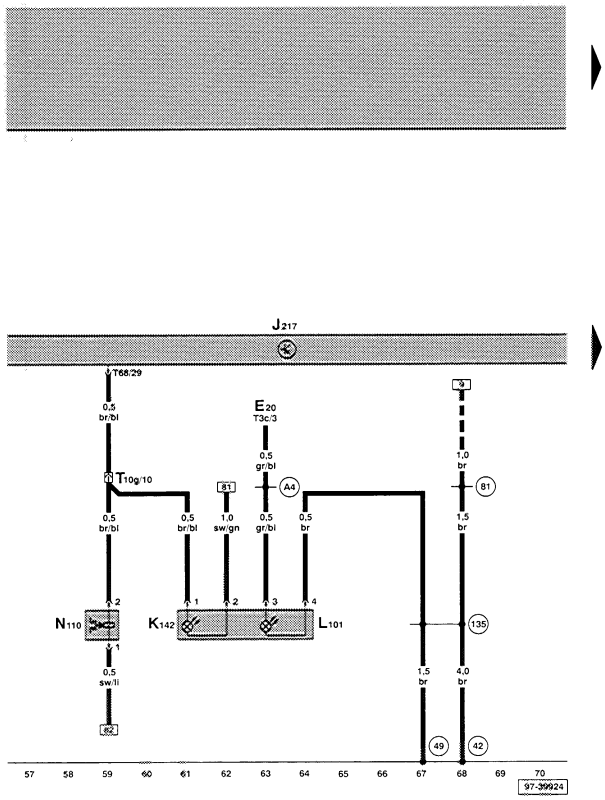
- F - Brake Light Switch
- G68 - Vehicle Speed Sensor (VSS)
- J104 - ABS Control Module (w/EDL)
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J533 - Data Bus On Board Diagnostic Interface
- T3 - 3-Pin Connector, on transmission
- T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T32a - 32-Pin Connector, green, on Instrument cluster
- T47a - 47-Pin Connector, on ABS Control Module
- T68 - 68-Pin Connector
- T121 - 121-Pin Connector

- (A18) - Wire connection (54), in instrument panel wiring harness
- (A121) - Connection (high bus), in instrument panel wiring harness
- (A122) - Connection (low bus), in instrument panel wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03

Transmission control module (TCM), shift lock solenoid, warning light for selector lever position P/N



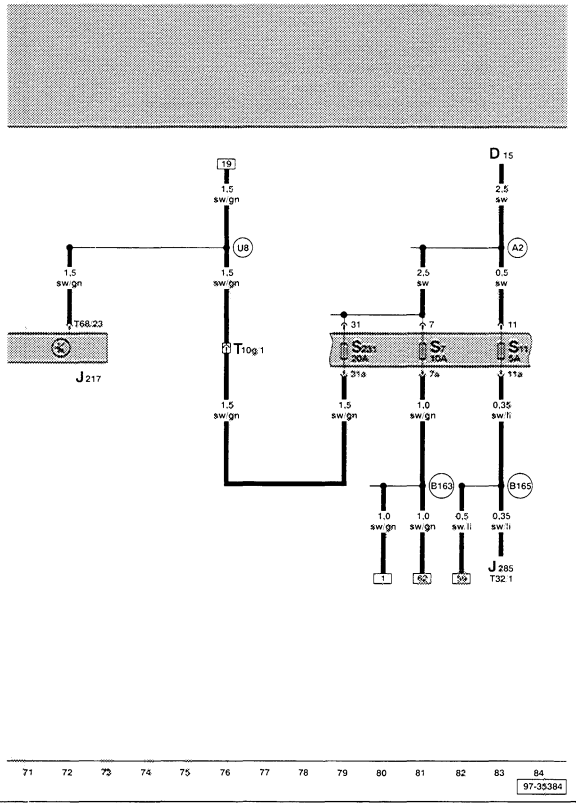
- E20 - Instrument Panel Light Dimmer Switch
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- K142 - Warning light for selector lever position P/N
- L101 - Illumination for selector lever scale
- N110 - Shift Lock Solenoid
- T3c - 3-Pin Connector
- T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
- T68 - 68-Pin Connector

- (42) - Ground connection, beside steering column
- (49) - Ground connection, on steering column
- (81) - Ground connection 1, in instrument panel wiring harness
- (135) - Ground connection 2, in instrument panel wiring harness
- (A4) - Plus connection (58b), in instrument panel wiring harness

--- 2.0L-Engine - code BBW only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.04



Transmission control module (TCM)

- D - Ignition/Starter Switch
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- J285 - Control module with indicator unit in instrument panel insert
- S7 - Fuse 7 in fuse holder
- S11 - Fuse 11 in fuse holder
- S231 - Fuse 31 in fuse holder
- T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
- T32 - 32-Pin Connector, blue
- T68a - 68-Pin Connector

- (A2) - Plus connection (15), in instrument panel wiring harness
- (B163) - Plus connector -1- (15) in wiring harness interior
- (B165) - Plus connection -2- (15) in wiring harness interior
- (U8) - Plus connection (15a) in automatic transmission wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Repair Manual page number 97-903

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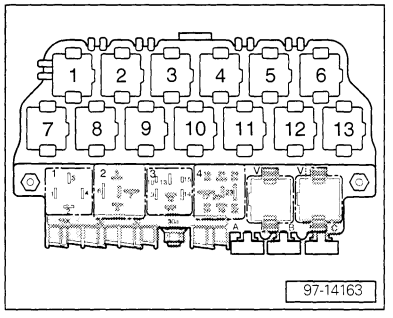
Automatic transmission, 5 speed automatic with Tiptronic,

from December 2002

- 1.8L - Engine - Motronic Multiport Fuel Injection (MFI)/132 kW, code AWP
- 2.8L - Engine - Motronic Multiport Fuel Injection (MFI)/147 kW, code BDF
- 1.9L - Engine - Turbo Diesel Fuel Injection (DFI)/74 kW, code BEW

Additional Fuse, Relay, Control Module and Connector locations ⇒ Compontent Locations

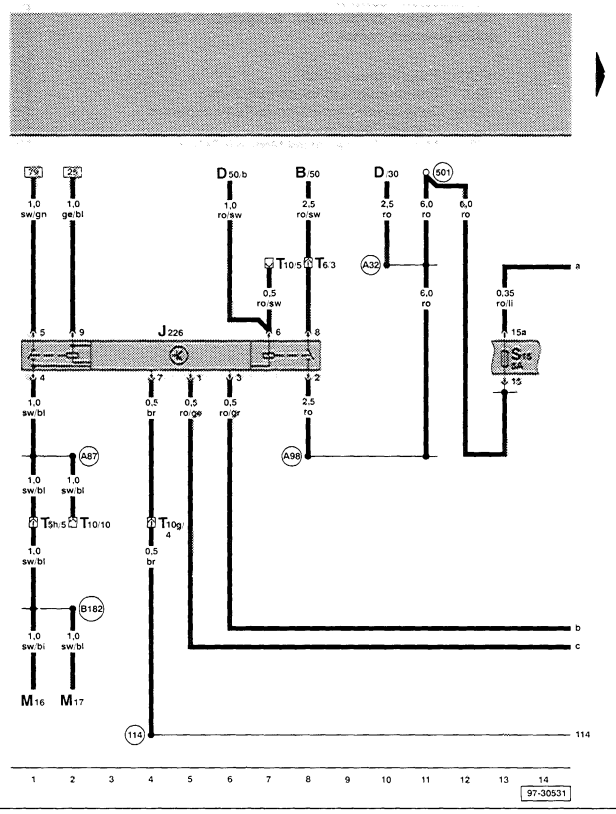
Troubleshooting Procedures ⇒ Guided Fault Finding using VAS 5051/5052



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

11 J317 - Park/Neutral Position (PNP) Relay (175)

Relay panel:

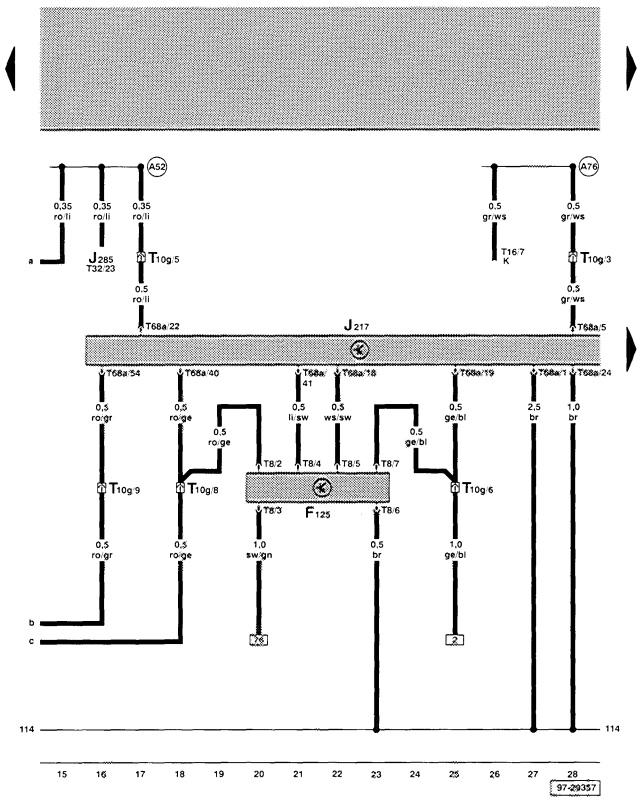


Park/neutral position (PNP) relay

B - Starter
D - Ignition/Starter Switch
J226 - Park/Neutral Position (PNP) Relay, on the thirteenfold auxiliary relay panel, above relay panel
M16 - Left Back-Up Light
M17 - Right Back-Up Light
S15 - Fuse 15 in fuse holder
T5h - 5-Pin Connector, near left A-pillar, lower part, in harness
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left

(114) - Ground connection, in automatic transmission wiring harness
(501) - Threaded connection -2- (30) on the relay plate
(A32) - Plus connection (30), in instrument panel wiring harness
(A87) - Connection (RF), in instrument panel wiring harness
(A98) - Plus connection -4- (30), in instrument panel wiring harness
(B182) - Connection (RF), in passenger compartment wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Transmission control module (TCM), multi-function transmission range (TR) switch

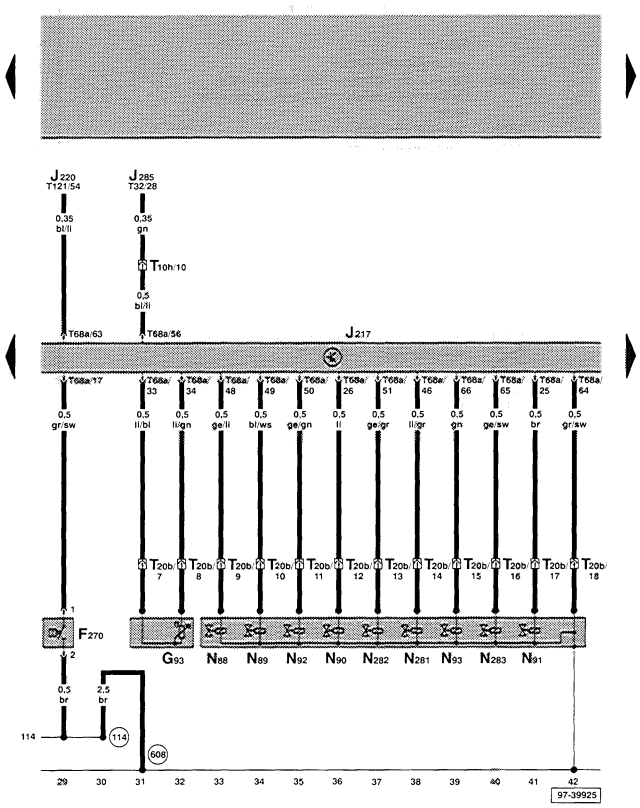
- F125 - Multi-Function Transmission Range (TR) Switch
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- J285 - Control module with indicator unit in instrument panel insert
- T8 - 8-Pin Connector
- T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
- T16 - Data Link Connector (DLC), below instrument panel, left
- T32 - 32-Pin Connector, blue
- T68a - 68-Pin Connector

- (A52) - Plus connection (30a), in instrument panel wiring harness
- (A76) - Connection (K-diagnosis wire) in instrument panel wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03

Repair Manual page number 97-907



Transmission control module (TCM), solenoid valves, transmission fluid temperature sensor, brake pressure switch

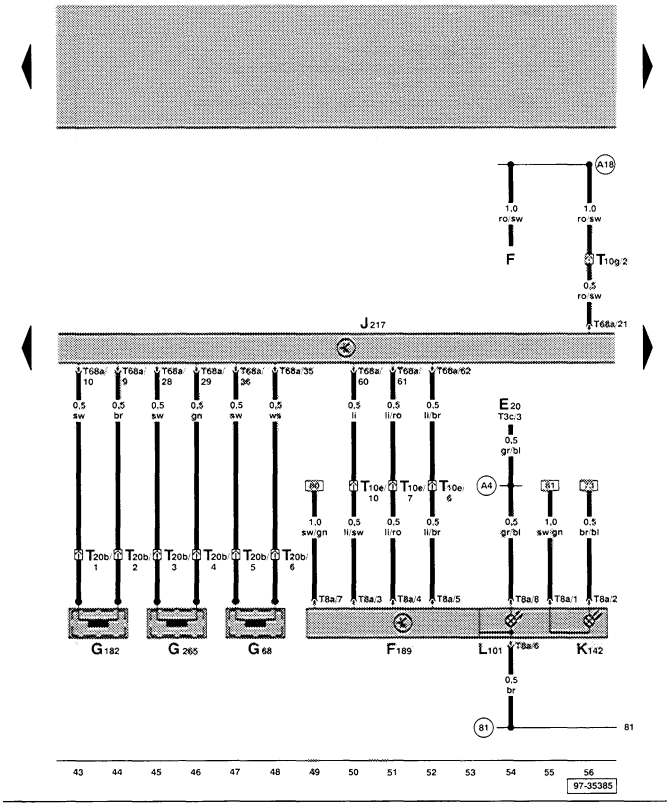
- F270 - Brake Pressure Switch
- G93 - Transmission Fluid Temperature Sensor
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J285 - Control module with indicator unit in instrument panel insert
- N88 - Solenoid Valve 1
- N89 - Solenoid Valve 2
- N90 - Solenoid Valve 3
- N91 - Solenoid Valve 4
- N92 - Solenoid Valve 5
- N93 - Solenoid Valve 6
- N281 - Solenoid Valve 8
- N282 - Solenoid Valve 9
- N283 - Solenoid Valve 10
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T20b - 20-Pin Connector, on transmission
- T32 - 32-Pin Connector, blue
- T68a - 68-Pin Connector
- T121 - 121-Pin Connector

- (114) - Ground connection, in automatic transmission wiring harness
- (608) - Ground connection (in center plenum chamber)

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.04

Repair Manual page number 97-906

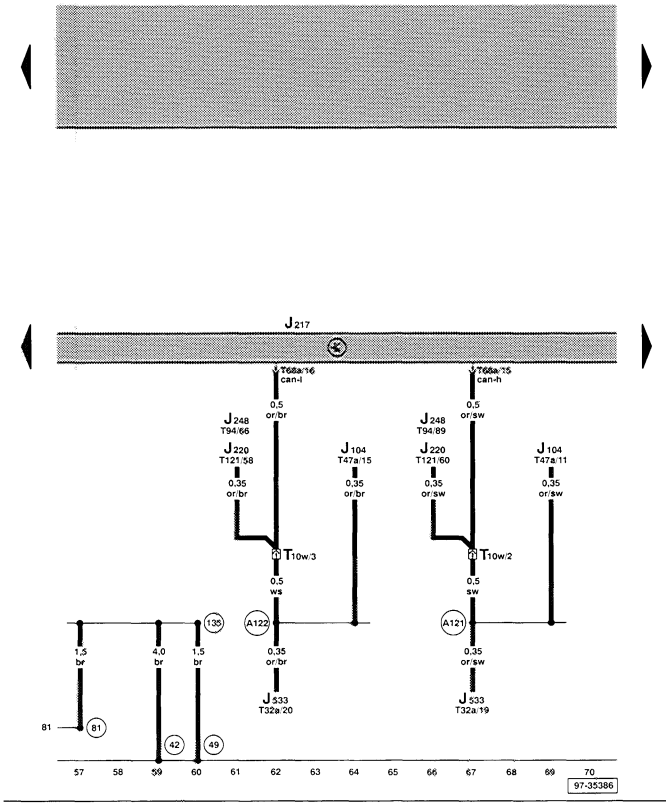


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Transmission control module (TCM), vehicle speed sensor (VSS), sensor for transmission RPM, intermediate shaft speed sensor, tiptronic switch

- E20 - Instrument Panel Light Dimmer Switch
- F - Brake Light Switch
- F189 - Tiptronic Switch
- G68 - Vehicle Speed Sensor (VSS)
- G182 - Sensor for transmission RPM
- G265 - Intermediate Shaft Speed Sensor
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- K142 - Warning light for selector lever position P/N
- L101 - Illumination for selector lever scale
- T3c - 3-Pin Connector
- T8a - 8-Pin Connector
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
- T20b - 20-Pin Connector, on transmission
- T68a - 68-Pin Connector

- (81) - Ground connection -1-, in instrument panel wiring harness
- (A4) - Plus connection (58b), in instrument panel wiring harness
- (A18) - Wire connection (54), in instrument panel wiring harness



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

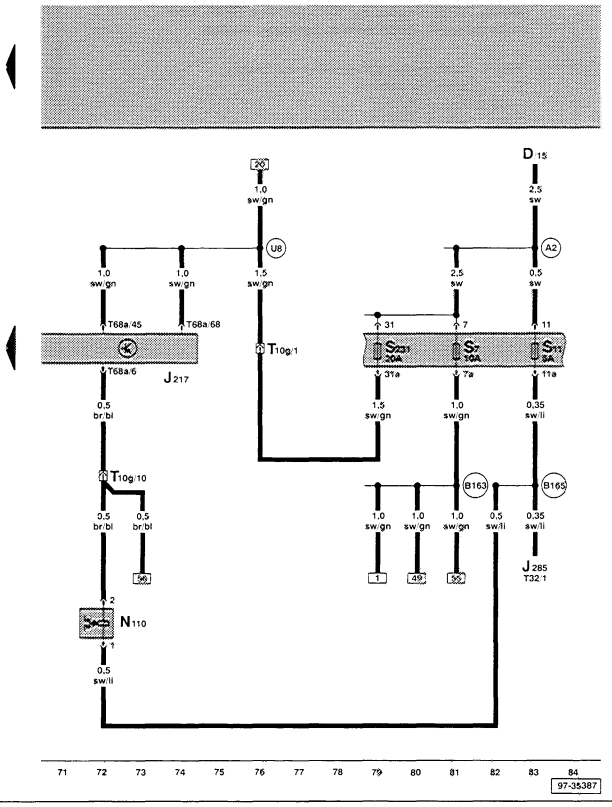
Transmission control module (TCM)

- J104 - ABS Control Module (w/EDL)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- J248 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM)
- J533 - Data Bus On Board Diagnostic Interface
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T32a - 32-Pin Connector, green, on Instrument cluster
- T47a - 47-Pin Connector, on ABS Control Module
- T68a - 68-Pin Connector
- T94 - 94-Pin Connector
- T121 - 121-Pin Connector

- (42) - Ground connection, beside steering column
- (49) - Ground connection, on steering column
- (81) - Ground connection -1-, in instrument panel wiring harness
- (135) - Ground connection -2-, in instrument panel wiring harness
- (A121) - Connection (high bus), in instrument panel wiring harness
- (A122) - Connection (low bus), in instrument panel wiring harness

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Repair Manual page number 97-908



Transmission control module (TCM), shift lock solenoid

- D - Ignition/Starter Switch
- J217 - Transmission Control Module (TCM), in plenum chamber, center
- J285 - Control module with indicator unit in instrument panel insert
- N110 - Shift Lock Solenoid
- S7 - Fuse 7 in fuse holder
- S11 - Fuse 11 in fuse holder
- S231 - Fuse 31 in fuse holder
- T10g - 10-Pin Connector, grey, in protective housing for connectors, in plenum chamber, left
- T32 - 32-Pin Connector, blue
- T68a - 68-Pin Connector

- (A2) - Plus connection (15), in instrument panel wiring harness
- (B163) - Plus connector -1- (15) in wiring harness interior
- (B165) - Plus connection -2- (15) in wiring harness interior
- (U8) - Plus connection (15a) in automatic transmission wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.03

Repair Manual page number 97-911

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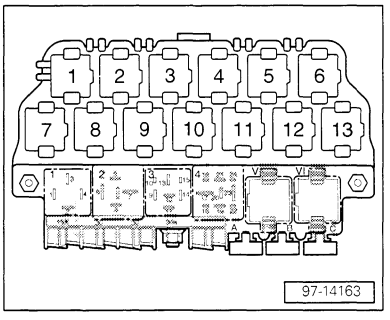
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Repair Manual page number 97-910

Telematics,

from May 2003

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations"



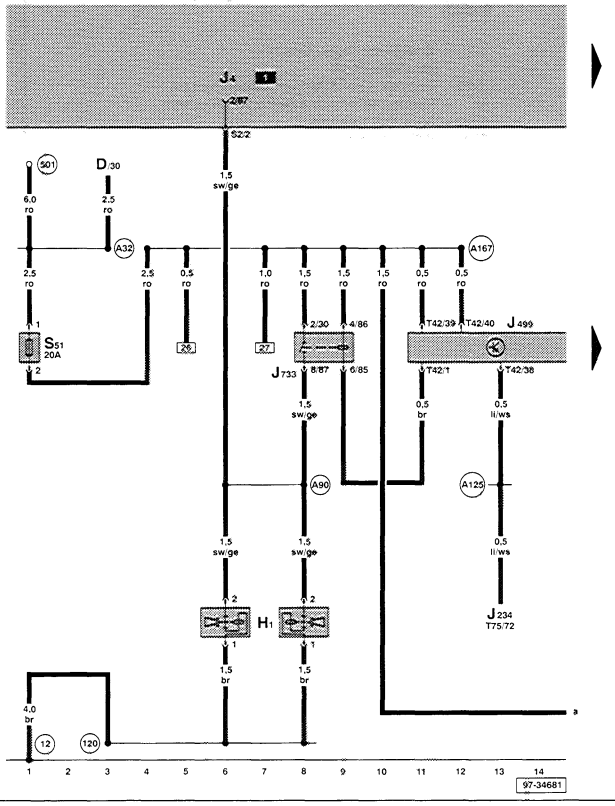
Relay location on the thirteenfold auxiliary relay panel, above relay panel:

1 J517 - Auxiliary Emergency Flasher Relay (404)

9 J733 - Dual Horn Auxiliary Relay (53)

10 J734 - Warning Lamp Auxiliary Relay (200)

Relay panel:



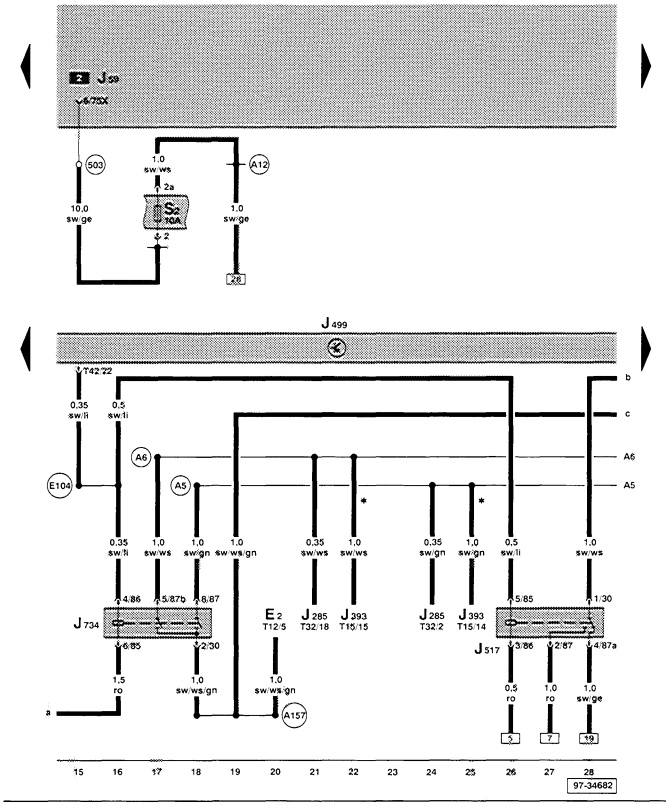
Telematic Control Module, Dual tone horn, Dual horn auxiliary relay

D - Ignition/Starter Switch
H1 - Dual tone horn
J4 - Dual Horn Relay
J234 - Airbag Control Module
J499 - Telematic Control Module, below spare tire
J733 - Dual Horn Auxiliary Relay
S51 - Fuse, on the thirteenfold auxiliary relay panel
T42 - 42-Pin Connector
T75 - 75-Pin Connector

(12) - Ground connection, in engine compartment, left
(120) - Ground connection -2-, in headlight wiring harness
(501) - Threaded connection -2- (30) on the relay plate
(A32) - Plus connection (30), in instrument panel wiring harness
(A90) - Connection (two-tone horn), in instrument panel wiring harness
(A125) - Connection (crash signal) in instrument panel wiring harness
(A167) - Plus connection -3- (30a), in instrument panel wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Telematic Control Module, warning lamp auxiliary relay, auxiliary emergency flasher relay



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

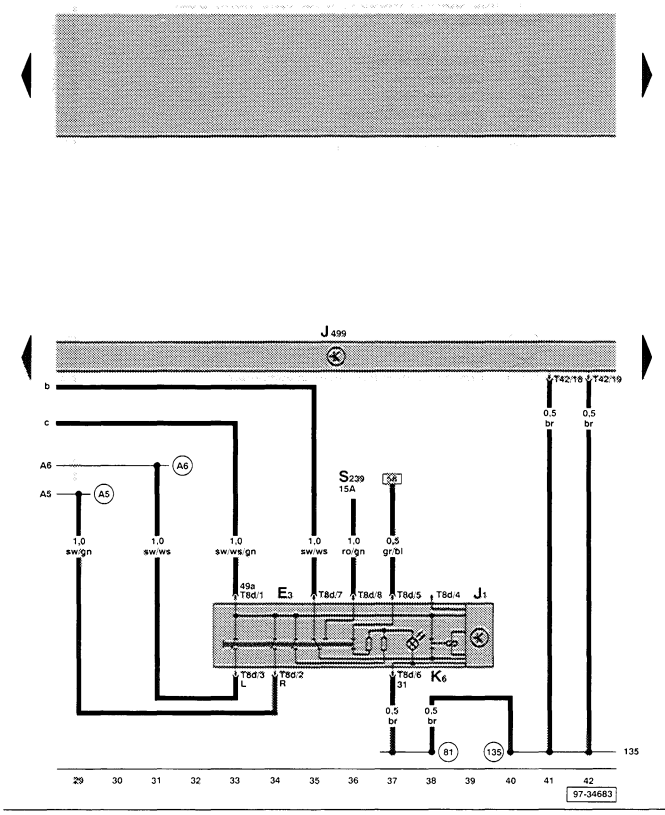
E2 - Turn signal switch
J59 - Load Reduction Relay
J285 - Control module with indicator unit in instrument panel insert
J393 - Central control module for comfort system
J499 - Telematic Control Module, below spare tire
J517 - Auxiliary Emergency Flasher Relay
J734 - Warning Lamp Auxiliary Relay
S2 - Fuse 2 in fuse holder
T12 - 12-Pin Connector
T15 - 15-Pin Connector
T32 - 32-Pin Connector, blue
T42 - 42-Pin Connector

(503) - Threaded connection -2- (75x) on the relay plate
(A5) - Plus connection (right turn signal), in instrument panel wiring harness
(A6) - Plus connection (left turn signal), in instrument panel wiring harness
(A12) - Plus connection (75a) in instrument panel wiring harness
(A157) - Connection (49a), in instrument panel wiring harness
(E104) - Ground connection in instrument panel wiring harness

* - Vehicles with anti-theft warning system only

Edition 04.03

Telematic Control Module, Emergency Flasher Switch

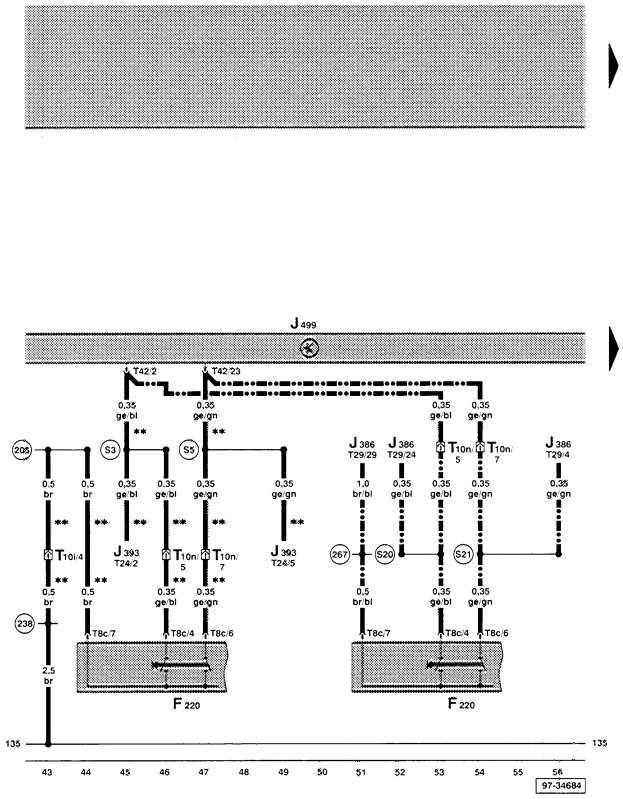


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

E3 - Emergency Flasher Switch
J1 - Turn Signal Relay
J499 - Telematic Control Module, below spare tire
K6 - Indicator light for emergency flasher system
S239 - Fuse 39 in fuse holder
T8d - 8-Pin Connector
T42 - 42-Pin Connector

(81) - Ground connection -1-, in instrument panel wiring harness
(135) - Ground connection -2-, in instrument panel wiring harness
(A5) - Plus connection (right turn signal), in instrument panel wiring harness
(A6) - Plus connection (left turn signal), in instrument panel wiring harness

Edition 04.03



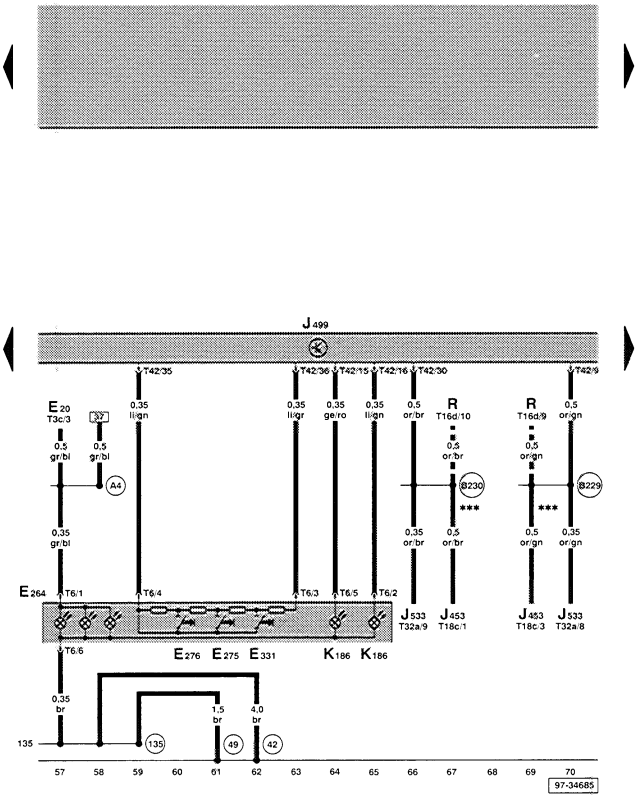
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sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Telematic Control Module, Lock unit for central locking (driver side)

- F220 - Lock unit for central locking, driver side
- J386 - Door control module, driver side
- J393 - Central control module for comfort system, behind instrument panel, left
- J499 - Telematic Control Module, below spare tire
- T8c - 8-Pin Connector
- T10i - 10-Pin Connector, black, connector station A-pillar, left
- T10n - 10-Pin Connector, brown, connector station A-pillar, left
- T24 - 24-Pin Connector
- T29 - 29-Pin Connector
- T42 - 42-Pin Connector

- (205) - Ground connection, in driver's door wiring harness
- (238) - Ground connection -1-, in wiring harness interior
- (267) - Ground connection -2-, in wiring harness door cable - driver side
- (S3) - Wire connection (switch/control module) -1-, central locking system wiring harness
- (S5) - Wire connection (switch/control module) -2-, in central locking system wiring harness
- (S20) - Connection -4- in wiring harness central locking
- (S21) - Connection -5- in wiring harness central locking
- ** - Only comfort system (vehicles without power windows)
- ----- - Only comfort system (vehicles with power windows)

Repair Manual page number 97-917



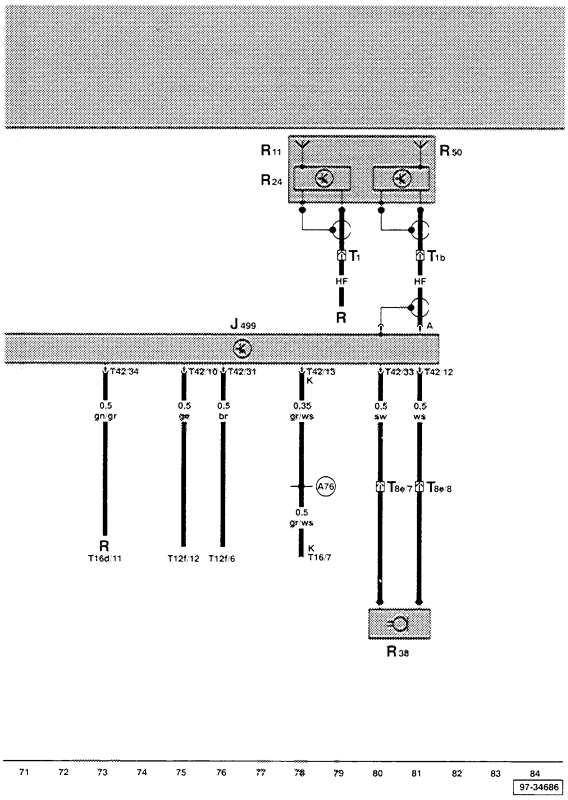
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ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Telematic Control Module, Telematic Control Head, Roadside Assistance Button, Emergency Call Button, End Conversation Button (Telematic USA), Telematics Indicator Lamp

- E20 - Instrument Panel Light Dimmer Switch
- E264 - Telematic Control Head
- E275 - Roadside Assistance Button
- E276 - Emergency Call Button
- E331 - End Conversation Button (Telematic USA)
- J453 - Control module for multi-function steering wheel
- J499 - Telematic Control Module, below spare tire
- J533 - Data Bus On Board Diagnostic Interface, in instrument cluster
- K186 - Telematics Indicator Lamp
- R - Radio
- T3c - 3-Pin Connector
- T6 - 6-Pin Connector
- T16d - 16-Pin Connector
- T18c - 18-Pin Connector
- T32a - 32-Pin Connector, green
- T42 - 42-Pin Connector

- (42) - Ground connection, beside steering column
- (49) - Ground connection, on steering column
- (135) - Ground connection -2-, in instrument panel wiring harness
- (A4) - Plus connection (58b), in instrument panel wiring harness
- (B229) - Connection (High-Bus) (interior wiring harness)
- (B230) - Connection (Low-Bus) (interior wiring harness)
- *** - Vehicles with multi-function steering wheel only
- --- - Vehicles with Radio System and CD - Player

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Telematic Control Module, Antenna, Antenna for Navigation System (GPS), Telephone Microphone

J499 - Telematic Control Module, below spare tire
R - Radio
R11 - Antenna
R24 - Antenna Amplifier
R38 - Telephone Microphone
R50 - Antenna for Navigation System (GPS)
T1 - Single Connector, near antenna
T1b - Single Connector, near antenna
T8e - 8-Pin Connector, behind left A-pillar trim, center
T12f - 12-Pin Connector, behind radio
T16 - Data Link Connector (DLC), below instrument panel, left
T42 - 42-Pin Connector

(A76) - Connection (K-diagnosis wire), in instrument panel wiring harness

* - Vehicles with Standard Radio System
--- Vehicles with Radio System and CD - Player

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

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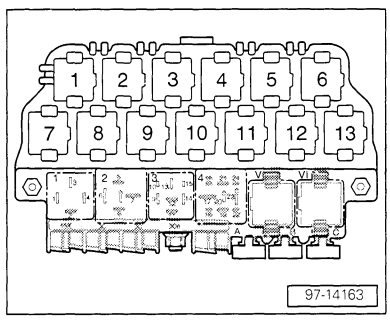
Repair Manual page number 97-921

2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code BBW,

from December 2002

Additional Fuse, Relay, Control Module and Connector locations ⇒ Compontent Locations

Troubleshooting Procedures ⇒ Guided Fault Finding using VAS 5051/5052



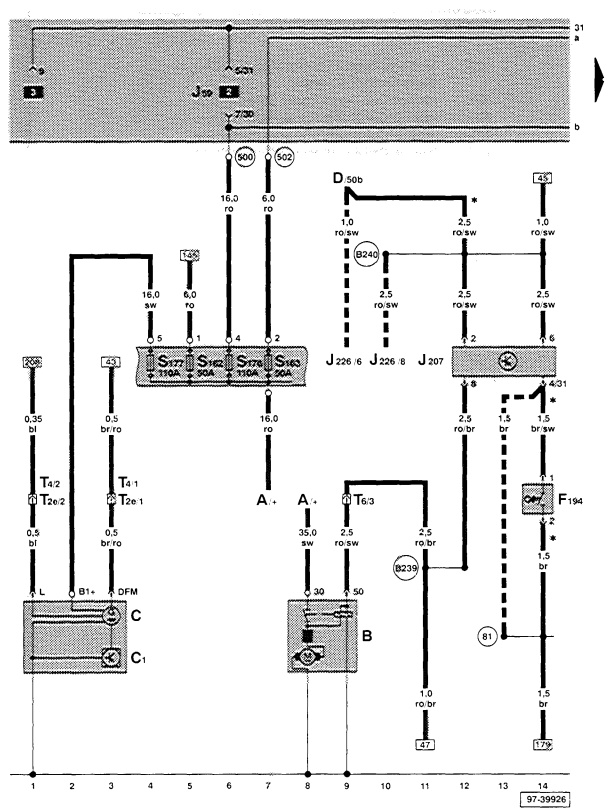
Relay location on the thirteenfold auxiliary relay panel, above relay panel:

3 J207 - Starting Interlock Relay (465)

Relay panel:

2 J59 - Load Reduction Relay (100)

4 J17 - Fuel Pump (FP) Relay (409)



Generator (GEN), starter, starting interlock relay

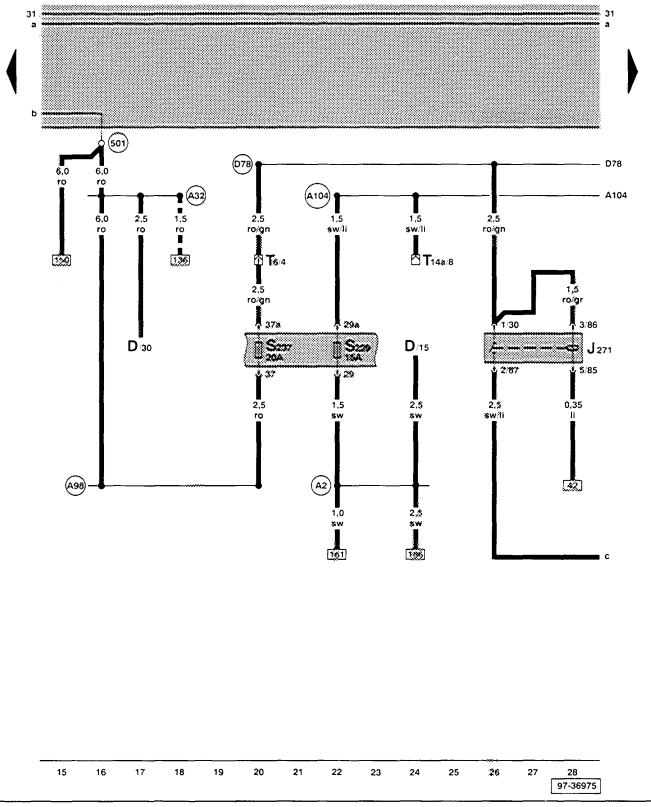
A - Battery
B - Starter
C - Generator (GEN)
C1 - Voltage Regulator (VR)
D - Ignition/Starter Switch
F194 - Clutch Pedal Position (CPP) Switch*
J59 - Load Reduction Relay
J207 - Starting Interlock Relay, on the thirteenfold auxiliary relay panel, above relay panel
J226 - Park/Neutral Position (PNP) Relay
S162 - Fuse 1 (30) in fuse bracket/battery
S163 - Fuse 2 (30) in fuse bracket/battery
S176 - Fuse 4 (30) in fuse bracket/battery
S177 - Fuse 5 (30) in fuse bracket/battery
T2e - Double Connector, near starter (vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left

(81) - Ground connection 1, in instrument panel wiring harness
(500) - Threaded connection 1 (30) on the relay plate
(502) - Threaded connection 1 (30a) on the relay plate
(B239) - Plus connection 1 (50) (in interior wiring harness)
(B240) - Plus connection 2 (50) (in interior wiring harness)

* - Manual transmission only
--- Automatic transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Repair Manual page number 97-920



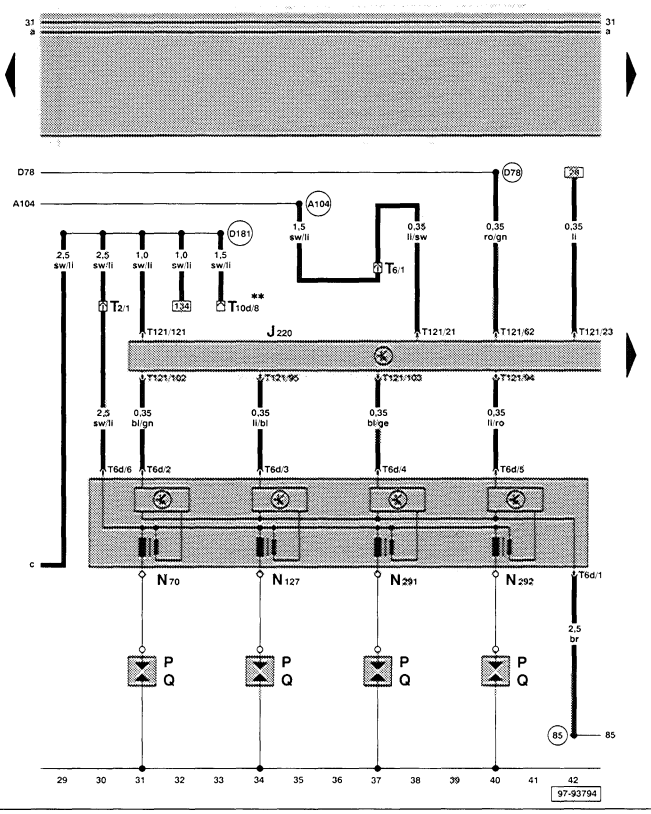
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sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Power supply relay

D - Ignition/Starter Switch
J271 - Motronic Engine Control Module (ECM) Power Supply Relay, in protective housing, in engine compartment, left, production control number (428)
S229 - Fuse 29 in fuse holder
S237 - Fuse 37 in fuse holder
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, near battery

(501) - Threaded connection -2- (30) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connection -4- (30), in instrument panel wiring harness
(A104) - Plus connection -2- (15), in instrument panel wiring harness
(D78) - Plus connection -1- (30a), in engine compartment wiring harness

--- Automatic transmission only



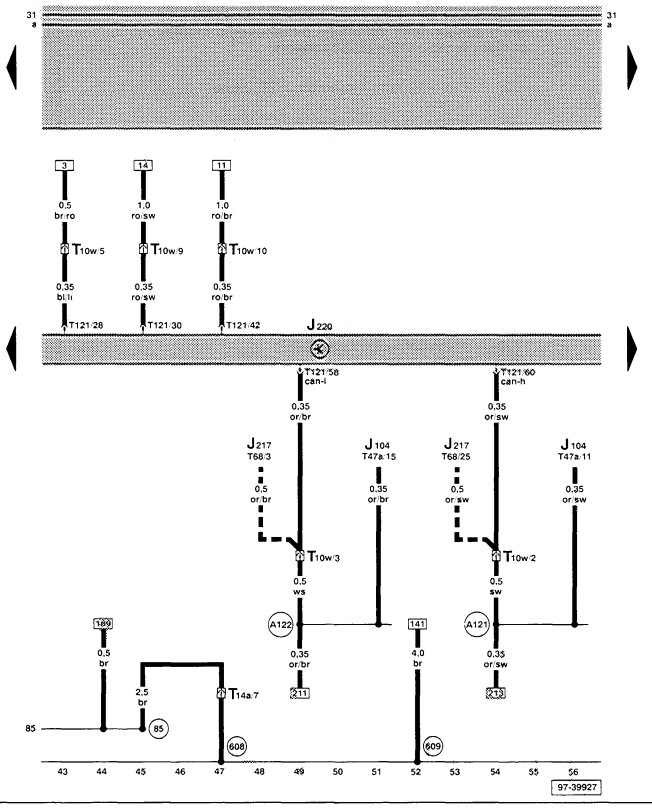
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sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), ignition system

J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N70 - Ignition Coil 1 with Power Output Stage
N127 - Ignition Coil 2 with Power Output Stage
N291 - Ignition Coil 3 with Power Output Stage
N292 - Ignition Coil 4 with Power Output Stage
P - Spark Plug Connectors
Q - Spark Plugs
T2 - 2-Pin Connector, in engine compartment, left
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T6d - 6-Pin Connector
T10d - 10-Pin Connector, green, in protective housing for connectors, in plenum chamber, left
T121 - 121-Pin Connector

(85) - Ground connection -1-, in engine compartment wiring harness
(A104) - Plus connection -2- (15), in instrument panel wiring harness
(D78) - Plus connection -1- (30a), in engine compartment wiring harness
(D181) - Connection 2 (87a) (in engine wiring harness)

** - A/C connection/ Coolant FC (Fan Control) Control Module



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sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

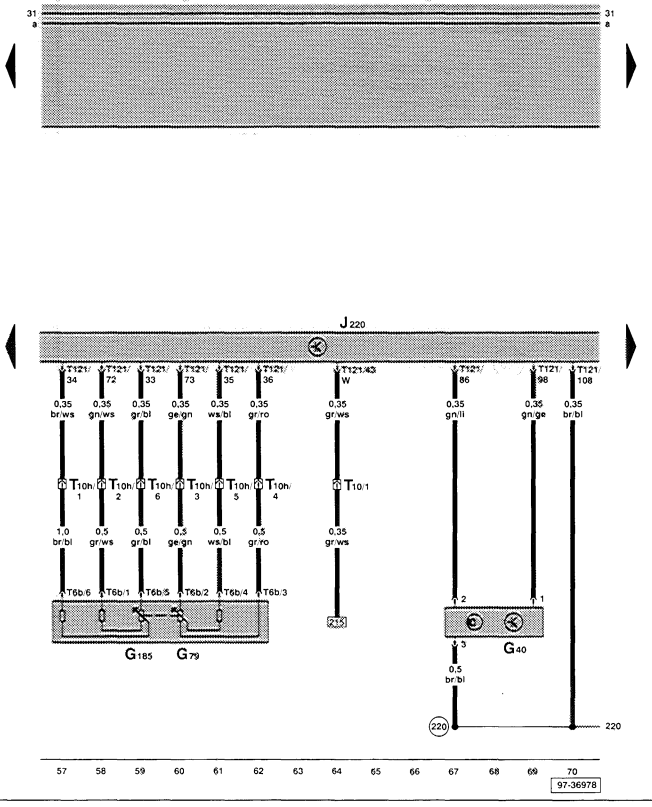
Motronic engine control module (ECM)

- J104 - ABS Control Module, in engine compartment, left
- J217 - Transmission Control Module (TCM)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- T47a - 47-Pin Connector, on ABS Control Module
- T68 - 68-Pin Connector, on Transmission Control Module (TCM)
- T121 - 121-Pin Connector

- (85) - Ground connection 1, in engine compartment wiring harness
- (608) - Ground connection (in center plenum chamber)
- (609) - Ground connection (in right plenum chamber)
- (A121) - Connection (high bus), in instrument panel wiring harness
- (A122) - Connection (low bus), in instrument panel wiring harness

--- Automatic transmission only

Edition 04.04



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sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

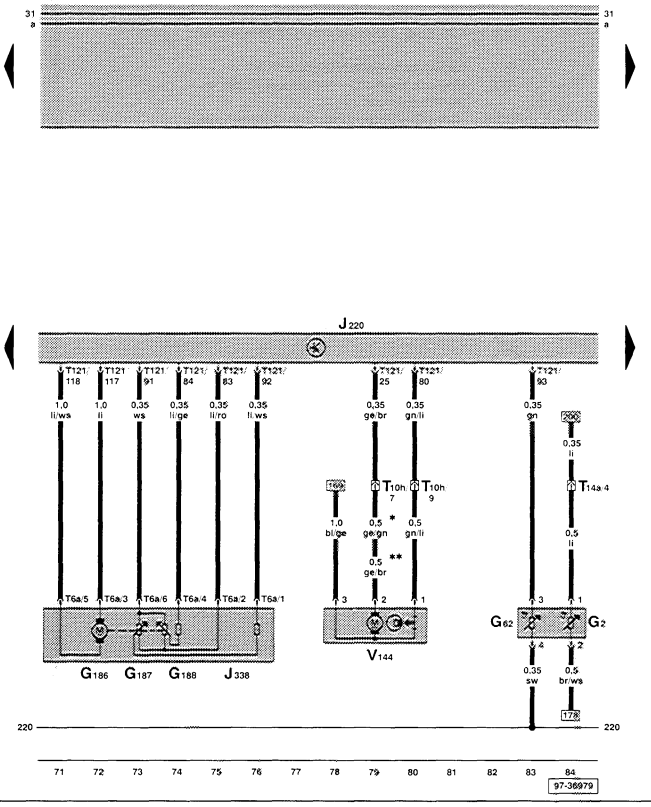
Motronic engine control module (ECM), throttle position (TP) sensor, camshaft position (CMP) sensor

- G40 - Camshaft Position (CMP) Sensor
- G79 - Throttle Position (TP) Sensor
- G185 - Accelerator Pedal Position Sensor 2
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T6b - 6-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector

- (220) - Ground connection (sensor ground), in engine compartment wiring harness

Edition 09.03

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Repair Manual page number 97-924

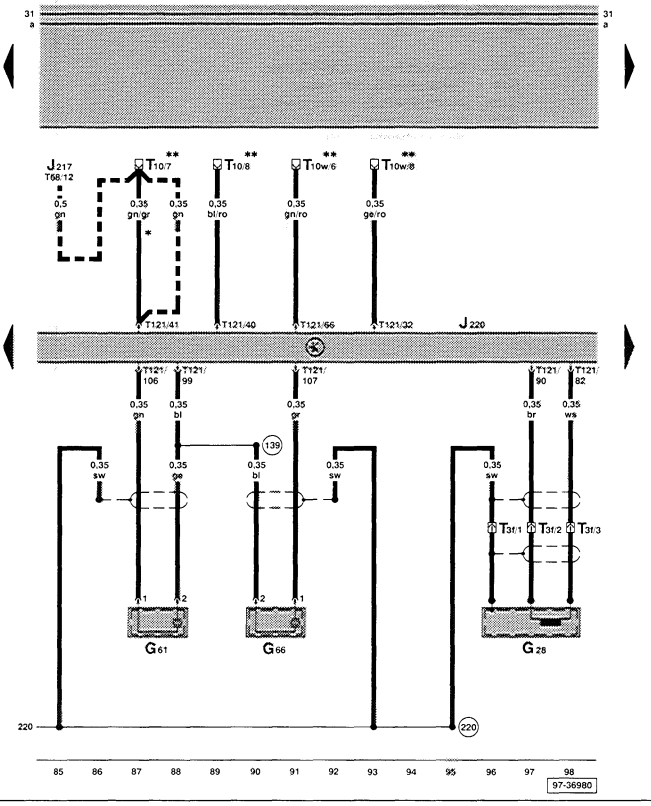


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sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), throttle drive angle sensors, engine coolant temperature (ECT) gauge, leak detection pump (LDP), engine coolant temperature (ECT) sensors

- G2 - Engine Coolant Temperature (ECT) Gauge Sensor
- G62 - Engine Coolant Temperature (ECT) Sensor
- G186 - Throttle Drive (for Electronic Power Control (EPC))
- G187 - Throttle Drive Angle Sensor 1 (for Electronic Power Control (EPC))
- G188 - Throttle Drive Angle Sensor 2 (for Electronic Power Control (EPC))
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J338 - Throttle Valve Control Module
- T6a - 6-Pin Connector
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- T121 - 121-Pin Connector
- V144 - Leak Detection Pump (LDP)

* - Jetta only
** - Golf only

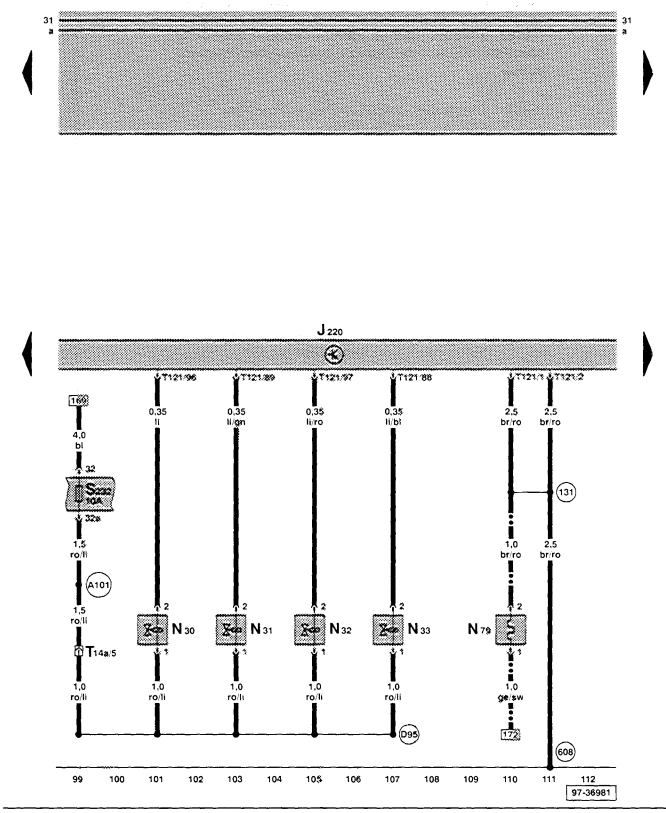


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), engine speed (RPM) sensor, knock sensor (KS) 1, knock sensor (KS) 2

- G28 - Engine Speed (RPM) Sensor
- G61 - Knock Sensor (KS) 1
- G66 - Knock Sensor (KS) 2
- J217 - Transmission Control Module (TCM)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T3f - 3-Pin Connector, in engine compartment, front
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T68 - Connector, 68 point
- T121 - 121-Pin Connector
- (139) - Ground connection (sensor Ground), in Motronic Multiport Fuel Injection (MFI) wiring harness
- (220) - Ground connection (sensor ground), in engine compartment wiring harness

* - Manual transmission only
** - A/C connection/ Coolant FC (Fan Control) Control Module
--- Automatic transmission only



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), injectors, positive crankcase ventilation (PCV) heating element

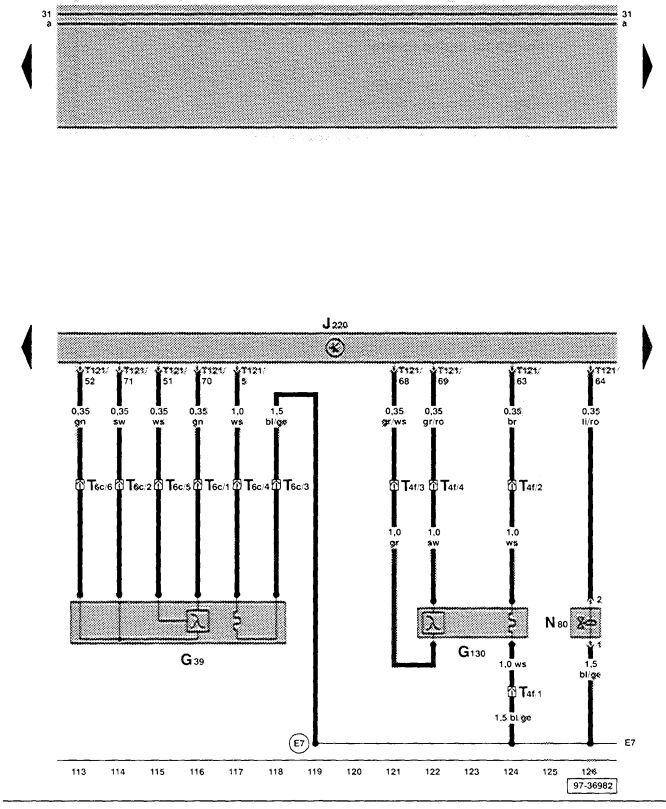
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N30 - Cylinder 1 Fuel Injector
N31 - Cylinder 2 Fuel Injector
N32 - Cylinder 3 Fuel Injector
N33 - Cylinder 4 Fuel Injector
N79 - Positive Crankcase Ventilation (PCV) Heating Element
S232 - Fuse 32 (in fuse panel)
T14a - 14-Pin Connector, near battery
T121 - 121-Pin Connector

(131) - Ground connection -2-, in engine compartment wiring harness
(608) - Ground connection (in center plenum chamber)

(A101) - Connection -3- (87a), in instrument panel wiring harness
(D95) - Wire connection (injectors), in engine compartment wiring harness

-•••- Vehicles with positive crankcase ventilation (PCV) heating element only

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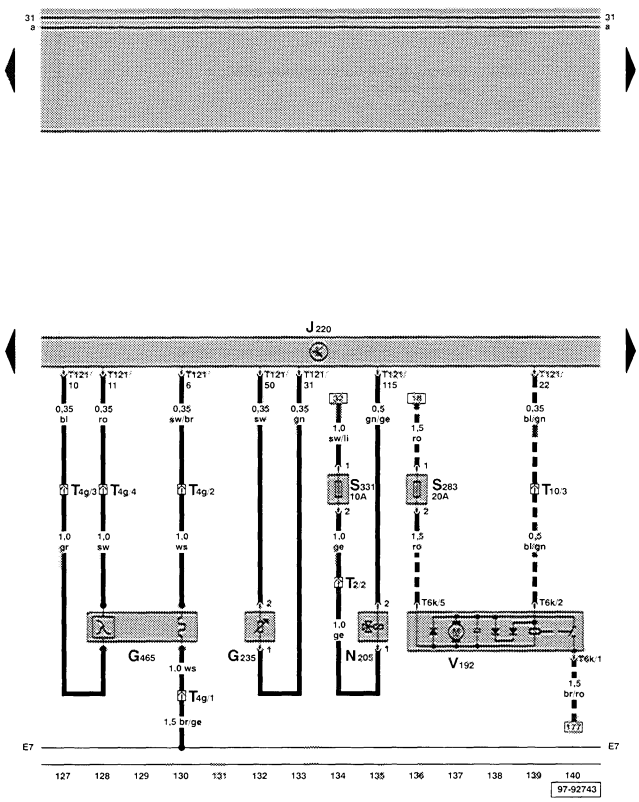
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ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), Heated oxygen sensor (HO2S), oxygen sensor (O2S) behind three way catalytic converter (TWC), evaporative emission (EVAP) canister purge regulator valve

G39 - Heated Oxygen Sensor (HO2S)
G130 - Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC)
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N80 - Evaporative Emission (EVAP) Canister Purge Regulator Valve
T4f - 4-Pin Connector, in protective housing for connectors under right floor
T6c - 6-Pin Connector, in protective housing for connectors under right floor
T121 - 121-Pin Connector

(E7) - Plus connection (87a), in Motronic Multiport Fuel Injection (MFI) wiring harness

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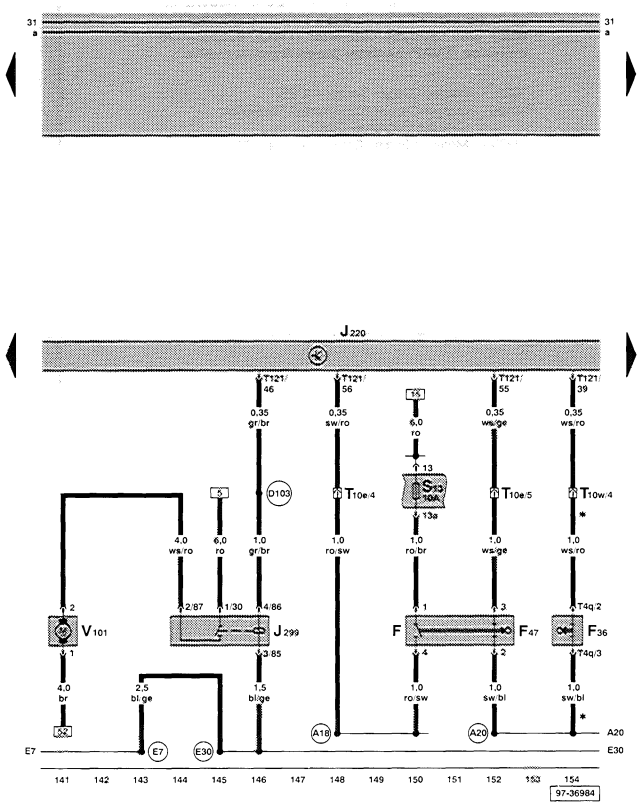


Motronic engine control module (ECM), Oxygen sensor (O2S) 2 behind three way catalytic converter (TWC), exhaust gast temperature (EGT) sensor 1, camshaft adjustment valve 1, brake system vacuum pump

- G131 - Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC)
- G235 - Exhaust Gas Temperature (EGT) Sensor 1
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- N205 - Camshaft Adjustment Valve 1
- S283 - Brake Vacuum Pump Fuse, on the relay panel
- S331 - Camshaft adjustment valve fuse , in protective housing, in engine compartment, left
- T2 - 2-Pin Connector, in engine compartment, left
- T4g - 4-Pin Connector, in protective housing for connectors under right floor
- T6k - 6-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector
- V192 - Brake System Vacuum Pump

--- Automatic transmission only

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ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



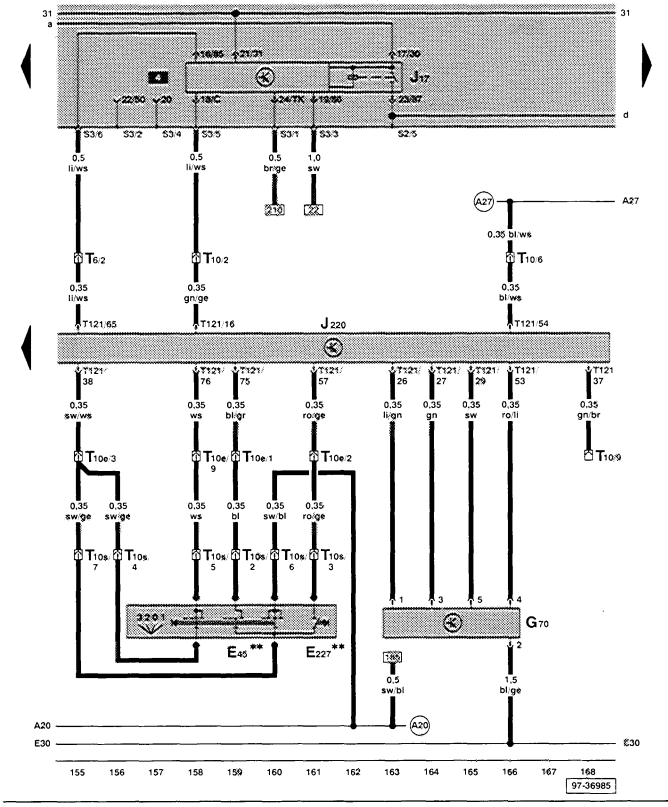
Motronic engine control module (ECM), secondary air injection (AIR) pump motor, secondary air injection (AIR) pump relay, clutch vacuum vent valve switch for cruise control

- F - Brake Light Switch
- F36 - Clutch Pedal Switch*
- F47 - Brake Pedal Switch
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J299 - Secondary Air Injection (AIR) Pump Relay, in protective housing, in engine compartment, left, production control number (100)
- S13 - Fuse 13 in fuse holder
- T4q - 4-Pin Connector
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector
- V101 - Secondary Air Injection (AIR) Pump Motor

(A18) - Wire connection (54), in instrument panel
(A20) - Wire connection (15a), in instrument panel wiring harness
(D103) - Wire connection -3-, in engine compartment wiring harness
(E7) - Plus connection (87a), in Motronic Multiport Fuel Injection (MFI) wiring harness
(E30) - Connection (87a), in wiring harness engine

* - Manual transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Motronic engine control module (ECM), cruise control switch, mass air flow (MAF) sensor, fuel pump (FP) relay

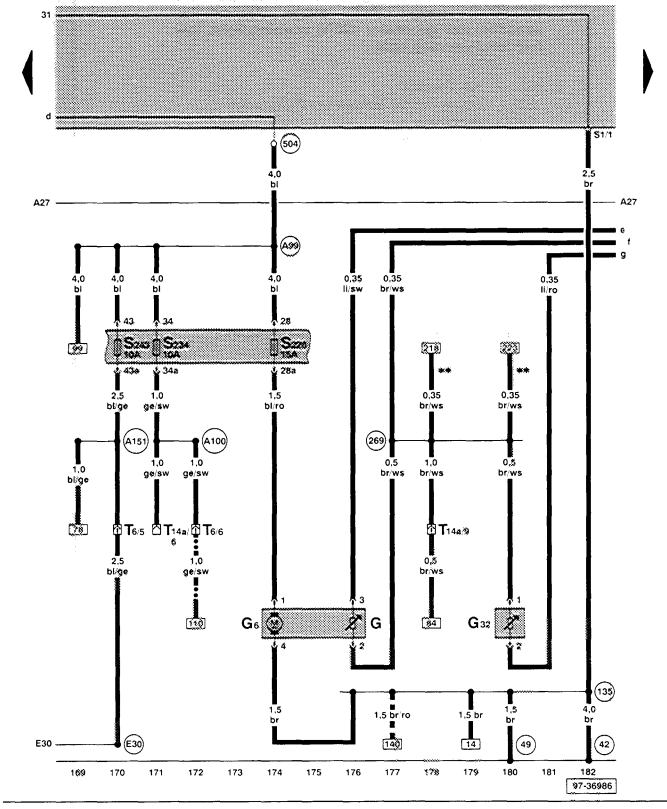
- E45 - Cruise Control Switch**
- E227 - Cruise Control Push Button (SET)**
- G70 - Mass Air Flow (MAF) Sensor
- J17 - Fuel Pump (FP) Relay
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T10s - 10-Pin Connector, near steering column
- T121 - 121-Pin Connector

- (A20) - Wire connection (15a), in instrument panel wiring harness
- (A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness

- ** - Vehicles with cruise control only. Vehicles with Multi-function steering wheel ⇒ Wiring diagram Multi-function steering wheel for cruise control and radio

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 09.03



Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor

- G - Fuel Level Sensor
- G6 - Fuel Pump (FP)
- G32 - Engine Coolant Level (ECL) Sensor
- S228 - Fuse 28 (in fuse panel)
- S234 - Fuse 34 (in fuse panel)
- S243 - Fuse 43 (in fuse panel)
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery

- (42) - Ground connection, beside steering column
- (49) - Ground connection, on steering column
- (135) - Ground connection -2-, in instrument panel wiring harnes
- (269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
- (504) - Threaded connection -1- (87) on the relay plate
- (A99) - Connection -1- (87), in instrument panel wiring harness
- (A100) - Connection -2- (87), in instrument panel wiring harness
- (A151) - Connection -4- (87), in instrument panel wiring harness
- (E30) - Connection (87a), in wiring harness engine

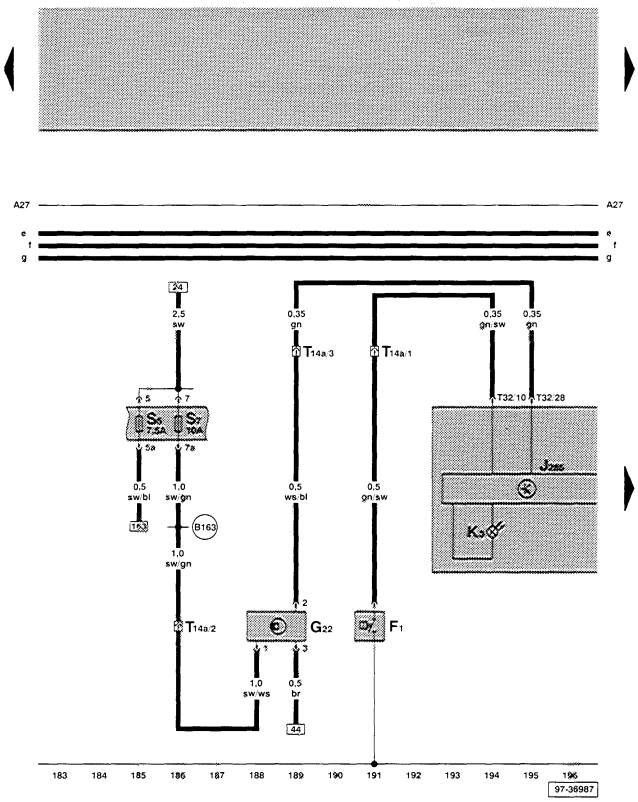
- ** - Vehicles with Multi-Function Indicator (MFI) only
- --- Automatic transmission only
- -•-• - Vehicles with positive crankcase ventilation (PCV) heating element only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

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Repair Manual page number 97-933

Repair Manual page number 97-932



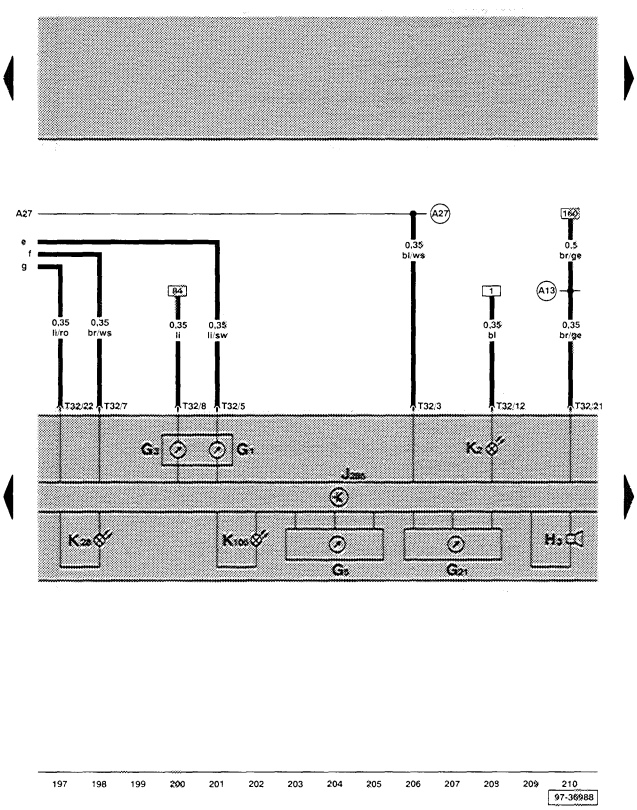
Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light

F1 - Oil Pressure Switch
G22 - Speedometer Vehicle Speed Sensor (VSS)
J285 - Instrument Cluster Control Module
K3 - Oil Pressure Warning Light
S5 - Fuse 5 (in fuse panel)
S7 - Fuse 7 (in fuse panel)
T14a - 14-Pin Connector, near battery
T32 - 32-Pin Connector, blue

(B163) - Plus connection -1- (15) in wiring harness interior

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 09.03



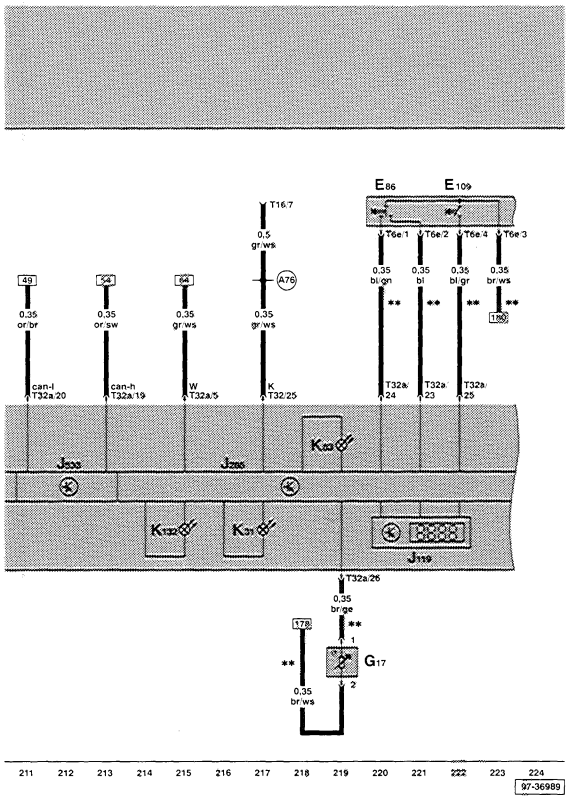
Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light

G1 - Fuel Gauge
G3 - Engine Coolant Temperature (ECT) Gauge
G5 - Tachometer
G21 - Speedometer
H3 - Warning Buzzer
J285 - Instrument Cluster Control Module
K2 - Generator (GEN) Warning Light
K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
K105 - Low Fuel Level Warning Light
T32 - 32-Pin Connector, blue

(A13) - Wire connection (door contact switch), in instrument panel wiring harness
(A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness

ws = white
sw = black
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or = orange

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Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp

E86 - Multi-Function Indicator Mode Select Switch**
E109 - Multi-Function Indicator Memory Switch**
G17 - Outside Air Temperature Sensor
J119 - Multi-function Indicator (MFI)
J285 - Instrument Cluster Control Module
J533 - Data Bus On Board Diagnostic Interface
K31 - Cruise Control Indicator Light
K83 - Malfunction Indicator Lamp (MIL)
K132 - Electronic Power Control (EPC) Warning Lamp
T6e - 6-Pin Connector
T16 - 16-pin Connector, black, Data Link Connector (DLC), below instrument panel, left
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(A76) - Connection (K-diagnosis wire), in instrument panel wiring harness

** - Vehicles with Multi-Function Indicator (MFI) only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 09.03

Repair Manual page number 97-937

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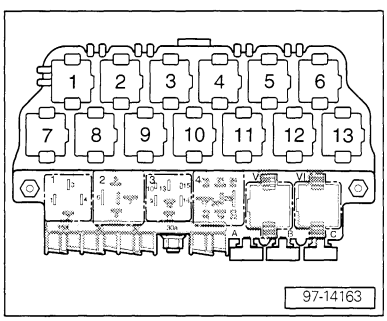
Repair Manual page number 97-936

Air conditioning (manual control),

from May 2003

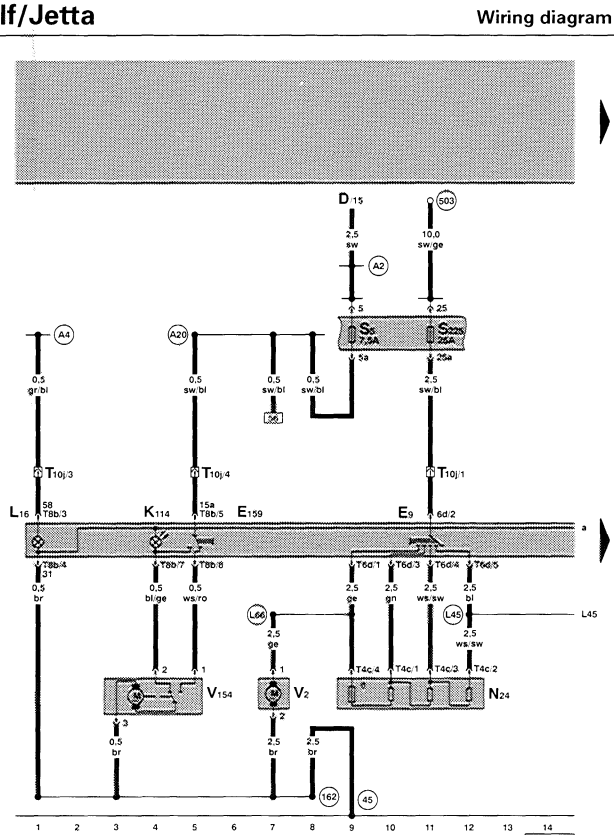
● 2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code BBW

Deviate relay location and fuseplacements as well as the locations of multiple connectors see section "component locations"



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

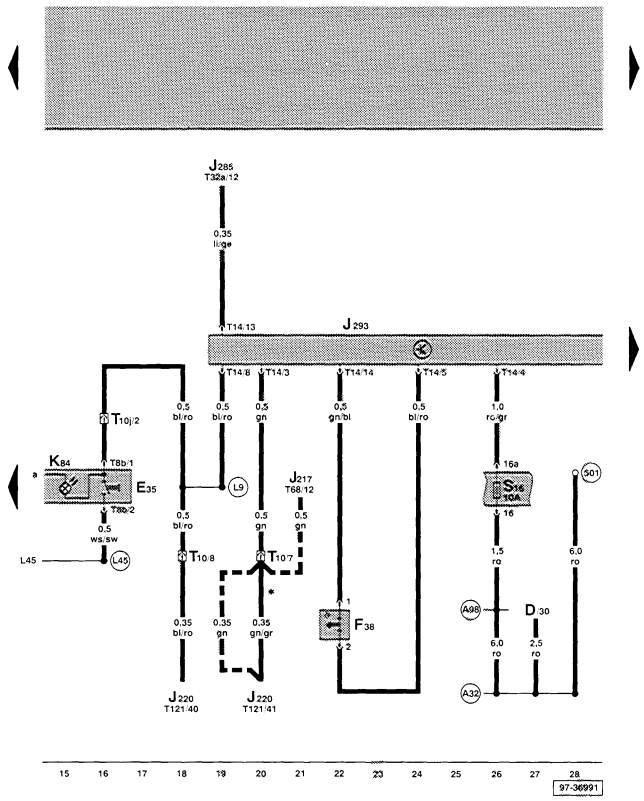
Relay panel:



ws = white
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Fresh air blower switch, fresh air/recirculating flap switch, fresh air blower, servo motor for fresh-/re-circulating air flap

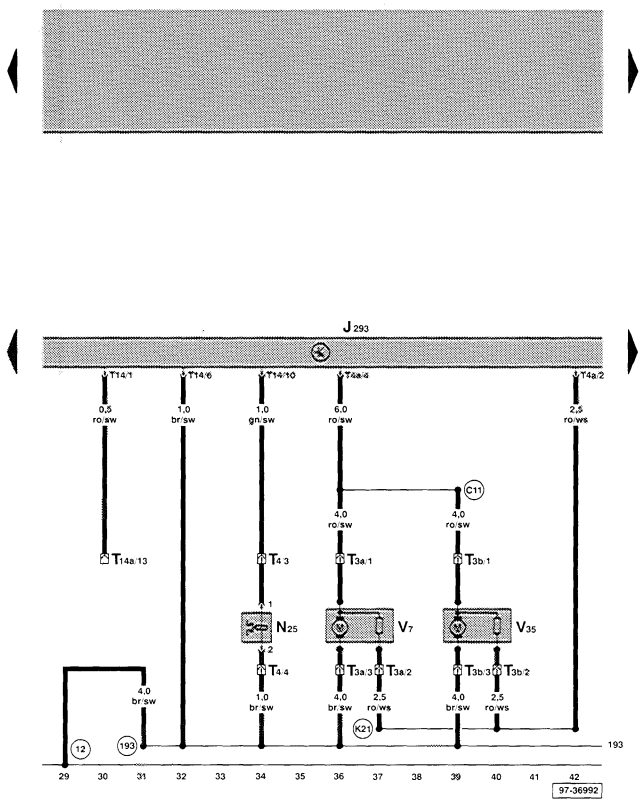
D	-	Ignition/Starter Switch
E9	-	Fresh Air Blower Switch
E159	-	Fresh Air/Recirculating Flap Switch
K114	-	Fresh Air and Recirculating Air Mode Indicator Light
L16	-	Fresh Air Control Lever Light
N24	-	Fresh Air Blower Series Resistance with Fuse
S5	-	Fuse 5 in fuse holder
S225	-	Fuse 25 in fuse holder
T4c	-	4-Pin Connector
T6d	-	6-Pin Connector
T8b	-	8-Pin Connector
T10j	-	10-Pin Connector, behind instrument panel, center
V2	-	Fresh Air Blower
V154	-	Servo motor for fresh-/recirculating air flap
(45)	-	Ground connection, behind instrument panel, center
(162)	-	Ground connection, in blower motor wiring harness
(503)	-	Threaded connection -2- (75x) on the relay plate
(A2)	-	Plus connection (15), in instrument panel wiring harness
(A4)	-	Plus connection (58b), in instrument panel wiring harness
(A20)	-	Wire connection (15a), in instrument panel wiring harness
(L45)	-	Wire connection, in A/C system wiring harness
(L66)	-	Connector, in wiring harness heater blower



ws = white
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Coolant fan control (FC) control module, A/C switch, ambient temperature switch

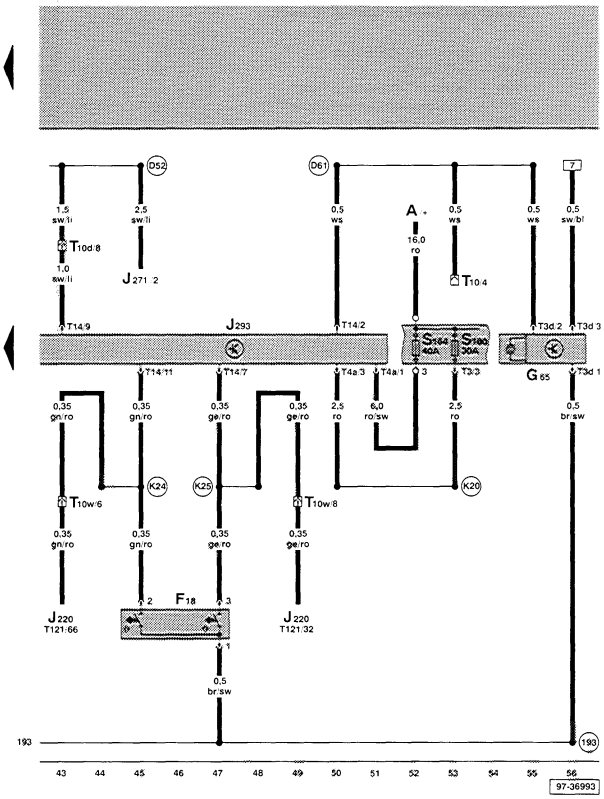
- D - Ignition/Starter Switch
- E35 - A/C Switch
- F38 - Ambient Temperature Switch
- J217 - Transmission Control Module (TCM)
- J220 - Motronic Engine Control Module (ECM)
- J285 - Control module with indicator unit in instrument panel insert
- J293 - Coolant Fan Control (FC) Control Module, in engine compartment, left
- J... - Engine Control Module (ECM)
- K84 - A/C Indicator Light
- S16 - Fuse 16 in fuse holder
- T8b - 8-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10j - 10-Pin Connector, behind instrument panel, center
- T14 - 14-Pin Connector
- T32a - 32-Pin Connector, green
- T68 - 68-Pin Connector
- T121 - 121-Pin Connector
- (501) - Threaded connection -2- (30) on the relay plate
- (A32) - Plus connection (30), in instrument panel wiring harness
- (A98) - Plus connector -4- (30), in instrument panel wiring harness
- (L9) - Wire connection -1-, in A/C wiring harness
- (L45) - Wire connection, in A/C system wiring harness
- * - Manual transmission only
- --- Automatic transmission only (4 speed autom.)



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Coolant fan control (FC) module, A/C clutch, coolant fan

- J293 - Coolant Fan Control (FC) Control Module, in engine compartment, left
- N25 - A/C Clutch
- T3a - 3-Pin Connector, in engine compartment, left
- T3b - 3-Pin Connector, in engine compartment, left
- T4 - 4-Pin Connector, near starter
- T4a - 4-Pin Connector
- T14 - 14-Pin Connector
- T14a - 14-Pin Connector, near battery
- T32a - 32-Pin Connector, green
- V7 - Left Coolant Fan
- V35 - Right Coolant Fan
- (12) - Ground connection, in engine compartment, left
- (193) - Ground connection -1-, in coolant fan wiring harness
- (K21) - Wire connection -1-, in coolant fan wiring harness



ws = white
sw = black
ro = red
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Coolant fan control (FC) module, coolant fan control (FC) thermal switch, high pressure sensor

- A - Battery
- F18 - Coolant Fan Control (FC) Thermal Switch
- G65 - High Pressure Sensor
- J220 - Motronic Engine Control Module (ECM)
- J271 - Motronic engine control module (ECM) power supply relay, in protective housing, in engine compartment, left, production control number (428)
- J293 - Coolant Fan Control (FC) Control Module, in engine compartment, left
- S164 - Fuse -3- (30) in fuse bracket/battery
- S180 - Fuse -8- (30) in fuse bracket/battery
- T3 - 3-Pin Connector
- T3d - 3-Pin Connector
- T4a - 4-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10d - 10-Pin Connector, green, in protective housing for connectors, in plenum chamber, left
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T14 - 14-Pin Connector
- T121 - 121-Pin Connector

- (193) - Ground connection -1-, in coolant fan wiring harness
- (D52) - Plus connection (15a), in engine compartment wiring harness
- (D61) - Wire connection (A/C), in engine compartment wiring harness
- (K20) - Plus connection -1- (30), in coolant fan wiring harness
- (K24) - Wire connection -3-, in coolant fan wiring harness
- (K25) - Wire connection -4-, in coolant fan wiring harness

Edition 09.03

Repair Manual page number 97-943

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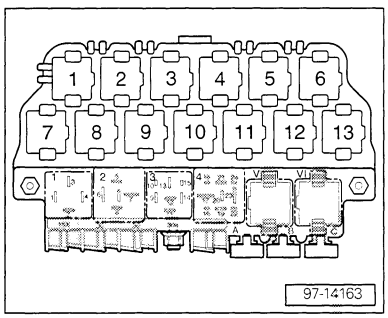
Repair Manual page number 97-945

2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code BEV,

from May 2003

Additional Fuse, Relay, Control Module and Connector locations ⇒ Compontent Locations

Troubleshooting Procedures ⇒ Guided Fault Finding using VAS 5051/5052

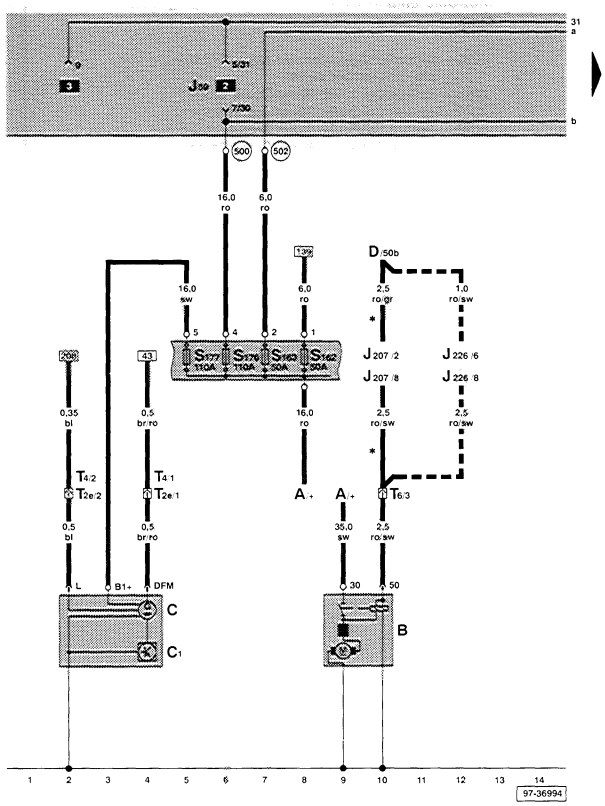


Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

2 J52 - Load Reduction Relay (100)

4 J17 - Fuel Pump (FP) Relay (409)



Generator (GEN), starter

A - Battery
B - Starter
C - Generator (GEN)
C1 - Voltage Regulator (VR)
D - Ignition/Starter Switch
J59 - Load Reduction Relay
J207 - Starting Interlock Relay
J226 - Park/Neutral Position (PNP) Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
T2e - Double Connector, near starter (vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left

(500) - Threaded connection -1- (30) on the relay plate

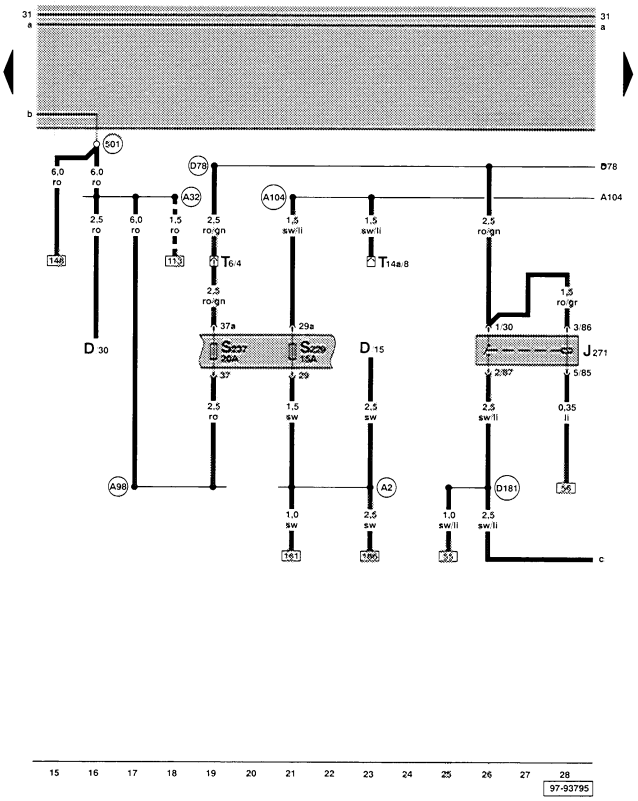
(502) - Threaded connection -1- (30a) on the relay plate

* - Manual transmission only

--- Automatic transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Repair Manual page number 97-944



Power supply relay

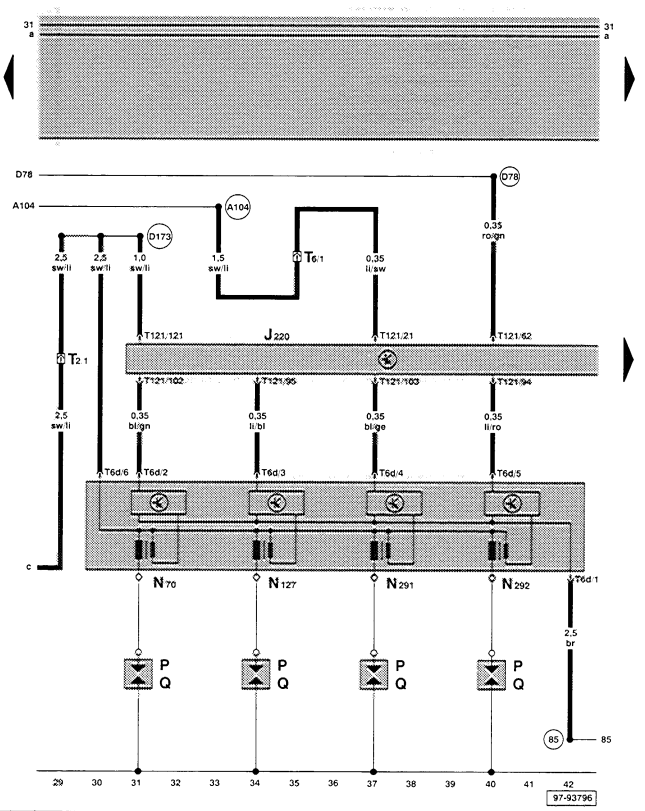
D - Ignition/Starter Switch
J271 - Motronic engine control module (ECM) power supply relay, in protective housing, in engine compartment, left, production control number (428)
S229 - Fuse 29 in fuse holder
S237 - Fuse 37 in fuse holder
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, near battery

(501) - Threaded connection -2- (30) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connection -4- (30), in instrument panel wiring harness
(A104) - Plus connection -2- (15), in instrument panel wiring harness
(D78) - Plus connection -1- (30a), in engine compartment wiring harness
(D181) - Connection 2 (87a) (in engine wiring harness)

--- Automatic transmission only

ws = white
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ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 12.04



Motronic engine control module (ECM), ignition system

J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N70 - Ignition Coil 1 with Power Output Stage
N127 - Ignition Coil 2 with Power Output Stage
N291 - Ignition Coil 3 with Power Output Stage
N292 - Ignition Coil 4 with Power Output Stage
P - Spark Plug Connectors
Q - Spark Plugs
T2 - 2-Pin Connector, in engine compartment, left
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T6d - 6-Pin Connector
T121 - 121-Pin Connector

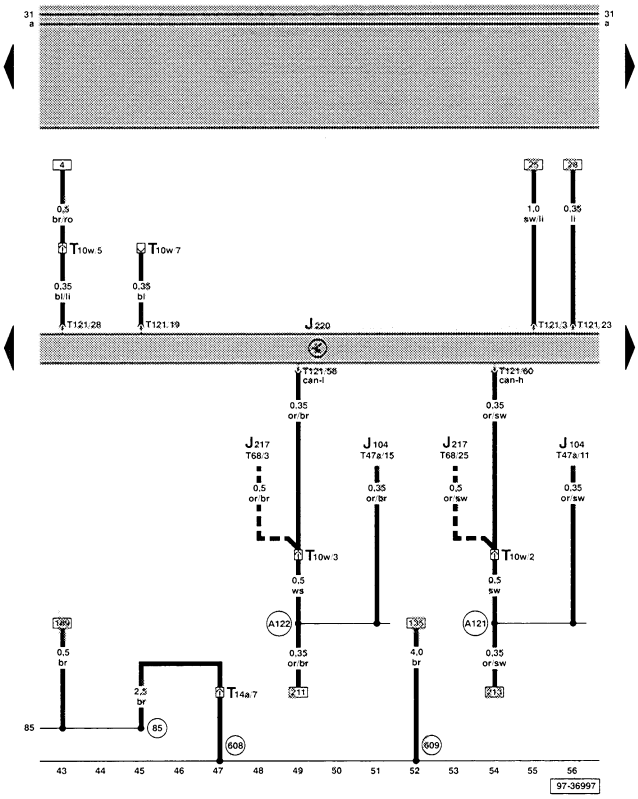
(85) - Ground connection -1-, in engine compartment wiring harness
(A104) - Plus connection -2- (15), in instrument panel wiring harness
(D78) - Plus connection -1- (30a), in engine compartment wiring harness
(D173) - Connection (87)(in engine wiring harness)

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 12.04

Repair Manual page number 97-947

Repair Manual page number 97-946



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

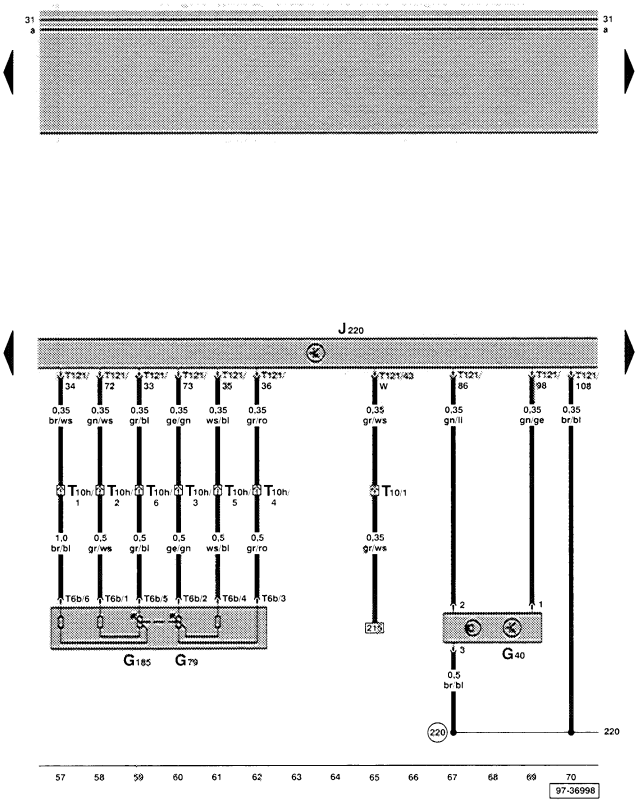
Motronic engine control module (ECM)

- J104 - ABS Control Module (w/EDL), in engine compartment, left
- J217 - Transmission Control Module (TCM)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- T47a - 47-Pin Connector, on ABS Control Module
- T68 - 68-Pin Connector, on Transmission Control Module (TCM)
- T121 - 121-Pin Connector

- (85) - Ground connection -1-, in engine compartment wiring harness
- (608) - Ground connection (in center plenum chamber)
- (609) - Ground connection (in right plenum chamber)
- (A121) - Connection (high bus), in instrument panel wiring harness
- (A122) - Connection (low bus), in instrument panel wiring harness

--- Automatic transmission only

Edition 09.03



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), throttle position (TP) sensor, camshaft position (CMP) sensor

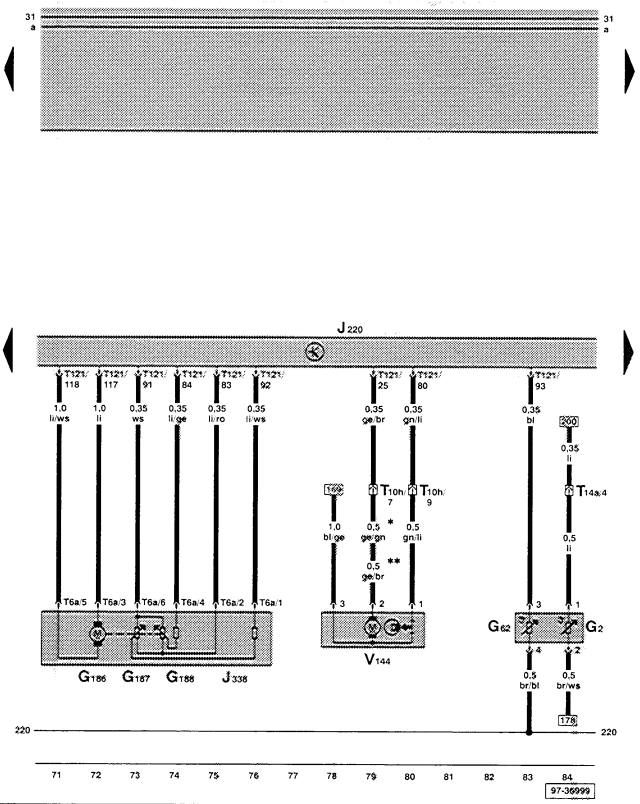
- G40 - Camshaft Position (CMP) Sensor
- G79 - Throttle Position (TP) Sensor
- G185 - Sender -2- for accelerator pedal position
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T6b - 6-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector

- (220) - Ground connection (sensor ground), in engine compartment wiring harness

Edition 09.03

Repair Manual page number 97-949

Repair Manual page number 97-948

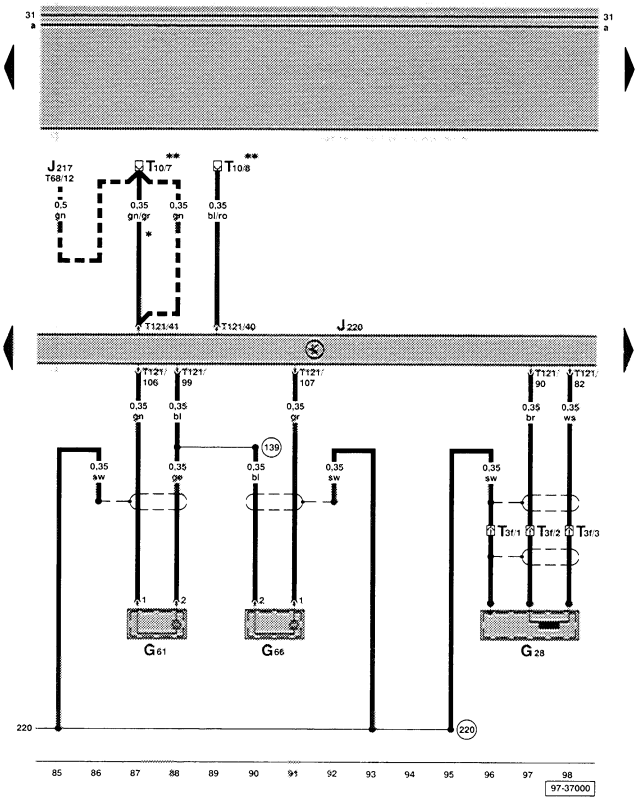


ws = white
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gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), throttle valve control module, engine coolant temperature (ECT) sensor, leak detection pump (LDP)

- G2 - Engine Coolant Temperature (ECT) Gauge Sensor
- G62 - Engine Coolant Temperature (ECT) Sensor
- G186 - Throttle drive (power accelerator actuation)
- G187 - Angle sensor -1- for throttle drive (power accelerator actuation)
- G188 - Angle sensor -2- for throttle drive (power accelerator actuation)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J338 - Throttle Valve Control Module
- T6a - 6-Pin Connector
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- T121 - 121-Pin Connector
- V144 - Leak Detection Pump (LDP)

* - Jetta only
** - Golf only

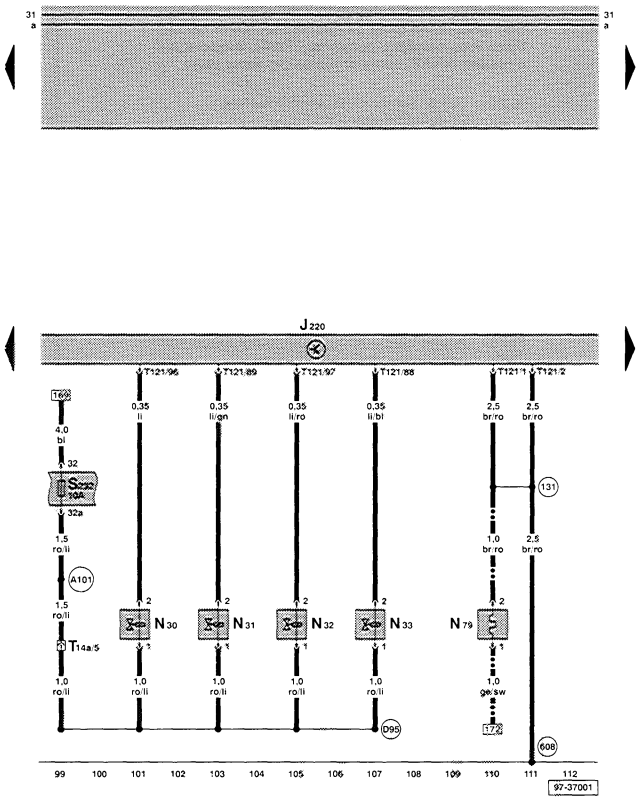


ws = white
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or = orange

Motronic engine control module (ECM), engine speed (RPM) sensor, knock sensor (KS) 1, knock sensor (KS) 2

- G28 - Engine Speed (RPM) Sensor
- G61 - Knock Sensor (KS) 1
- G66 - Knock Sensor (KS) 2
- J217 - Transmission Control Module (TCM)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T3f - 3-Pin Connector, in engine compartment, front
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T68 - 68-Pin Connector, on Transmission Control Module (TCM)
- T121 - 121-Pin Connector
- (139) - Ground connection (sensor Ground), in Motronic Multiport Fuel Injection (MFI) wiring harness
- (220) - Ground connection (sensor ground), in engine compartment wiring harness

* - Manual transmission only
** - A/C connection
--- Automatic transmission only



Motronic engine control module (ECM), injectors, positive crankcase ventilation (PCV) heating element

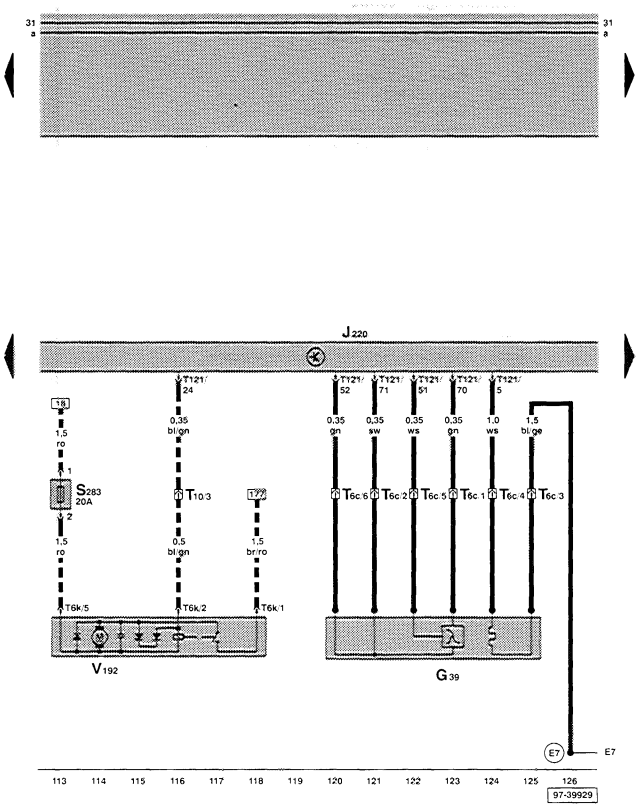
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- N30 - Cylinder 1 Fuel Injector
- N31 - Cylinder 2 Fuel Injector
- N32 - Cylinder 3 Fuel Injector
- N33 - Cylinder 4 Fuel Injector
- N79 - Positive Crankcase Ventilation (PCV) Heating Element
- S232 - Fuse 32 in fuse holder
- T14a - 14-Pin Connector, near battery
- T121 - 121-Pin Connector

- (131) - Ground connection -2-, in engine compartment wiring harness
- (608) - Ground connection (in center plenum chamber)
- (A101) - Connection -3- (87a), in instrument panel wiring harness
- (D95) - Wire connection (injectors), in engine compartment wiring harness

-•••- Vehicles with positive crankcase ventilation (PCV) heating element only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 09.03



Motronic engine control module (ECM), heated oxygen sensor (HO2S), brake system vacuum pump

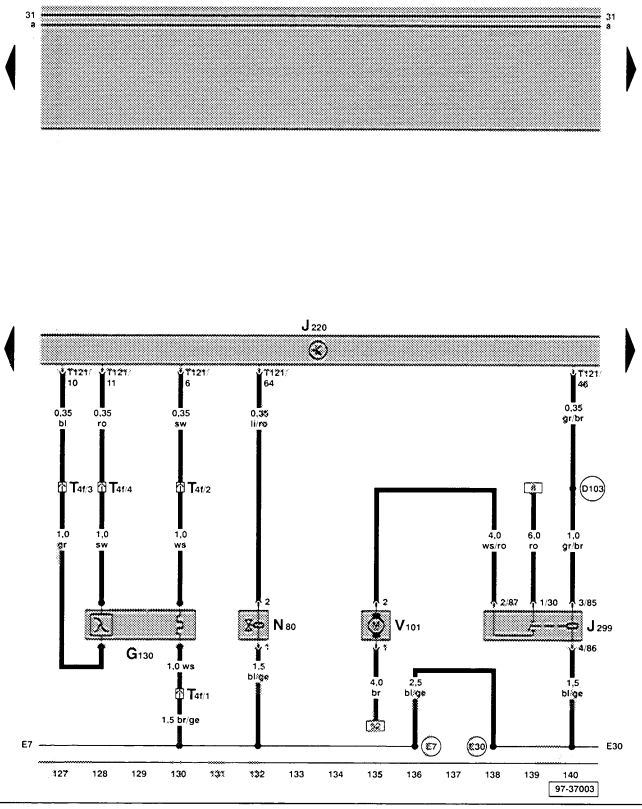
- G39 - Heated Oxygen Sensor (HO2S)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- S283 - Brake Vacuum Pump Fuse, on the relay panel
- T6c - 6-Pin Connector, in protective housing for connectors under right floor
- T6k - 6-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector
- V192 - Brake System Vacuum Pump

- (E7) - Plus connection (87a), in Motronic Multiport Fuel Injection (MFI) wiring harness

--- Automatic transmission only

ws = white
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ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.04



Motronic engine control module (ECM), secondary air injection (AIR) pump motor, secondary air injection (AIR) pump relay, oxygen sensor (O2S) behind three way catalytic converter (TWC), evaporative emission (EVAP) canister purge regulator valve

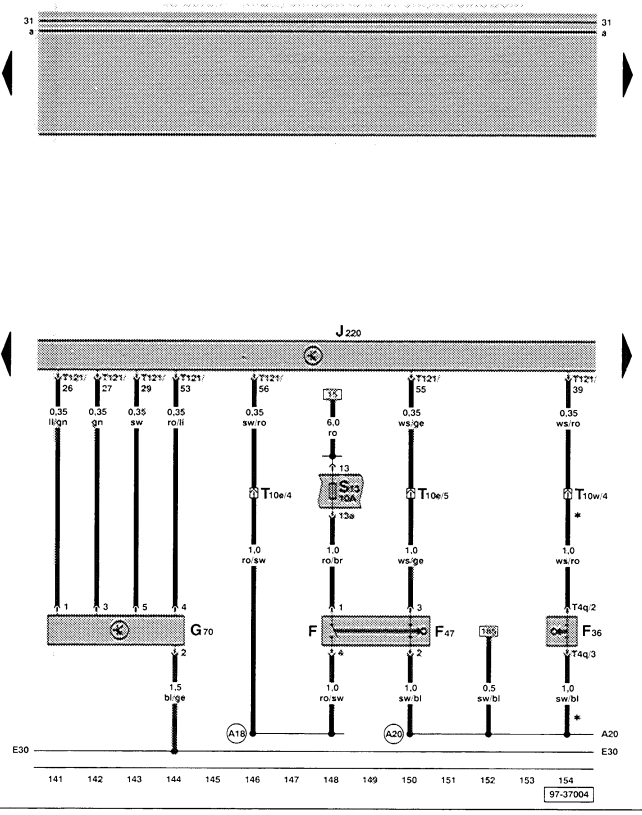
- G130 - Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J299 - Secondary Air Injection (AIR) Pump Relay, in protective housing, in engine compartment, left, production control number (100)
- N80 - Evaporative Emission (EVAP) Canister Purge Regulator Valve
- T4f - 4-Pin Connector, in protective housing for connectors under right floor
- T121 - 121-Pin Connector
- V101 - Secondary Air Injection (AIR) Pump Motor

- (E7) - Plus connection (87a), in Motronic Multiport Fuel Injection (MFI) wiring harness
- (D103) - Wire connection -3-, in engine compartment wiring harness
- (E30) - Connection (87a), in wiring harness engine

ws = white
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ro = red
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gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 09.03

Repair Manual page number 97-955



Motronic engine control module (ECM), mass air flow (MAF) sensor, brake light switch, brake pedal switch, clutch pedal switch

- F - Brake Light Switch
- F36 - Clutch Pedal Switch
- F47 - Brake Pedal Switch
- G70 - Mass Air Flow (MAF) Sensor
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- S13 - Fuse 13 in fuse holder
- T4q - 4-Pin Connector
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector

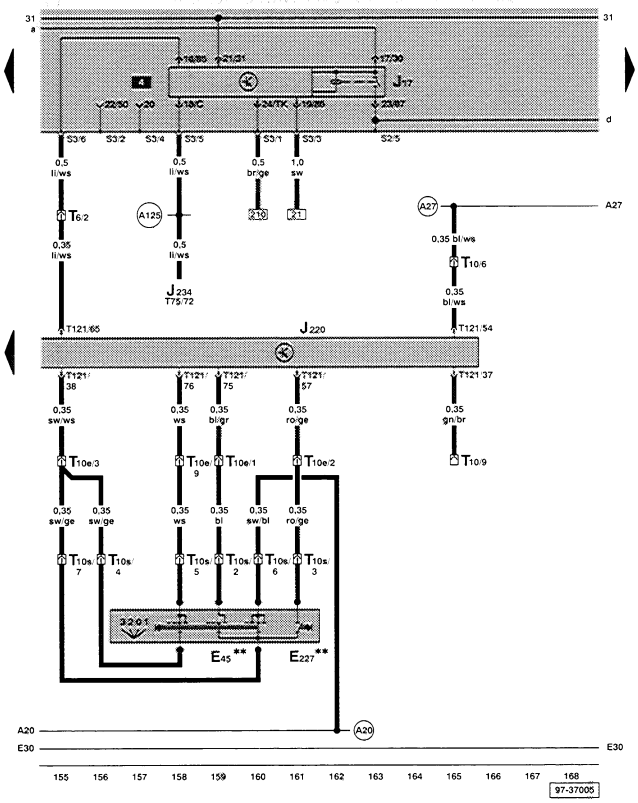
- (A18) - Wire connection (54), in instrument panel
- (A20) - Wire connection (15a), in instrument panel wiring harness

* - Manual transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 09.03

Repair Manual page number 97-954



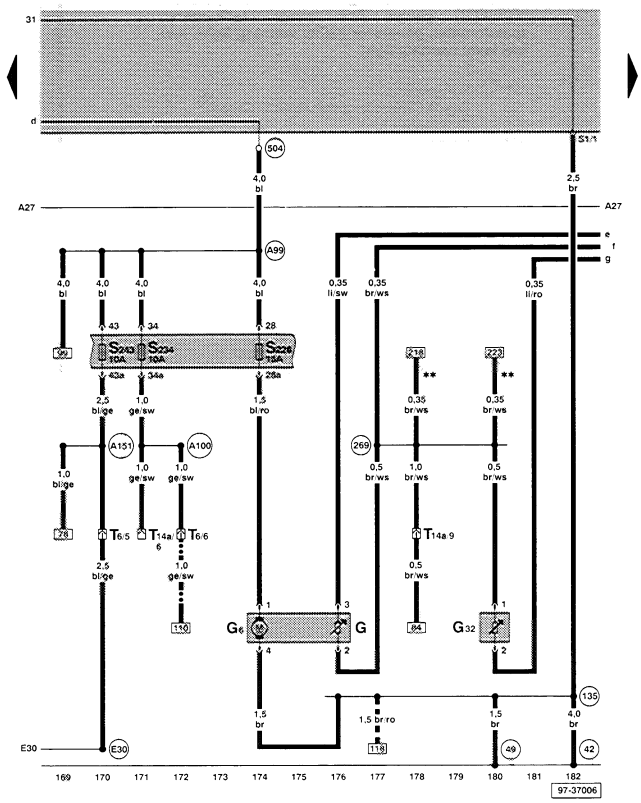
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
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or = orange

Motronic engine control module (ECM), cruise control switch, fuel pump (FP) relay

- E45 - Cruise Control Switch**
- E227 - Cruise Control Push Button (SET)**
- J17 - Fuel Pump (FP) Relay
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J234 - Airbag Control Module
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T10s - 10-Pin Connector, near steering column
- T75 - 75-Pin Connector
- T121 - 121-Pin Connector

- (A20) - Wire connection (15a), in instrument panel wiring harness
- (A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness
- (A125) - Connection (crash signal) in instrument panel wiring harness

** - Vehicles with cruise control only. Vehicles with Multi-function steering wheel ⇒ Wiring diagram Multi-function steering wheel for cruise control and radio



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor

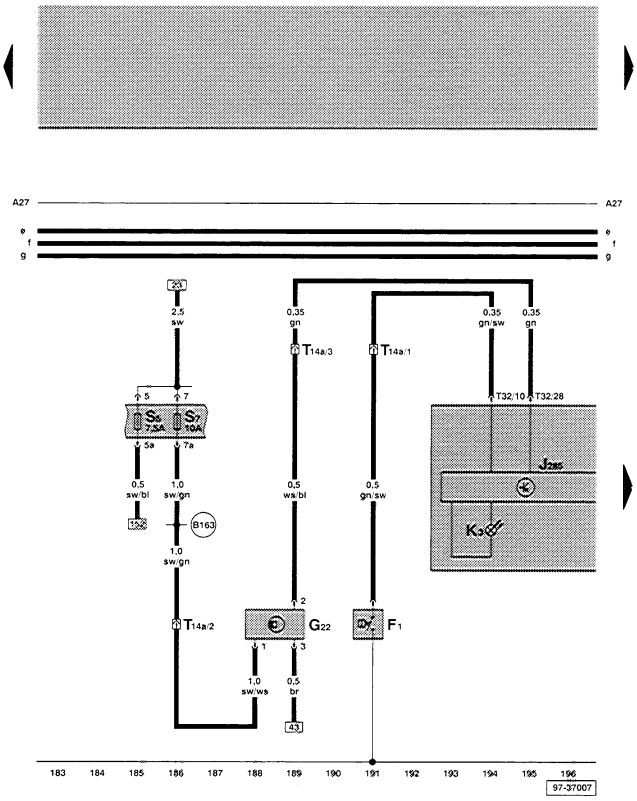
- G - Fuel Level Sensor
- G6 - Fuel Pump (FP)
- G32 - Engine Coolant Level (ECL) Sensor
- S228 - Fuse 28 in fuse holder
- S234 - Fuse 34 in fuse holder
- S243 - Fuse 43 in fuse holder
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery

- (42) - Ground connection, beside steering column
- (49) - Ground connection, on steering column
- (135) - Ground connection -2-, in instrument panel wiring harnes
- (269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
- (504) - Threaded connection -1- (87) on the relay plate
- (A99) - Connection -1- (87), in instrument panel wiring harness
- (A100) - Connection -2- (87), in instrument panel wiring harness
- (A151) - Connection -4- (87), in instrument panel wiring harness
- (E30) - Connection (87a), in wiring harness engine

** - Vehicles with Multi-Function Indicator (MFI) only

--- Automatic transmission only

-•-•- Vehicles with positive crankcase ventilation (PCV) heating element only

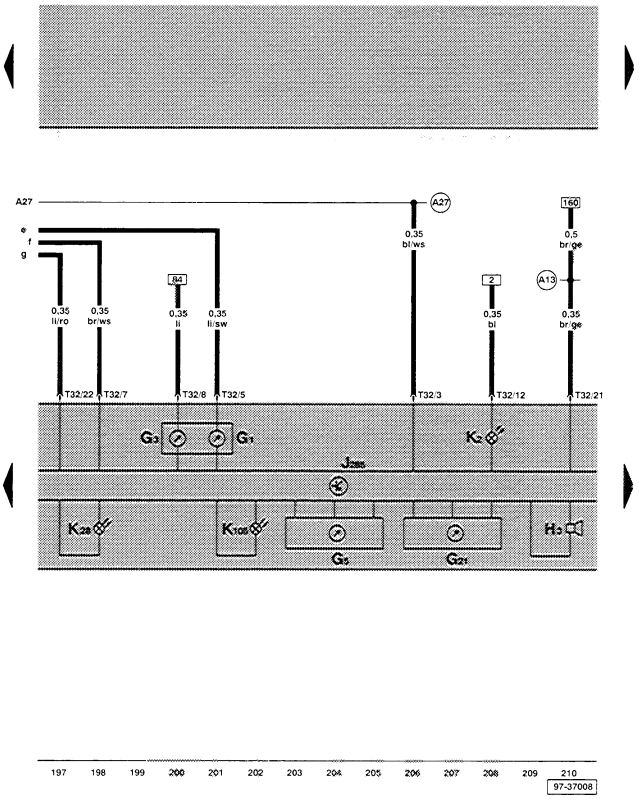


Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light

- F1 - Oil Pressure Switch
- G22 - Speedometer Vehicle Speed Sensor (VSS)
- J285 - Control module with indicator unit in instrument panel insert
- K3 - Oil Pressure Warning Light
- S5 - Fuse 5 in fuse holder
- S7 - Fuse 7 in fuse holder
- T14a - 14-Pin Connector, near battery
- T32 - 32-Pin Connector, blue

(B163) - Plus connection -1- (15) in wiring harness interior

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ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

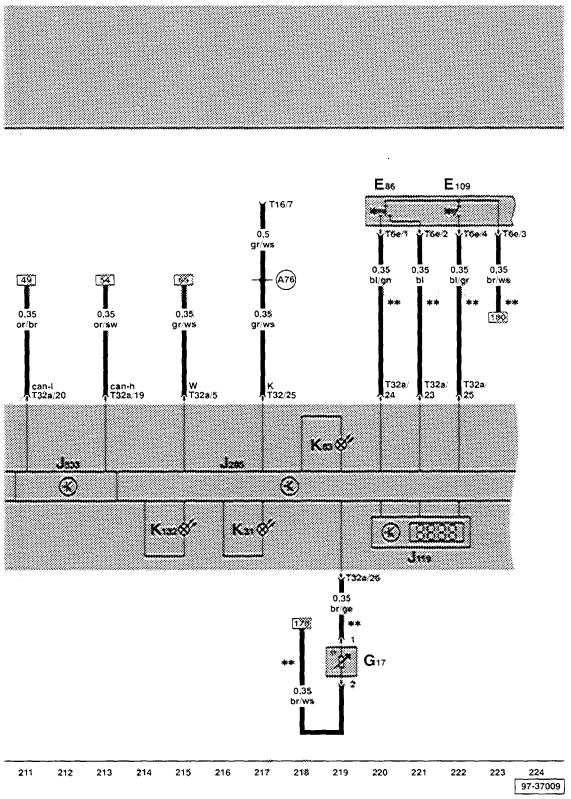


Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light

- G1 - Fuel gauge
- G3 - Engine Coolant Temperature (ECT) Gauge
- G5 - Tachometer
- G21 - Speedometer
- H3 - Warning Buzzer
- J285 - Control module with indicator unit in instrument panel insert
- K2 - Generator (GEN) Warning Light
- K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
- K105 - Low Fuel Level Warning Light
- T32 - 32-Pin Connector, blue

(A13) - Wire connection (door contact switch), in instrument panel wiring harness
(A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp

- E86 - Multi-Function Indicator Mode Select Switch**
- E109 - Multi-Function Indicator Memory Switch**
- G17 - Outside Air Temperature Sensor
- J119 - Multi-function Indicator (MFI)
- J285 - Control module with indicator unit in instrument panel insert
- J533 - Data Bus On Board Diagnostic Interface
- K31 - Cruise Control Indicator Light
- K83 - Malfunction Indicator Lamp (MIL)
- K132 - Electronic Power Control (EPC) Warning Lamp
- T6e - 6-Pin Connector
- T16 - Data Link Connector (DLC), below instrument panel, left
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green
- (A76) - Connection (K-diagnosis wire), in instrument panel wiring harness
- ** - Vehicles with Multi-Function Indicator (MFI) only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

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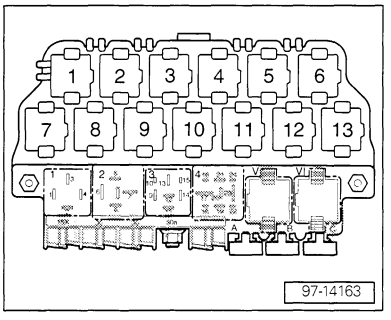
Repair Manual page number 97-960

3.2L - Engine - Motronic Multiport Fuel Injection (MFI)/177 kW, code BJS,

from October 2003

Additional Fuse, Relay, Control Module and Connector locations ⇒ Compontent Locations

Troubleshooting Procedures ⇒ Guided Fault Finding using VAS 5051/5052

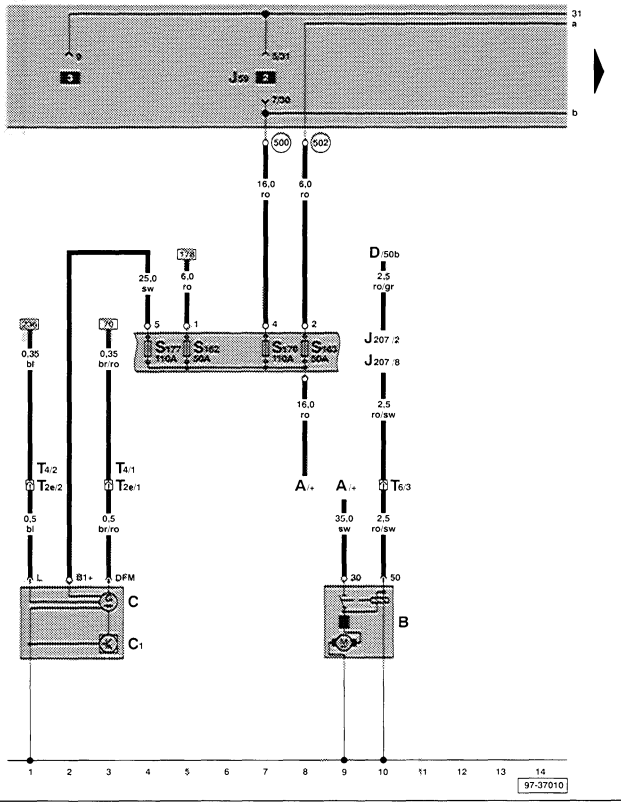


Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

2 J59 - Load Reduction Relay (100)

4 J17 - Fuel Pump (FP) Relay (409)



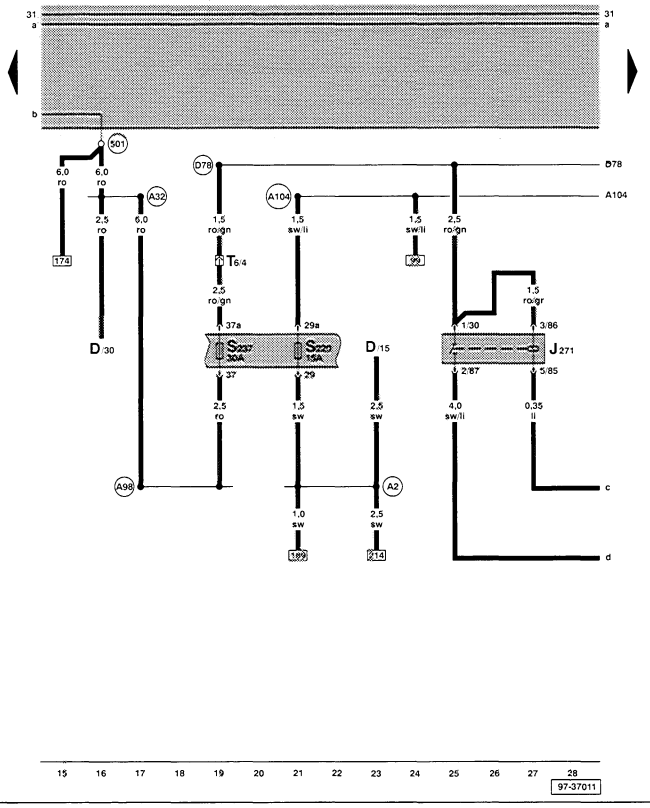
Generator (GEN), starter

A - Battery
B - Starter
C - Generator (GEN)
C1 - Voltage Regulator (VR)
D - Ignition/Starter Switch
J59 - Load Reduction Relay
J207 - Starting Interlock Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
T2e - Double Connector, near starter (vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left

(500) - Threaded connection -1- (30) on the relay plate

(502) - Threaded connection -1- (30a) on the relay plate

ws = white
sw = black
ro = red
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gr = grey
li = lilac
ge = yellow
or = orange



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gn = green
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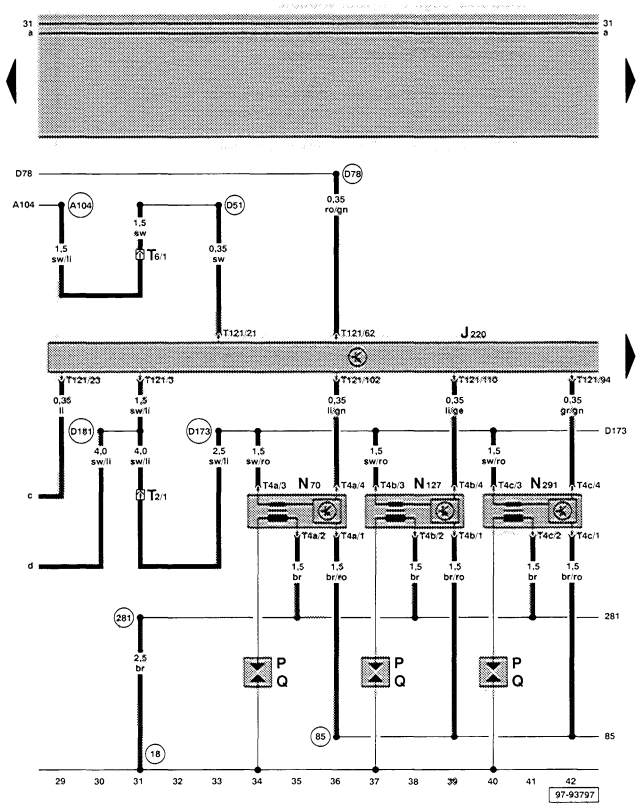
Power supply relay

- D - Ignition/Starter Switch
- J271 - Motronic Engine Control Module (ECM) Power Supply Relay, in protective housing, in engine compartment, left, production control number (428)
- S229 - Fuse 29 in fuse holder
- S237 - Fuse 37 in fuse holder
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left

- (501) - Threaded connection -2- (30) on the relay plate
- (A2) - Plus connection (15), in instrument panel wiring harness
- (A32) - Plus connection (30), in instrument panel wiring harness
- (A98) - Plus connection -4- (30), in instrument panel wiring harness
- (A104) - Plus connection -2- (15), in instrument panel wiring harness
- (D78) - Plus connection -1- (30a), in engine compartment wiring harness

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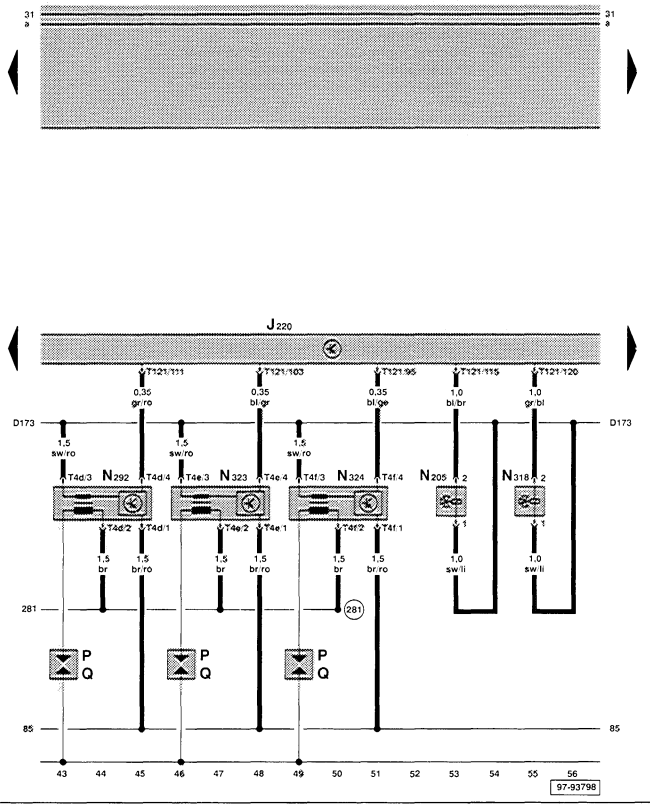
Motronic engine control module (ECM), ignition system

- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- N70 - Ignition Coil 1 with Power Output Stage
- N127 - Ignition Coil 2 with Power Output Stage
- N291 - Ignition Coil 3 with Power Output Stage
- P - Spark Plug Connectors
- Q - Spark Plugs
- T2 - 2-Pin Connector, in engine compartment, left
- T4a - 4-Pin Connector
- T4b - 4-Pin Connector
- T4c - 4-Pin Connector
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector

- (18) - Ground connection, on engine block
- (85) - Ground connection -1-, in engine compartment wiring harness
- (281) - Ground connection -1-, in wiring harness engine pre-wiring
- (A104) - Plus connection -2- (15), in instrument panel wiring harness
- (D51) - Plus connection (15), in engine compartment wiring harness
- (D78) - Plus connection -1- (30a), in engine compartment wiring harness
- (D173) - Connection (87)(in engine wiring harness)
- (D181) - Connection 2 (87a) (in engine wiring harness)

Edition 12.04

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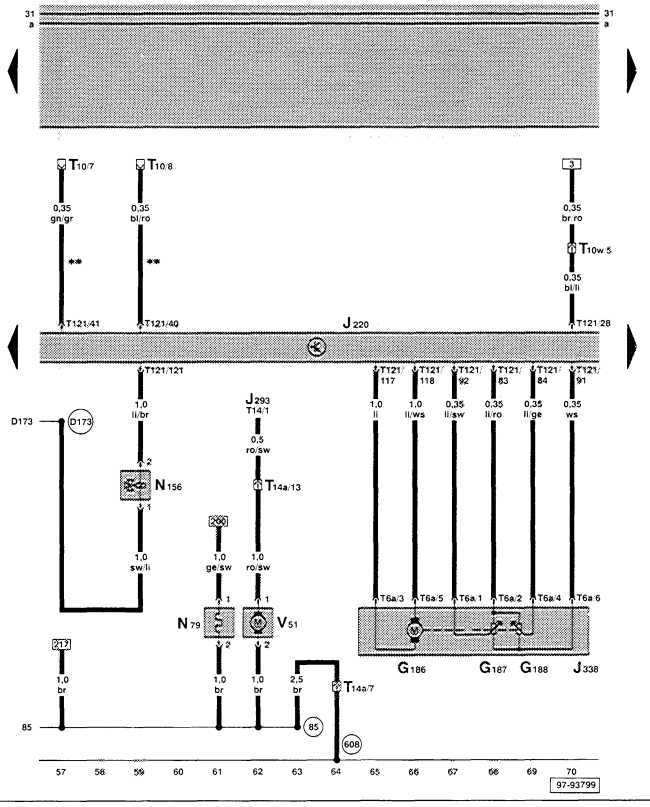


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), ignition system, Valve -1- for camshaft adjustment, camshaft adjustment valve 1 (exhaust)

- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- N205 - Valve -1- for camshaft adjustment
- N292 - Ignition Coil 4 with Power Output Stage
- N318 - Camshaft Adjustment Valve 1 (exhaust)
- N323 - Ignition Coil 5 with Power Output Stage
- N324 - Ignition Coil 6 with Power Output Stage
- P - Spark Plug Connectors
- Q - Spark Plugs
- T4d - 4-Pin Connector
- T4e - 4-Pin Connector
- T4f - 4-Pin Connector
- T121 - 121-Pin Connector

(281) - Ground connection -1-, in wiring harness engine pre-wiring

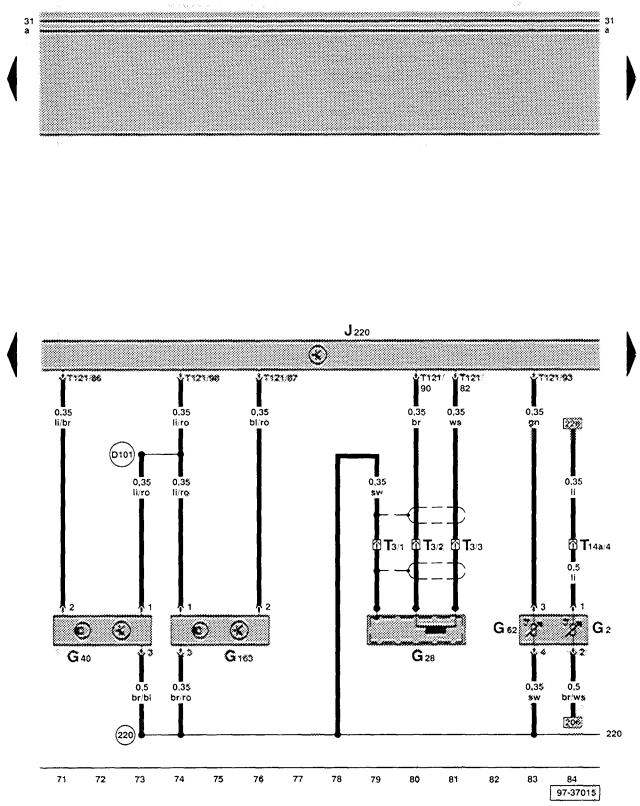


ws = white
sw = black
ro = red
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gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), throttle valve control module, intake manifold change-over valve, after-run coolant pump, positive crankcase ventilation (PCV) heating element

- G186 - Throttle drive (power accelerator actuation)
- G187 - Angle sensor -1- for throttle drive (power accelerator actuation)
- G188 - Angle sensor -2- for throttle drive (power accelerator actuation)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J293 - Coolant FC (Fan Control (FC)) Control Module
- J338 - Throttle Valve Control Module
- N79 - Positive Crankcase Ventilation (PCV) Heating Element
- N156 - Intake Manifold Change-Over Valve
- T6a - 6-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T14 - 14-Pin Connector
- T14a - 14-Pin Connector, near battery
- T121 - 121-Pin Connector
- V51 - After-Run Coolant Pump

(85) - Ground connection -1-, in engine compartment wiring harness
(608) - Ground connection (in center plenum chamber)
(D173) - Connection (87)(in engine wiring harness)
** - A/C connection/ Coolant FC (Fan Control) Control Module

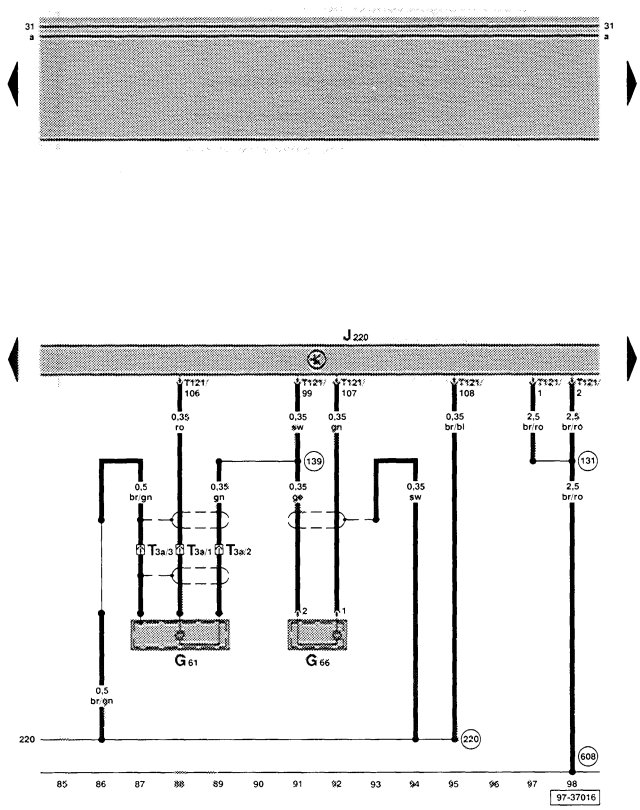


ws = white
sw = black
ro = red
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gn = green
bl = blue
gr = grey
li = lilac
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or = orange

Motronic engine control module (ECM), engine speed (RPM) sensor, camshaft position (CMP) sensors, engine coolant temperature (ECT) sensors

- G2 - Engine Coolant Temperature (ECT) Gauge Sensor
- G28 - Engine Speed (RPM) Sensor
- G40 - Camshaft Position (CMP) Sensor
- G62 - Engine Coolant Temperature (ECT) Sensor
- G163 - Camshaft Position (CMP) Sensor 2
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T3 - 3-Pin Connector, near intake manifold
- T14a - 14-Pin Connector, near battery
- T121 - 121-Pin Connector

- (220) - Ground connection (sensor ground), in engine compartment wiring harness
- (D101) - Wire connection -1-, in engine compartment wiring harness

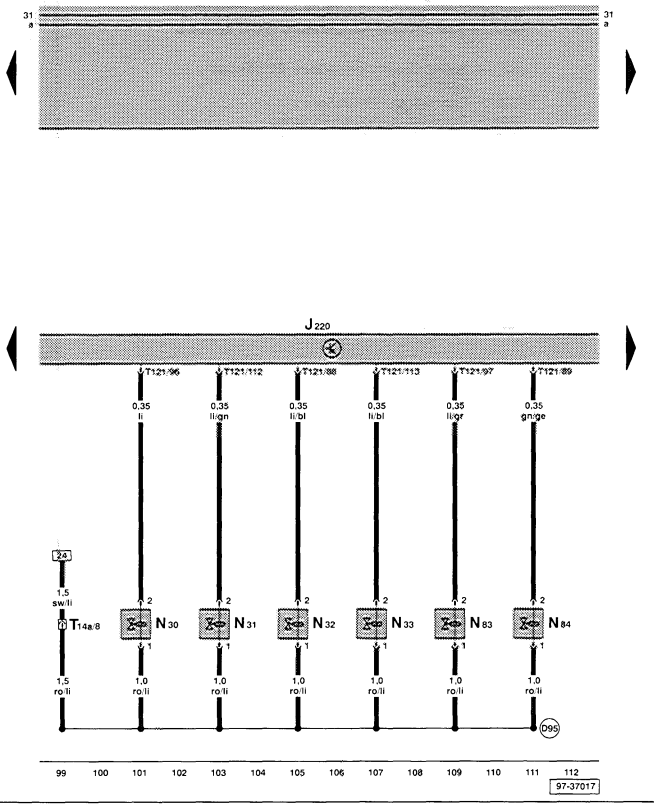


ws = white
sw = black
ro = red
br = brown
gn = green
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gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), engine speed (RPM) sensor, knock sensor (KS) 1, knock sensor (KS) 2

- G61 - Knock Sensor (KS) 1
- G66 - Knock Sensor (KS) 2
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T3a - 3-Pin Connector, in engine compartment, rear
- T121 - 121-Pin Connector

- (131) - Ground connection -2-, in engine compartment wiring harness
- (139) - Ground connection (sensor Ground), in Motronic Multiport Fuel Injection (MFI) wiring harness
- (220) - Ground connection (sensor ground), in engine compartment wiring harness
- (608) - Ground connection (in center plenum chamber)

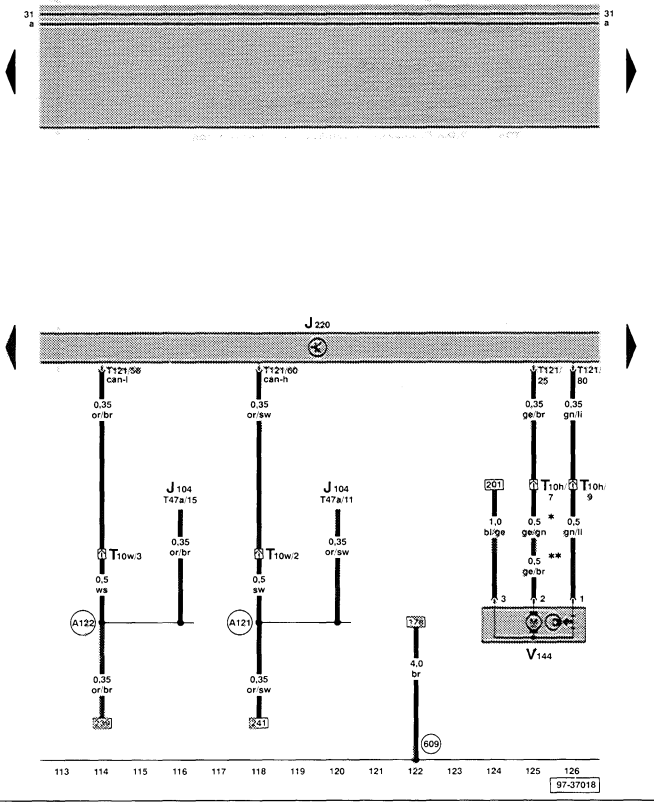


Motronic engine control module (ECM), injectors

J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N30 - Cylinder 1 Fuel Injector
N31 - Cylinder 2 Fuel Injector
N32 - Cylinder 3 Fuel Injector
N33 - Cylinder 4 Fuel Injector
N83 - Cylinder 5 Fuel Injector
N84 - Cylinder 6 Fuel Injector
T14a - 14-Pin Connector, near battery
T121 - 121-Pin Connector

(D95) - Wire connection (injectors), in engine compartment wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Motronic engine control module (ECM), leak detection pump (LDP)

J104 - ABS Control Module
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
T47a - 47-Pin Connector, on ABS Control Module
T121 - 121-Pin Connector
V144 - Leak Detection Pump (LDP)

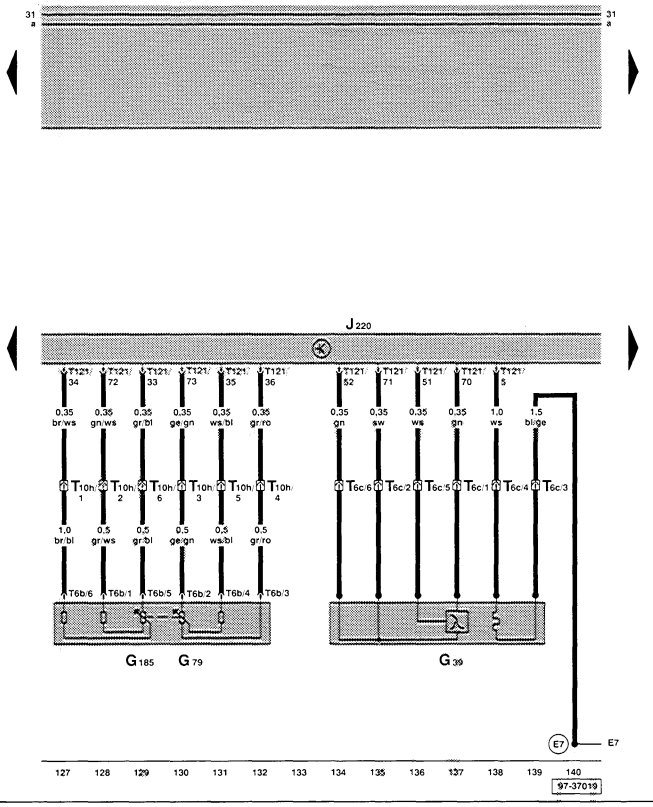
(609) - Ground connection (in right plenum chamber)
(A121) - Connection (high bus), in instrument panel wiring harness
(A122) - Connection (low bus), in instrument panel wiring harness

* - Jetta only
** - Golf only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), heated oxygen sensor (HO2S), throttle position (TP) sensor, sender -2- for accelerator pedal position

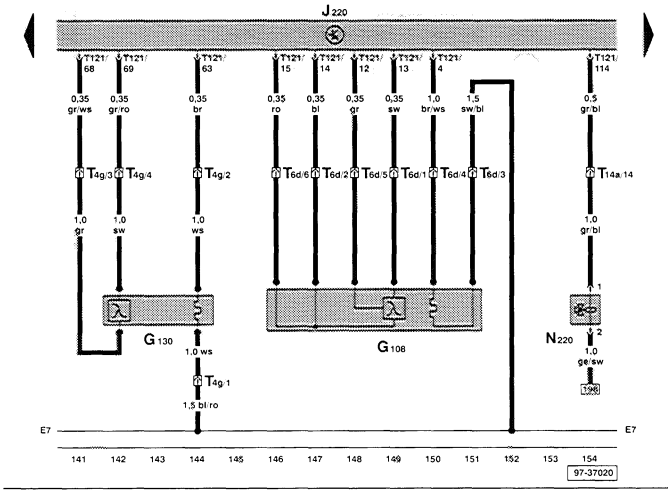
- G39 - Heated Oxygen Sensor (HO2S)
- G79 - Throttle Position (TP) Sensor
- G185 - Sender -2- for accelerator pedal position
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T6b - 6-Pin Connector
- T6c - 6-Pin Connector, in protective housing for connectors under right floor
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector
- (E7) - Plus connection (87a), in Motronic Multiport Fuel Injection (MFI) wiring harness



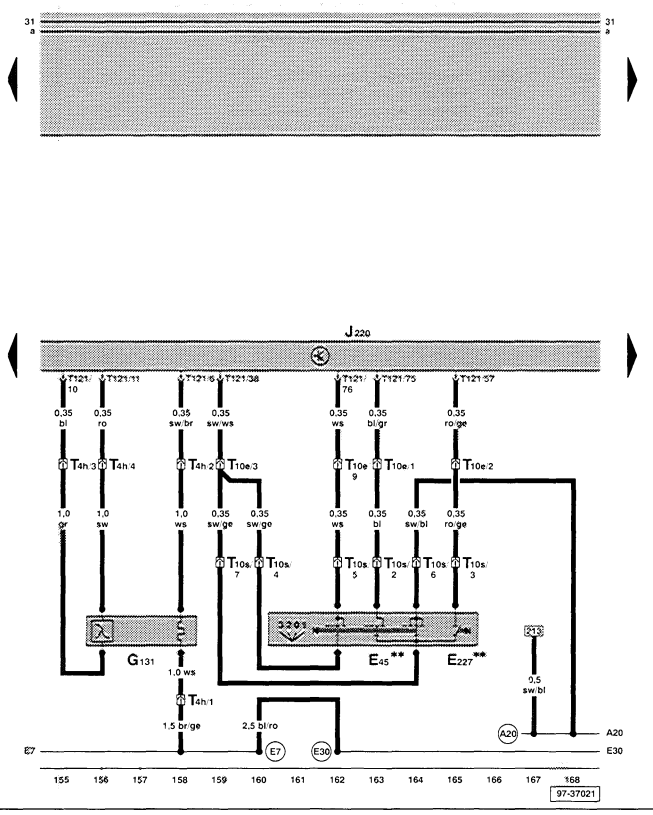
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), oxygen sensor (O2S) behind three way catalytic converter (TWC), heated oxygen sensor (HO2S) 2

- G108 - Heated Oxygen Sensor (HO2S) 2
- G130 - Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- N220 - Valve for exhaust flap
- T4g - 4-Pin Connector, in protective housing for connectors under right floor
- T6d - 6-Pin Connector, in protective housing for connectors under right floor
- T14a - 14-Pin Connector, near battery
- T121 - 121-Pin Connector



ws = white
sw = black
ro = red
br = brown
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bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



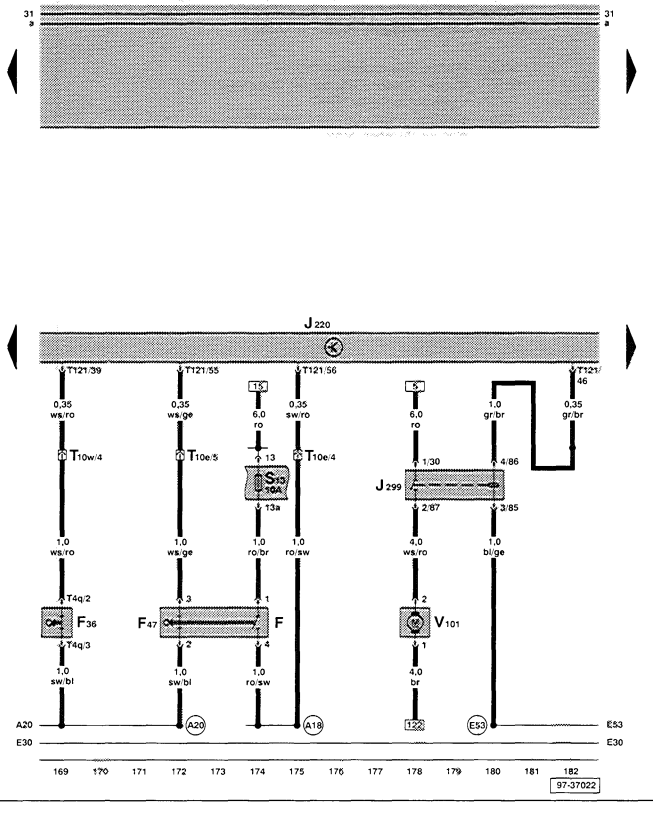
Motronic engine control module (ECM), Oxygen sensor (O2S) 2 behind three way catalytic converter (TWC), cruise control switch

- E45 - Cruise Control Switch**
- E227 - Cruise Control Push Button (SET)**
- G131 - Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T4h - 4-Pin Connector, in protective housing for connectors under right floor
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T10s - 10-Pin Connector, near steering column
- T121 - 121-Pin Connector

- (E7) - Plus connection (87a), in Motronic Multiport Fuel Injection (MFI) wiring harness
- (E30) - Connector (87a), in wiring harness engine
- (A20) - Wire connection (15a), in instrument panel wiring harness

** - Vehicles with cruise control only. Vehicles with Multi-function steering wheel ⇒ Wiring diagram Multi-function steering wheel for cruise control and radio

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sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
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or = orange

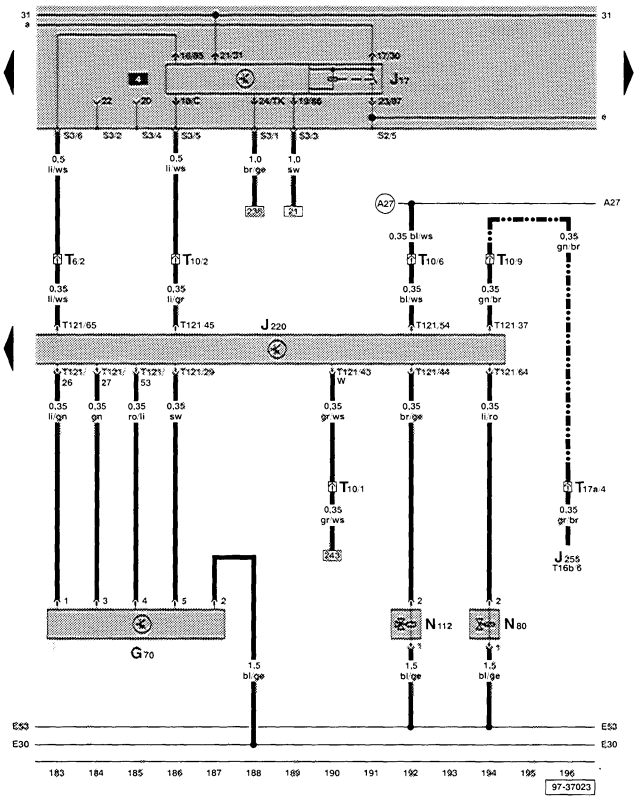


Motronic engine control module (ECM), secondary air injection (AIR) pump motor, secondary air injection (AIR) pump relay, clutch pedal switch, brake pedal switch

- F - Brake Light Switch
- F36 - Clutch Pedal Switch
- F47 - Brake Pedal Switch
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J299 - Secondary Air Injection (AIR) Pump Relay, in protective housing, in engine compartment, left, production control number (100)
- S13 - Fuse 13 in fuse holder
- T4q - 4-Pin Connector
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector
- V101 - Secondary Air Injection (AIR) Pump Motor

- (A18) - Wire connection (54), in instrument panel
- (A20) - Wire connection (15a), in instrument panel wiring harness
- (E53) - Connection 2 (87a) in Motronic wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

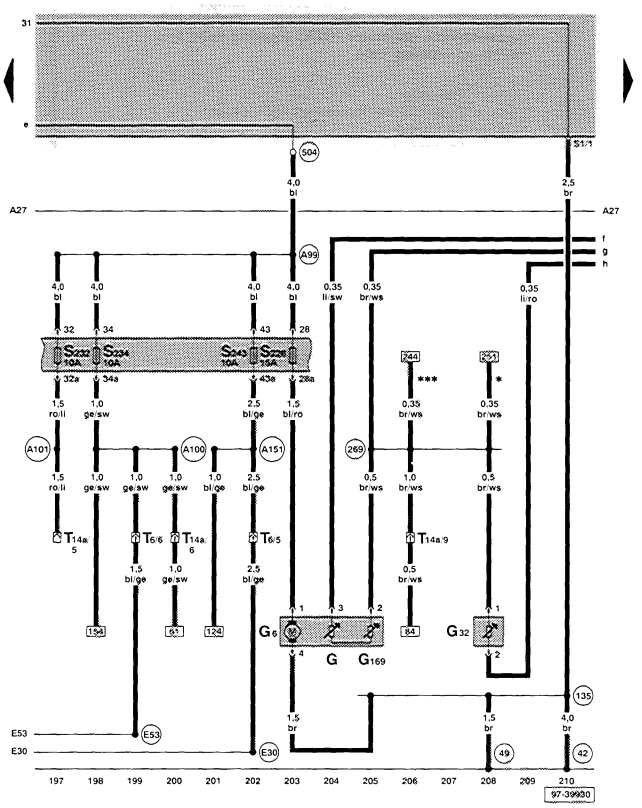


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), mass air flow (MAF) sensor, fuel pump (FP) relay, evaporative emission (EVAP) canister purge regulator valve, secondary air Injection (AIR) solenoid valve

- G70 - Mass Air Flow (MAF) Sensor
- J17 - Fuel Pump (FP) Relay
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J255 - Climatronic Control Module
- N80 - Evaporative Emission (EVAP) Canister Purge Regulator Valve
- N112 - Secondary Air Injection (AIR) Solenoid Valve
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T16b - 16-Pin Connector
- T17a - 17-Pin Connector, behind instrument panel, center
- T121 - 121-Pin Connector
- (A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness
- -•••- Vehicles with Climatronic only

Edition 09.03

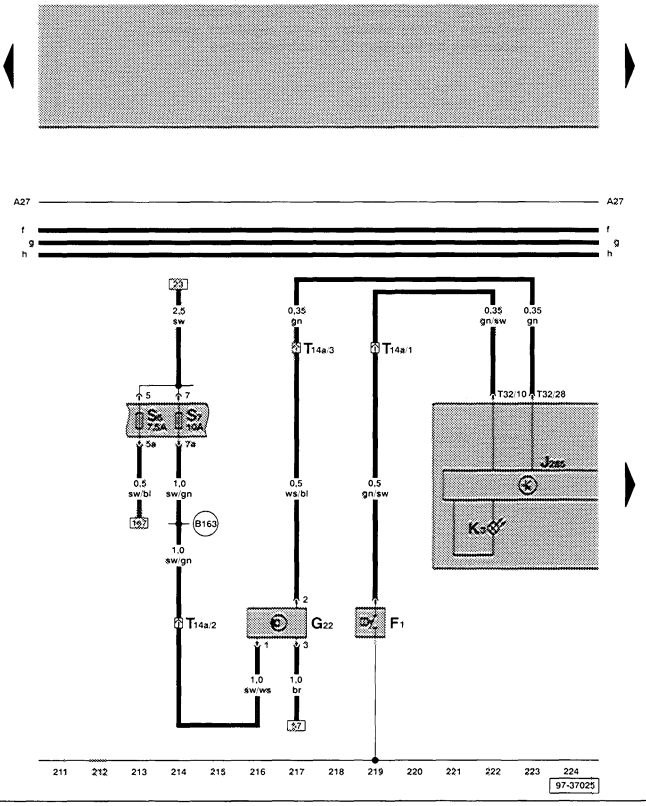


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor

- G - Fuel Level Sensor**
- G6 - Fuel Pump (FP)
- G32 - Engine Coolant Level (ECL) Sensor
- G169 - Fuel Level Sensor 2**
- S228 - Fuse 28 in fuse holder
- S232 - Fuse 32 in fuse holder
- S234 - Fuse 34 in fuse holder
- S243 - Fuse 43 in fuse holder
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- (42) - Ground connection, beside steering column
- (49) - Ground connection, on steering column
- (135) - Ground connection 2, in instrument panel wiring harnes
- (269) - Ground connection (sensor ground) 1, in instrument panel wiring harness
- (504) - Threaded connection 1 (87) on the relay plate
- (A99) - Connection 1 (87), in instrument panel wiring harness
- (A100) - Connection 2 (87), in instrument panel wiring harness
- (A101) - Connection 3 (87a), in instrument panel wiring harness
- (A151) - Connection 4 (87), in instrument panel wiring harness
- (E30) - Connection (87a), in wiring harness engine
- (E53) - Connection 2 (87a) in Motronic wiring harness
- * - Vehicles with Multi-Function Indicator (MFI) only
- ** - See also wiring diagram all-wheel drive control
- *** - Vehicles with Multi-Function Indicator (MFI) only (without Climatronic)

Edition 04.04

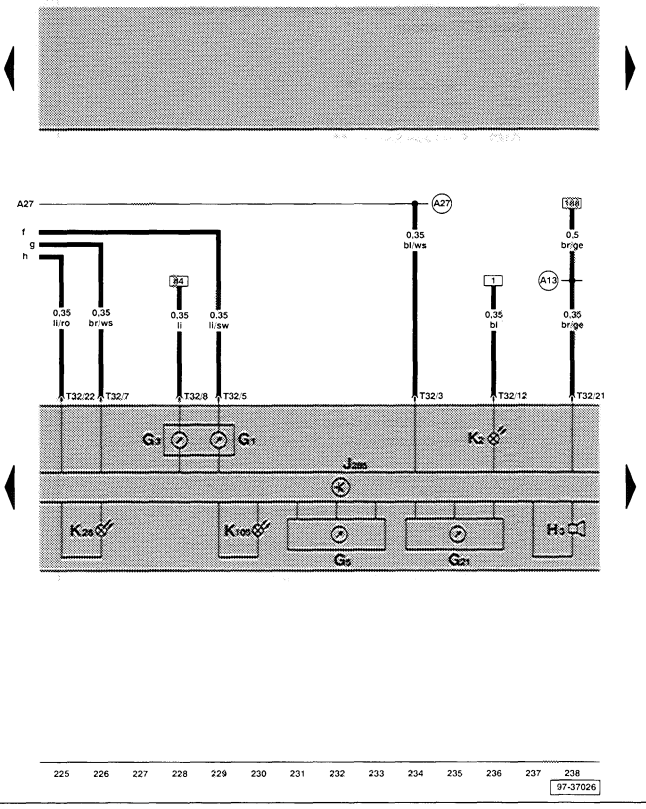


Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light

- F1 - Oil Pressure Switch
- G22 - Speedometer Vehicle Speed Sensor (VSS)
- J285 - Control module with indicator unit in instrument panel insert
- K3 - Oil Pressure Warning Light
- S5 - Fuse 5 in fuse holder
- S7 - Fuse 7 in fuse holder
- T14a - 14-Pin Connector, near battery
- T32 - 32-Pin Connector, blue

- (B163) - Plus connection -1- (15) in wiring harness interior

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sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

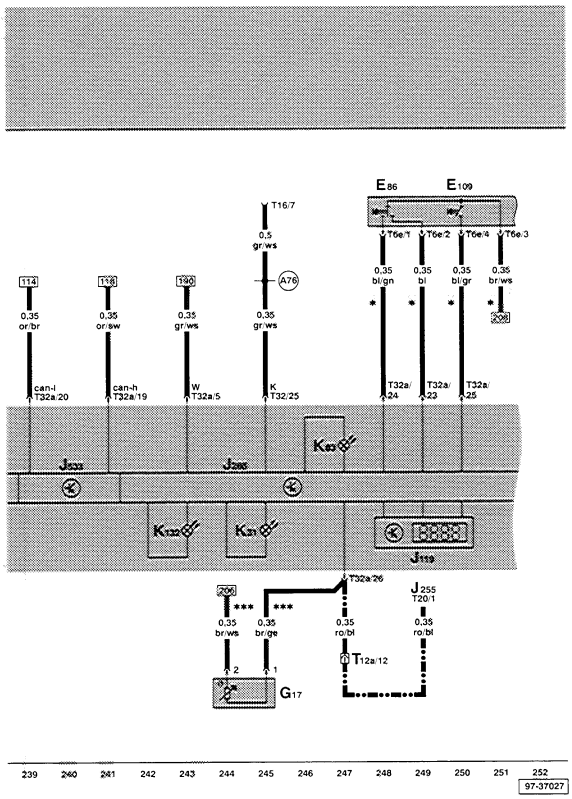


Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light

- G1 - Fuel gauge
- G3 - Engine Coolant Temperature (ECT) Gauge
- G5 - Tachometer
- G21 - Speedometer
- H3 - Warning Buzzer
- J285 - Control module with indicator unit in instrument panel insert
- K2 - Generator (GEN) Warning Light
- K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
- K105 - Low Fuel Level Warning Light
- T32 - 32-Pin Connector, blue

- (A13) - Wire connection (door contact switch), in instrument panel wiring harness
- (A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp

- E86 - Multi-Function Indicator Mode Select Switch*
- E109 - Multi-Function Indicator Memory Switch*
- G17 - Outside Air Temperature Sensor
- J119 - Multi-function Indicator (MFI)
- J255 - Climatronic Control Module
- J285 - Control module with indicator unit in instrument panel insert
- J533 - Data Bus On Board Diagnostic Interface
- K31 - Cruise Control Indicator Light
- K83 - Malfunction Indicator Lamp (MIL)
- K132 - Electronic Power Control (EPC) Warning Lamp
- T6e - 6-Pin Connector
- T12a - 12-Pin Connector, behind instrument panel, center
- T16 - Data Link Connector (DLC), below instrument panel, left
- T20 - 20-Pin Connector
- T32 - 32-Pin Connector, blue
- T32a - 32-Pin Connector, green
- (A76) - Connection (K-diagnosis wire), in instrument panel wiring harness
- * - Vehicles with Multi-Function Indicator (MFI) only
- *** - Vehicles with Multi-Function Indicator (MFI) only (without Climatronic)
- -•••- Vehicles with Climatronic only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

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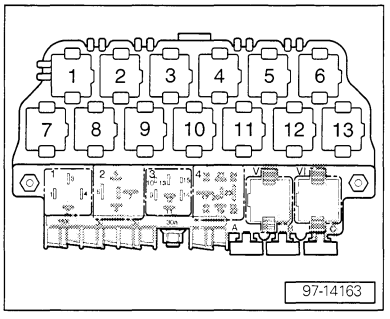
Repair Manual page number 97-983

Haldex Coupling (02A) for All-Wheel Drive,

from October 2003

Additional Fuse, Relay, Control Module and Connector locations ⇒ Compontent Locations

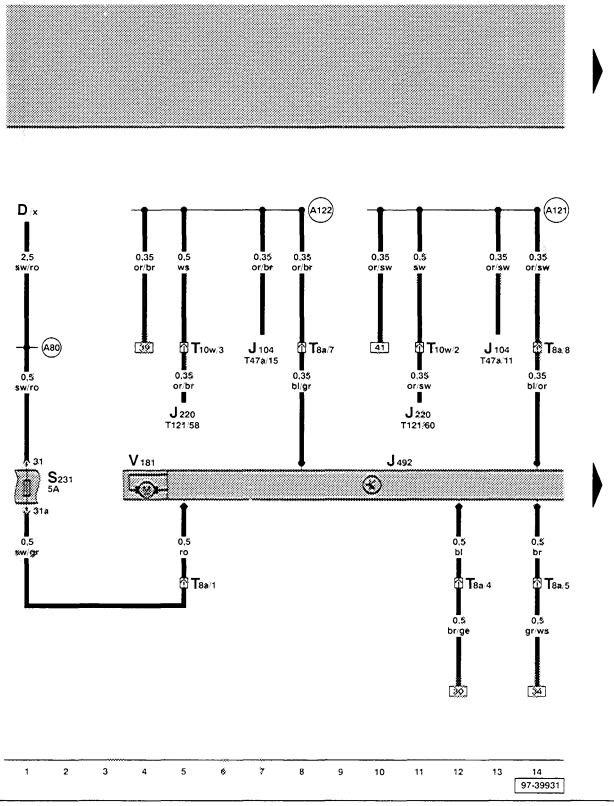
Troubleshooting Procedures ⇒ Guided Fault Finding using VAS 5051/5052



Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

4 J17 - Fuel Pump (FP) Relay (409)



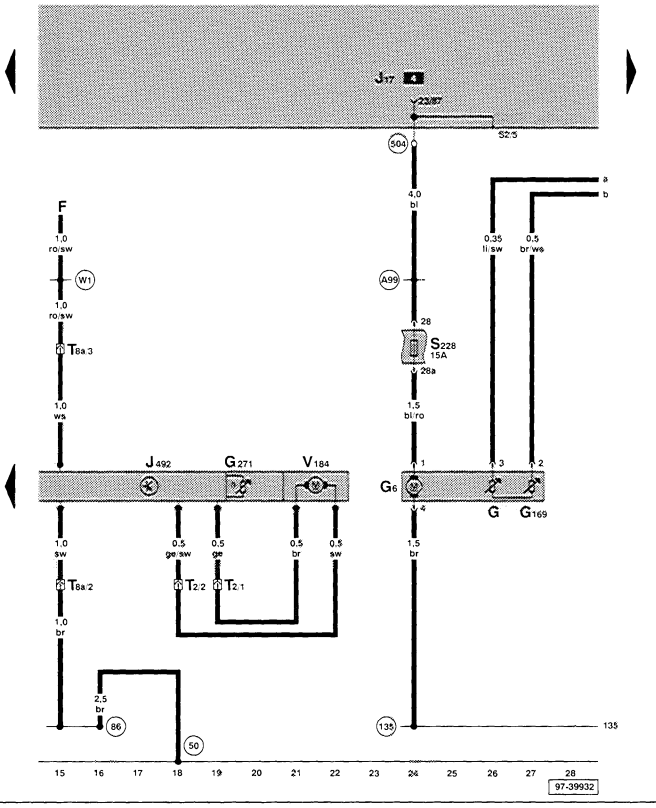
All-wheel drive control module, Haldex clutch pump

- D - Ignition/Starter Switch
- J104 - ABS Control Module
- J220 - Motronic Engine Control Module (ECM)
- J492 - All-Wheel Drive Control Module, in Haldex clutch rear
- S231 - Fuse 31 in fuse holder
- T8a - 8-Pin Connector, near Haldex clutch
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T47a - 47-Pin Connector, on ABS Control Module
- T121 - 121-Pin Connector
- V181 - Haldex Clutch Pump

(A80) - Connection 1 (X) in instrument panel wiring harness
(A121) - Connection (high bus) in instrument panel wiring harness
(A122) - Connection (low bus) in instrument panel wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Repair Manual page number 97-982



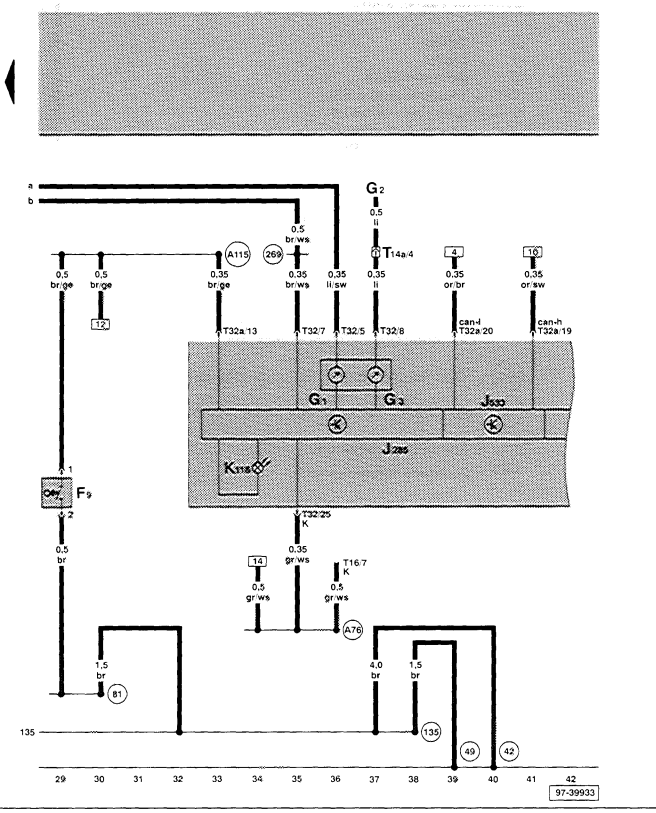
All-wheel drive control module, oil pressure actuator, hydraulic temperature sensor, fuel level sensor

F - Brake Light Switch
G - Fuel Level Sensor
G169 - Fuel Level Sensor 2
G271 - Hydraulic Temperature Sensor
J17 - Fuel Pump (FP) Relay
J492 - All-Wheel Drive Control Module, in Haldex clutch rear
T2 - Double Connector, on Haldex clutch
T8a - 8-Pin Connector, near Haldex clutch
S228 - Fuse 28 in fuse holder
V184 - Oil Pressure Actuator

(50) - Ground connection, in luggage compartment, left
(86) - Ground connection 1, in rear wiring harness
(135) - Ground Connection 2, in instrument panel wiring harness
(504) - Threaded connection 1 (87) on the relay plate
(A99) - Connection 1 (87), in instrument panel wiring harness
(W1) - Plus connection 1 (54), in rear wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.04



Instrument cluster, parking brake warning light switch, warning light for brake system, fuel gauge, engine coolant temperature (ECT) gauge

F9 - Parking Brake Warning Light Switch
G1 - Fuel gauge
G2 - Engine Coolant Temperature (ECT) Sensor
G3 - Engine Coolant Temperature (ECT) Gauge
J285 - Control module with indicator unit in instrument panel insert
J533 - Data Bus On Board Diagnostic Interface
K118 - Warning light for brake system
T14a - 14-Pin Connector, near battery
T16 - Data Link Connector (DLC), below instrument panel, left
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green

(42) - Ground connection, beside steering column
(49) - Ground connection, on steering column
(81) - Ground Connection 1, in instrument panel wiring harness
(135) - Ground Connection 2, in instrument panel wiring harness
(269) - Ground connection (sensor ground) 1, in instrument panel wiring harness
(A76) - Connection (K-diagnosis wire), in instrument panel wiring harness
(A115) - Connection (parking brake control) in instrument panel wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 04.04

Repair Manual page number 97-985
Repair Manual page number 97-984

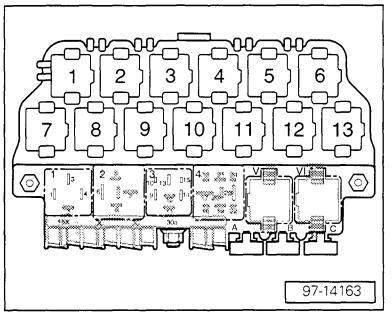
Repair Manual page number 97-987

2.0L - Engine - Motronic Multiport Fuel Injection (MFI)/85 kW, code BEV,

from June 2004

Additional Fuse, Relay, Control Module and Connector locations ⇒ Compontent Locations

Troubleshooting Procedures ⇒ Guided Fault Finding using VAS 5051/5052

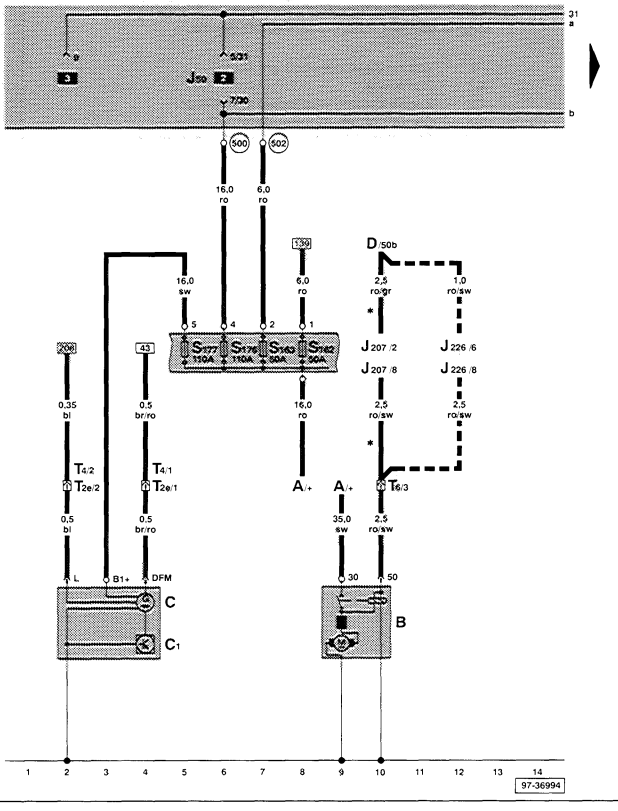


Relay location on the thirteenfold auxiliary relay panel, above relay panel:

Relay panel:

2 J52 - Load Reduction Relay (100)

4 J17 - Fuel Pump (FP) Relay (409)



Generator (GEN), starter

A - Battery
B - Starter
C - Generator (GEN)
C1 - Voltage Regulator (VR)
D - Ignition/Starter Switch
J59 - Load Reduction Relay
J207 - Starting Interlock Relay
J226 - Park/Neutral Position (PNP) Relay
S162 - Fuse -1- (30) in fuse bracket/battery
S163 - Fuse -2- (30) in fuse bracket/battery
S176 - Fuse -4- (30) in fuse bracket/battery
S177 - Fuse -5- (30) in fuse bracket/battery
T2e - Double Connector, near starter (vehicles without air conditioning)
T4 - 4-Pin Connector, near starter (vehicles with air conditioning only)
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left

(500) - Threaded connection -1- (30) on the relay plate

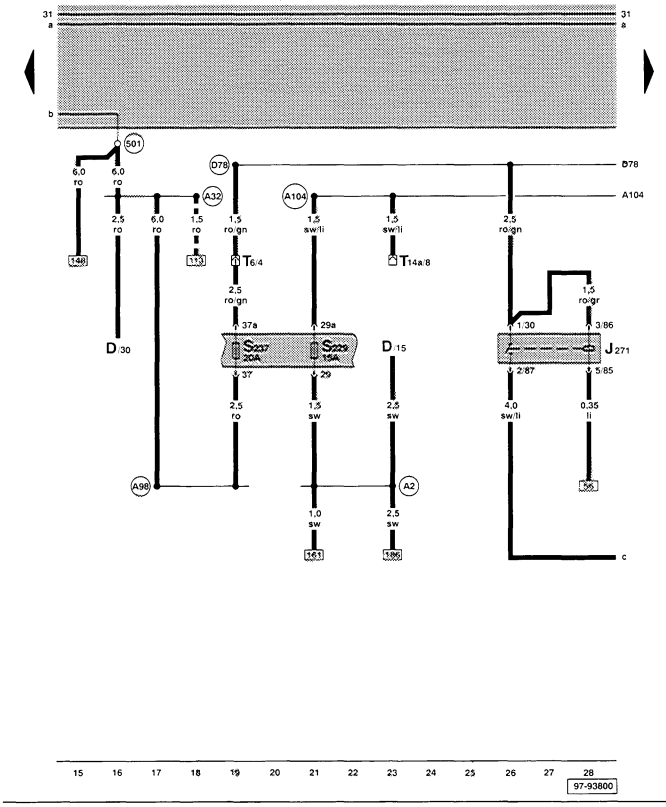
(502) - Threaded connection -1- (30a) on the relay plate

* - Manual transmission only

--- Automatic transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Repair Manual page number 97-986



Power supply relay

D - Ignition/Starter Switch
J271 - Motronic engine control module (ECM) power supply relay, in protective housing, in engine compartment, left, production control number (428)
S229 - Fuse 29 in fuse holder
S237 - Fuse 37 in fuse holder
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T14a - 14-Pin Connector, near battery

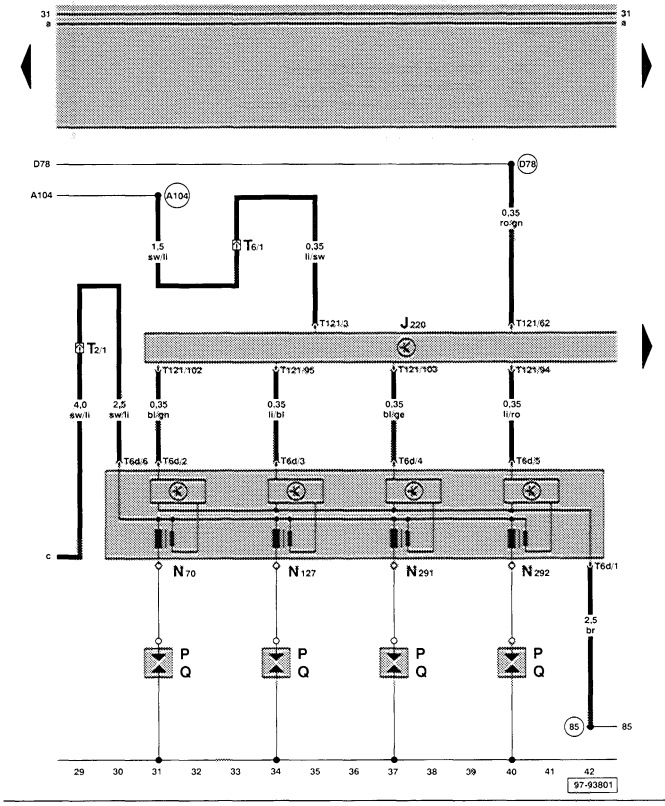
(501) - Threaded connection -2- (30) on the relay plate
(A2) - Plus connection (15), in instrument panel wiring harness
(A32) - Plus connection (30), in instrument panel wiring harness
(A98) - Plus connection -4- (30), in instrument panel wiring harness
(A104) - Plus connection -2- (15), in instrument panel wiring harness
(D78) - Plus connection -1- (30a), in engine compartment wiring harness

--- Automatic transmission only

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 12.04

Repair Manual page number 97-989



Motronic engine control module (ECM), ignition system

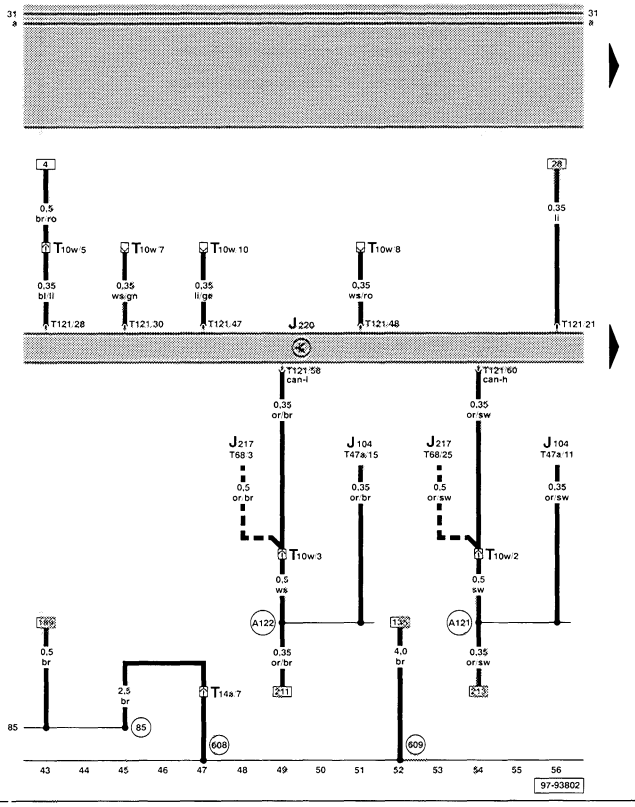
J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
N70 - Ignition Coil 1 with Power Output Stage
N127 - Ignition Coil 2 with Power Output Stage
N291 - Ignition Coil 3 with Power Output Stage
N292 - Ignition Coil 4 with Power Output Stage
P - Spark Plug Connectors
Q - Spark Plugs
T2 - 2-Pin Connector, in engine compartment, left
T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
T6d - 6-Pin Connector
T121 - 121-Pin Connector

(85) - Ground connection -1-, in engine compartment wiring harness
(A104) - Plus connection -2- (15), in instrument panel wiring harness
(D78) - Plus connection -1- (30a), in engine compartment wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Edition 12.04

Repair Manual page number 97-988



ws = white
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gn = green
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gr = grey
li = lilac
ge = yellow
or = orange

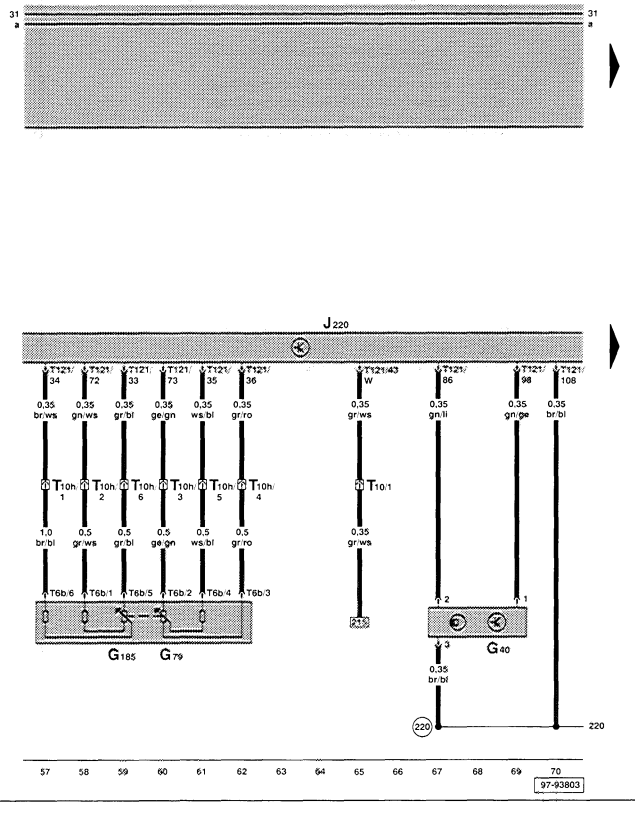
Motronic engine control module (ECM)

- J104 - ABS Control Module (w/EDL), in engine compartment, left
- J217 - Transmission Control Module (TCM)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- T47a - 47-Pin Connector, on ABS Control Module
- T68 - 68-Pin Connector, on Transmission Control Module (TCM)
- T121 - 121-Pin Connector

- (85) - Ground connection -1-, in engine compartment wiring harness
- (608) - Ground connection (in center plenum chamber)
- (609) - Ground connection (in right plenum chamber)
- (A121) - Connection (high bus), in instrument panel wiring harness
- (A122) - Connection (low bus), in instrument panel wiring harness

--- Automatic transmission only

Edition 12.04



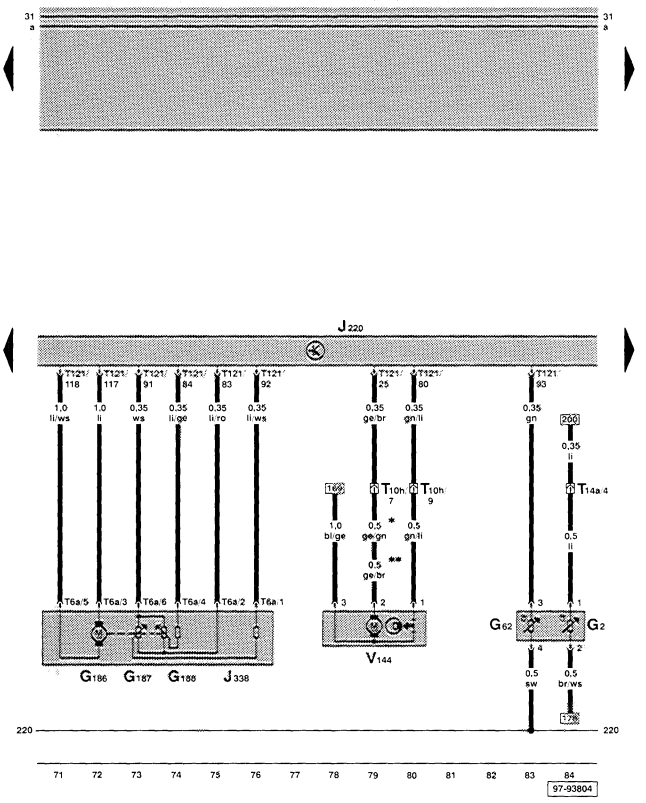
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sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), throttle position (TP) sensor, camshaft position (CMP) sensor

- G40 - Camshaft Position (CMP) Sensor
- G79 - Throttle Position (TP) Sensor
- G185 - Sender -2- for accelerator pedal position
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T6b - 6-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector

- (220) - Ground connection (sensor ground), in engine compartment wiring harness

Edition 12.04

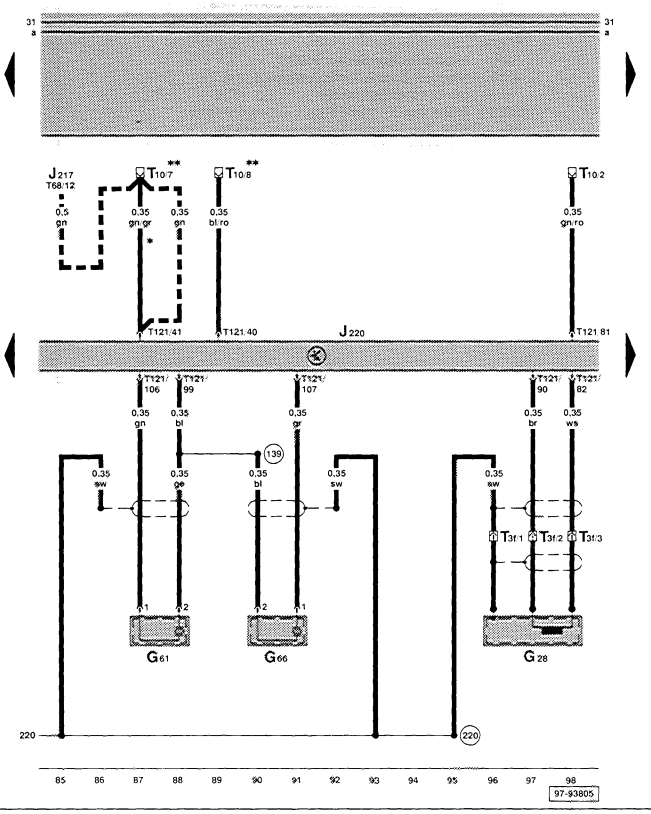


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), throttle valve control module, engine coolant temperature (ECT) sensor, leak detection pump (LDP)

- G2 - Engine Coolant Temperature (ECT) Sensor
- G62 - Engine Coolant Temperature (ECT) Sensor
- G186 - Throttle drive (power accelerator actuation)
- G187 - Angle sensor -1- for throttle drive (power accelerator actuation)
- G188 - Angle sensor -2- for throttle drive (power accelerator actuation)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J338 - Throttle Valve Control Module
- T6a - 6-Pin Connector
- T10h - 10-Pin Connector, blue, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery
- T121 - 121-Pin Connector
- V144 - Leak detection pump (LDP)

* - Jetta only
** - Golf only



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

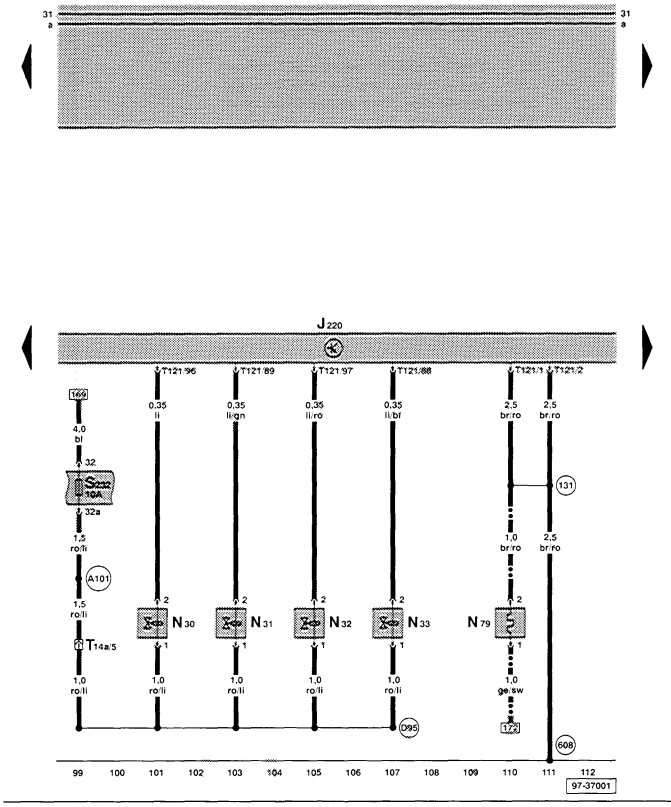
Motronic engine control module (ECM), engine speed (RPM) sensor, knock sensor (KS) 1, knock sensor (KS) 2

- G28 - Engine Speed (RPM) Sensor
- G61 - Knock Sensor (KS) 1
- G66 - Knock Sensor (KS) 2
- J217 - Transmission Control Module (TCM)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- T3f - 3-Pin Connector, in engine compartment, front
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T68 - 68-Pin Connector, on Transmission Control Module (TCM)
- T121 - 121-Pin Connector
- (139) - Ground connection (sensor Ground), in Motronic Multiport Fuel Injection (MFI) wiring harness
- (220) - Ground connection (sensor ground), in engine compartment wiring harness

* - Manual transmission only
** - A/C connection
--- Automatic transmission only

Repair Manual page number 97-993

Repair Manual page number 97-992



ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
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ge = yellow
or = orange

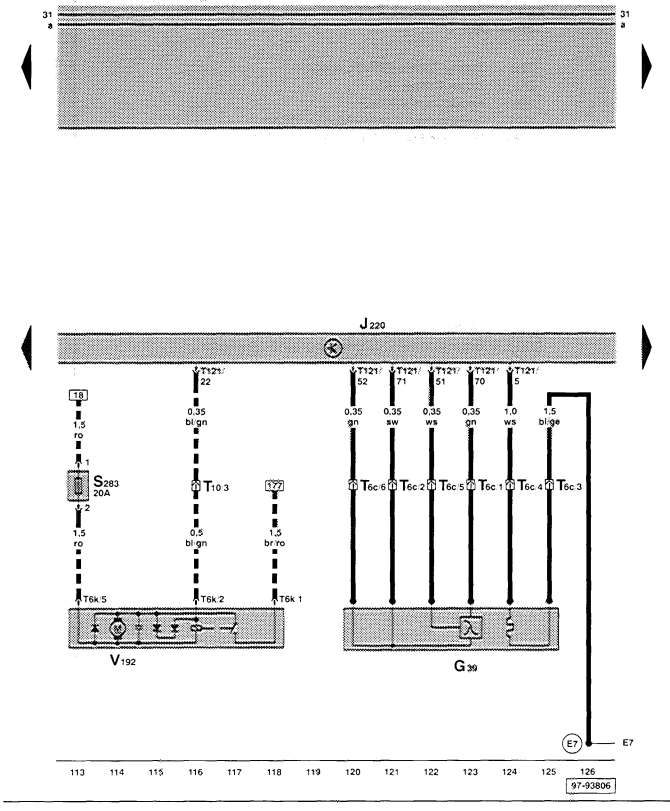
Motronic engine control module (ECM), injectors, positive crankcase ventilation (PCV) heating element

- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- N30 - Cylinder 1 Fuel Injector
- N31 - Cylinder 2 Fuel Injector
- N32 - Cylinder 3 Fuel Injector
- N33 - Cylinder 4 Fuel Injector
- N79 - Positive Crankcase Ventilation (PCV) Heating Element
- S232 - Fuse 32 in fuse holder
- T14a - 14-Pin Connector, near battery
- T121 - 121-Pin Connector

- (131) - Ground connection -2-, in engine compartment wiring harness
- (608) - Ground connection (in center plenum chamber)

- (A101) - Connection -3- (87a), in instrument panel wiring harness
- (D95) - Wire connection (injectors), in engine compartment wiring harness

-•••- Vehicles with positive crankcase ventilation (PCV) heating element only



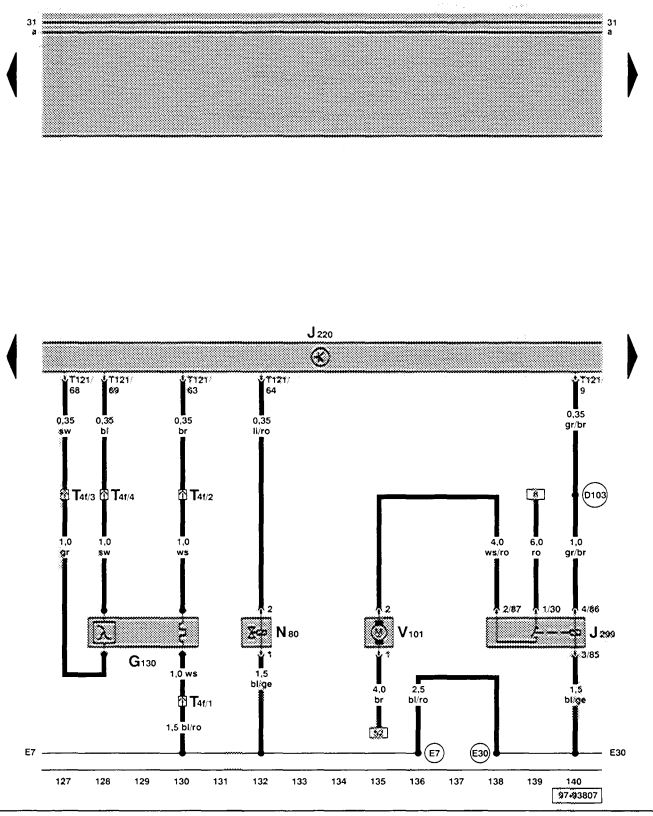
ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), heated oxygen sensor (HO2S), brake system vacuum pump

- G39 - Heated Oxygen Sensor (HO2S)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- S283 - Brake Vacuum Pump Fuse, on the relay panel
- T6c - 6-Pin Connector, in protective housing for connectors under right floor
- T6k - 6-Pin Connector
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector
- V192 - Brake System Vacuum Pump

- (E7) - Plus connection (87a), in Motronic Multiport Fuel Injection (MFI) wiring harness

--- Automatic transmission only

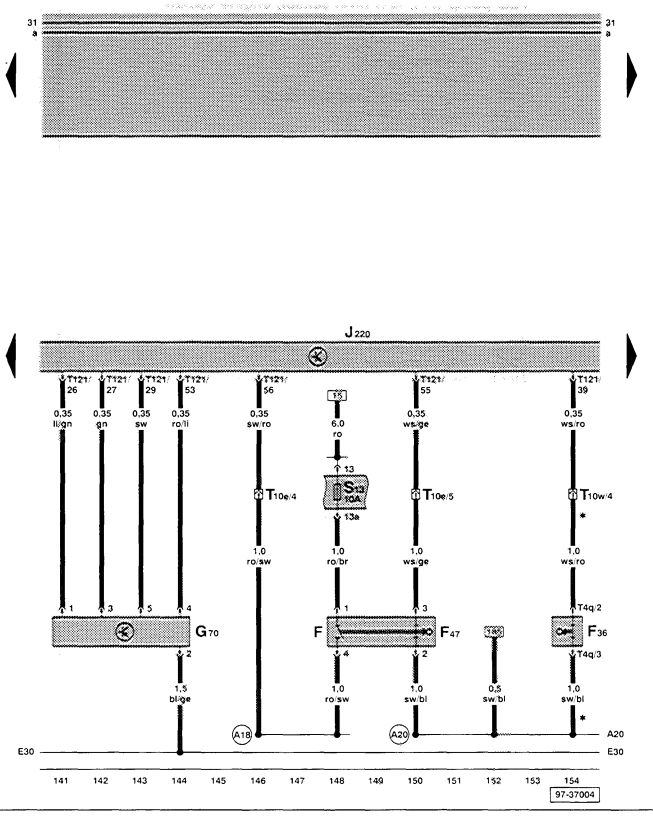


ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

Motronic engine control module (ECM), secondary air injection (AIR) pump motor, secondary air injection (AIR) pump relay, oxygen sensor (O2S) behind three way catalytic converter (TWC), evaporative emission (EVAP) canister purge regulator valve

- G130 - Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC)
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J299 - Secondary Air Injection (AIR) Pump Relay, in protective housing, in engine compartment, left, production control number (100)
- N80 - Evaporative Emission (EVAP) Canister Purge Regulator Valve
- T4f - 4-Pin Connector, in protective housing for connectors under right floor
- T121 - 121-Pin Connector
- V101 - Secondary Air Injection (AIR) Pump Motor

- (E7) - Plus connection (87a), in Motronic Multiport Fuel Injection (MFI) wiring harness
- (D103) - Wire connection -3-, in engine compartment wiring harness
- (E30) - Connection (87a), in wiring harness engine



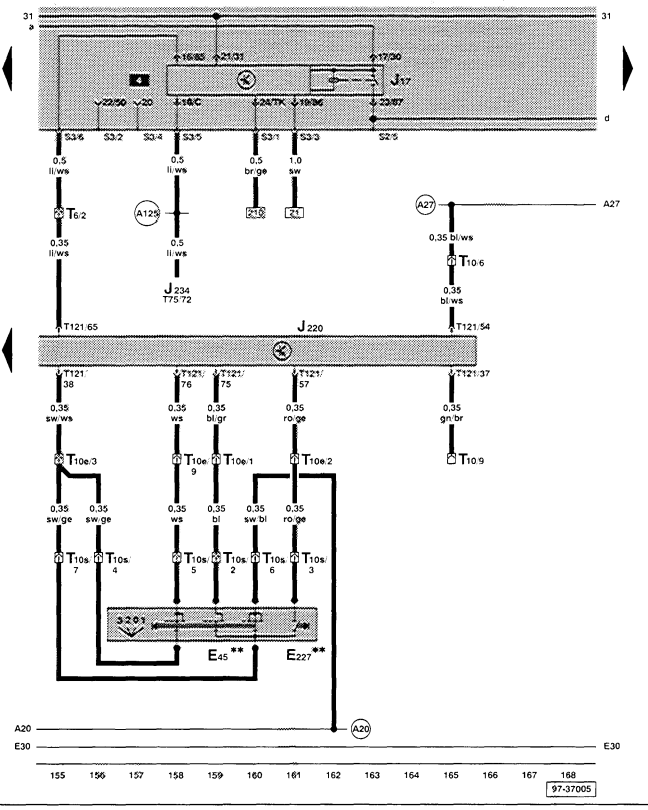
ws = white
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Motronic engine control module (ECM), mass air flow (MAF) sensor, brake light switch, brake vacuum vent valve switch for cruise control, clutch vacuum vent valve switch

- F - Brake Light Switch
- F36 - Clutch Vacuum Vent Valve Switch*
- F47 - Brake Vacuum Vent Valve Switch for cruise control
- G70 - Mass Air Flow (MAF) Sensor
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- S13 - Fuse 13 in fuse holder
- T4q - 4-Pin Connector
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T10w - 10-Pin Connector, white, in protective housing for connectors, in plenum chamber, left
- T121 - 121-Pin Connector

- (A18) - Wire connection (54), in instrument panel
- (A20) - Wire connection (15a), in instrument panel wiring harness

* - Manual transmission only



Motronic engine control module (ECM), cruise control switch, fuel pump (FP) relay

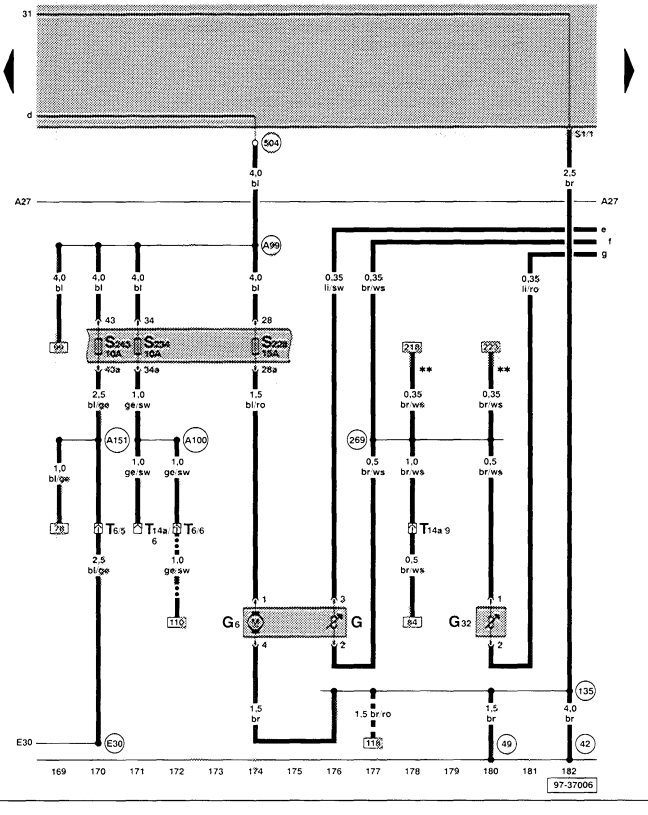
- E45 - Cruise Control Switch**
- E227 - Cruise Control Push Button (SET)**
- J17 - Fuel Pump (FP) Relay
- J220 - Motronic Engine Control Module (ECM), in plenum chamber, center
- J234 - Airbag Control Module
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T10 - 10-Pin Connector, orange, in protective housing for connectors, in plenum chamber, left
- T10e - 10-Pin Connector, black, in protective housing for connectors, in plenum chamber, left
- T10s - 10-Pin Connector, near steering column
- T75 - 75-Pin Connector
- T121 - 121-Pin Connector

- (A20) - Wire connection (15a), in instrument panel wiring harness
- (A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness
- (A125) - Connection (crash signal) in instrument panel wiring harness

** - Vehicles with cruise control only. Vehicles with Multi-function steering wheel ⇒ Wiring diagram Multi-function steering wheel for cruise control and radio

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

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Fuel pump (FP), fuel level sensor, engine coolant level (ECL) sensor

- G - Fuel Level Sensor
- G6 - Fuel Pump (FP)
- G32 - Engine Coolant Level (ECL) Sensor
- S228 - Fuse 28 in fuse holder
- S234 - Fuse 34 in fuse holder
- S243 - Fuse 43 in fuse holder
- T6 - 6-Pin Connector, brown, in protective housing for connectors, in plenum chamber, left
- T14a - 14-Pin Connector, near battery

- (42) - Ground connection, beside steering column
- (49) - Ground connection, on steering column
- (135) - Ground connection -2-, in instrument panel wiring harnes
- (269) - Ground connection (sensor ground) -1-, in instrument panel wiring harness
- (504) - Threaded connection -1- (87) on the relay plate
- (A99) - Connection -1- (87), in instrument panel wiring harness
- (A100) - Connection -2- (87), in instrument panel wiring harness
- (A151) - Connection -4- (87), in instrument panel wiring harness
- (E30) - Connection (87a), in wiring harness engine

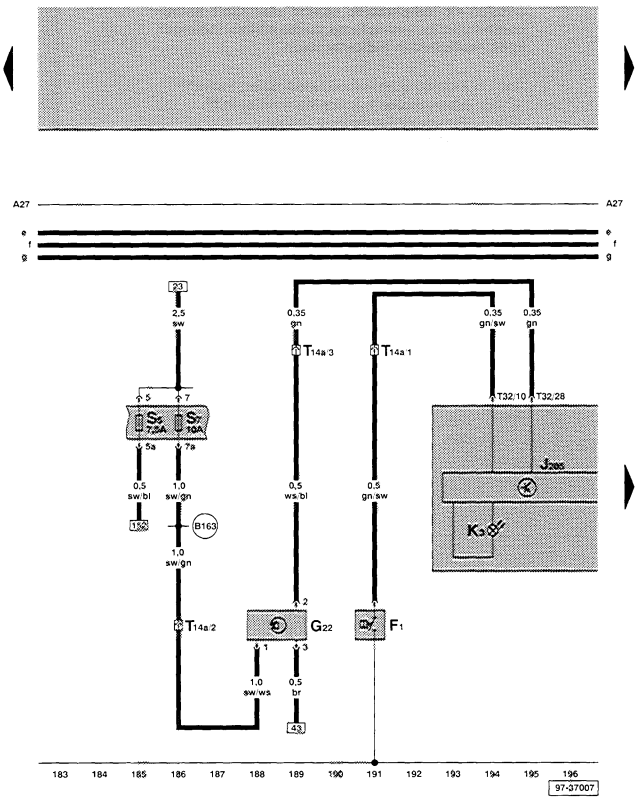
** - Vehicles with Multi-Function Indicator (MFI) only

--- Automatic transmission only

-•-•- Vehicles with positive crankcase ventilation (PCV) heating element only

ws = white
sw = black
ro = red
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gr = grey
li = lilac
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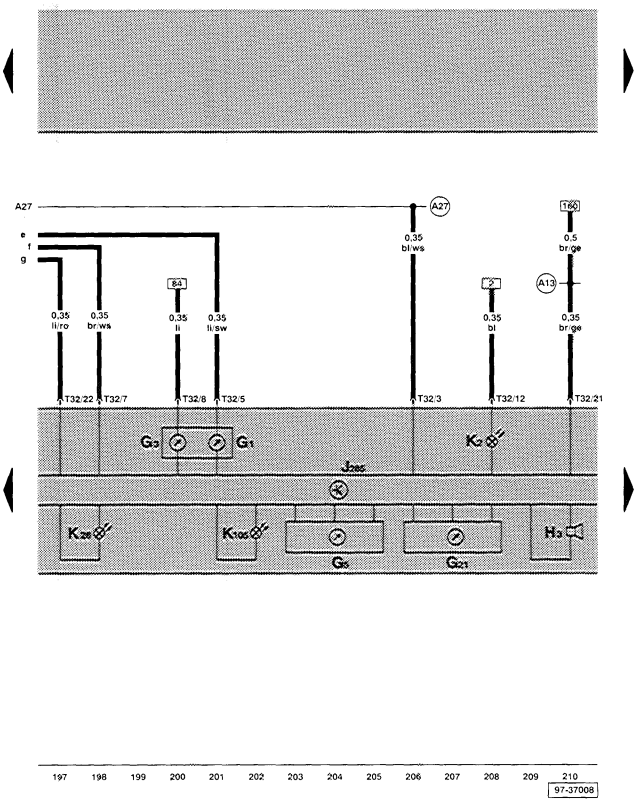


Instrument cluster, oil pressure switch, speedometer vehicle speed sensor (VSS), oil pressure warning light

F1 - Oil Pressure Switch
G22 - Speedometer Vehicle Speed Sensor (VSS)
J285 - Control module with indicator unit in instrument panel insert
K3 - Oil Pressure Warning Light
S5 - Fuse 5 in fuse holder
S7 - Fuse 7 in fuse holder
T14a - 14-Pin Connector, near battery
T32 - 32-Pin Connector, blue

(B163) - Plus connection -1- (15) in wiring harness interior

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange

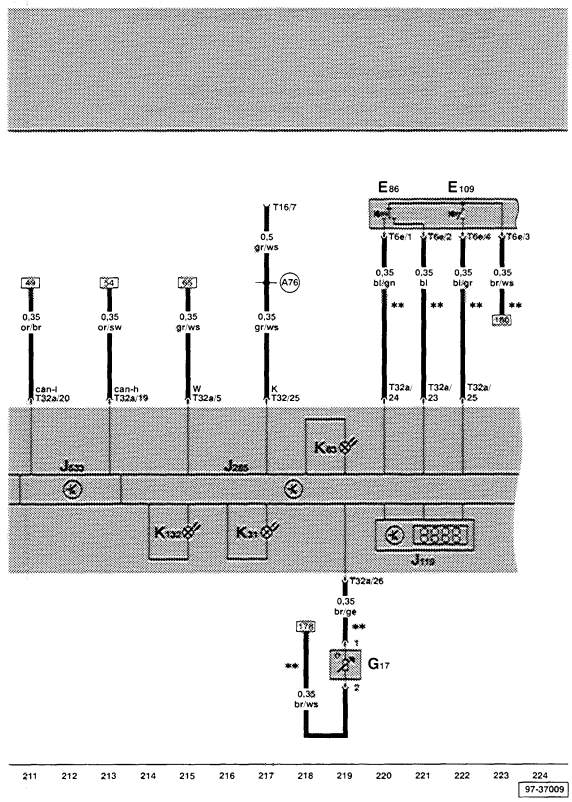


Instrument cluster, engine coolant temperature (ECL/ECT) gauge, fuel gauge, tachometer, speedometer, generator (GEN) warning light, low fuel level warning light

G1 - Fuel gauge
G3 - Engine Coolant Temperature (ECT) Gauge
G5 - Tachometer
G21 - Speedometer
H3 - Warning Buzzer
J285 - Control module with indicator unit in instrument panel insert
K2 - Generator (GEN) Warning Light
K28 - Engine Coolant Level/Temperature (ECL/ECT) Warning Light
K105 - Low Fuel Level Warning Light
T32 - 32-Pin Connector, blue

(A13) - Wire connection (door contact switch), in instrument panel wiring harness
(A27) - Wire connection (vehicle speed signal), in instrument panel wiring harness

ws = white
sw = black
ro = red
br = brown
gn = green
bl = blue
gr = grey
li = lilac
ge = yellow
or = orange



Instrument cluster, multi-function indicator (MFI), outside air temperature sensor, electronic power control (EPC) warning lamp, cruise control indicator light, malfunction indicator lamp

E86 - Multi-Function Indicator Mode Select Switch**
E109 - Multi-Function Indicator Memory Switch**
G17 - Outside Air Temperature Sensor
J119 - Multi-function Indicator (MFI)
J285 - Control module with indicator unit in instrument panel insert
J533 - Data Bus On Board Diagnostic Interface
K31 - Cruise Control Indicator Light
K83 - Malfunction Indicator Lamp (MIL)
K132 - Electronic Power Control (EPC) Warning Lamp
T6e - 6-Pin Connector
T16 - Data Link Connector (DLC), below instrument panel, left
T32 - 32-Pin Connector, blue
T32a - 32-Pin Connector, green
(A76) - Connection (K-diagnosis wire), in instrument panel wiring harness
** - Vehicles with Multi-Function Indicator (MFI) only

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Repair Manual page number 97-1003

Service Information

Repair Manual Technical Bulletin

Golf / Jetta 1999 ▶

Bulletin-No.: 18

The following have been integrated into the Electrical Wiring Diagrams:

- Replace Index with pages supplied.
- Replace Wiring Diagrams: No. 62/4, 64/4, 71/4, 71/6, 78/4, 79/4, 80/4, 80/5, 80/6, 86/4, 88/3, 88/4, 89/4, 89/5 and 89/6.
- Add new Wiring Diagram No. 91.

W42.USA.5102.18.21

Edition 12.04

Repair Manual page number 97-1002

ST Scan Tool

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TCM Coding ST-34
ABS/EDL/ASR/ESP Coding Tables ST-35
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VAG 1551/1552 OPERATING OVERVIEW FLOW CHART ST-56

GENERAL

This section covers a brief overview of On-Board Diagnostics and a list of applicable Diagnostic Trouble Codes (DTCs). Also given here is control module coding information which is used in conjunction with a diagnostic scan tool. New or replacement control units will usually require coding of the control module before they will function properly.

ON-BOARD DIAGNOSTICS II

All vehicles covered by this manual are equipped with On-Board Diagnostics II (OBD II). This system monitors operation and function of all engine management system activity and automatic transmission operation to insure compliance with specified emission levels.

Vehicle emission levels are continually monitored by the OBD II system and problems are recognized and recorded. A Malfunction Indicator Light (MIL) in the instrument cluster alerts the driver to the problem and the need to have the system checked for codes. These codes follow a standard format and are known as Diagnostic Trouble Codes (DTCs).

Each DTC is assigned two codes. The first code is a numerical code assigned by Volkswagen (VAG code). The second code is referred to as a P-code and follows a structure required by law and defined by the Society of Automotive Engineers (SAE). This standard uses a letter to designate the system and four numbers to further identify and detail the malfunction as listed below.

First digit structure is as follows:

- Pxxxx for powertrain
- Uxxxx for vehicle network communications
- Bxxxx for body
- Cxxxx for chassis

Second digit structure is:

- P0xxx Government required codes
- P1xxx Manufacturer codes for additional emission system function; not required but reported to government

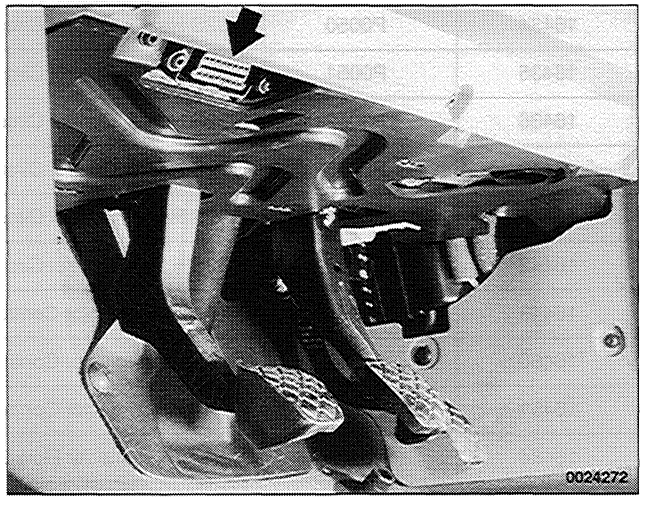
Third digit structure is:

- Px1xx measurement of air and fuel
- Px2xx measurement of air and fuel
- Px3xx ignition system
- Px4xx additional emission control
- Px5xx speed and idle regulation
- Px6xx computer and output signals
- Px7xx transmission
- Px8xx transmission
- Px9xx control modules, input and output signals

The fourth and fifth digits denote the individual components and systems.

The digit structure shown above has "P" as the first digit, however, letters "B" and "C" could be used where applicable. Only "P" and "U" DTCs are currently used in vehicles covered by this manual.

DTCs can be retrieved with Volkswagen Factory scan tools such as the VAG 1551/1552, diagnostic computer VAS 5051/5052, or equivalent aftermarket scan tools or scan tool programs. A Data Link Connector (DLC) is located in the passenger compartment above the pedals for this purpose as shown below (**arrow**).



ST

DTC TABLE

NOTE —
The following table contains a list of available scan tool codes for all Volkswagen and Audi vehicles available at the time of publication. Not all of the codes apply to the vehicles covered by this manual.

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
16394	P0010	Intake "A" Camshaft Position Actuator Circuit Bank 1 Malfunction
16395	P0011	Intake "A" Camshaft Position, Timing Over Advanced or System Performance Bank 1
16396	P0012	Intake "A" Camshaft Position, Timing Over Retarded Bank 1
16397	P0013	Intake "B" Camshaft Position Actuator Circuit Bank 1 Malfunction
16398	P0014	Intake "B" Camshaft Position, Timing Over Advanced or System Performance Bank 1
16399	P0015	Intake "B" Camshaft Position, Timing Over Retarded Bank 1
16100	P0016	Camshaft Position, Camshaft Position Correlation B1 Sensor "A"
16402	P0018	Camshaft Position, Camshaft Position Correlation B1 Sensor "B"
16406	P0020	-A- Camshaft Pos. Actuator Circ. Bank 2 Malfunction
16414	P0030	HO2S Heater Control Circuit, B1S1
16415	P0031	HO2S Heater Control Circuit Low, B1S1
16416	P0032	HO2S Heater Control Circuit High, B1S1
16420	P0036	HO2S Heater Control Circuit B1S2
16421	P0037	HO2S Heater Control Circuit Low B1S2
16422	P0038	HO2S Heater Control Circuit High B1S2
16424	P0040	O2 Sensor Signals Swapped B1S1/B2S1
16425	P0041	O2 Sensor Signals Swapped B2S1/B2S2
16426	P0042	HO2S Heater Control Circuit B1S3
16427	P0043	HO2S Heater Control Circuit Low B1S3
16428	P0044	HO2S Heater Control Circuit High B1S3
16434	P0050	HO2S Heater Control Circuit B2S1
16435	P0051	HO2S Heater Control Circuit Low B2S1
16436	P0052	HO2S Heater Control Circuit High B2S1
16440	P0056	HO2S Heater Control Circuit B2S2
16441	P0057	HO2S Heater Control Circuit Low B2S2
16442	P0058	HO2S Heater Control Circuit High B2S2
16449	P0065	Air Assisted Injector Control Range/Performance
16450	P0066	Air Assisted Injector Control Low Input/Short to ground
16451	P0067	Air Assisted Injector Control Input/Short to B+
16484	P0100	Mass or Volume Air Flow Circuit

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
16485	P0101	Mass or Volume Air Flow Circ Range/Performance
16486	P0102	Mass or Volume Air Flow Circ Low Input
16487	P0103	Mass or Volume Air Flow Circ High Input
16489	P0105	Manifold Abs.Pressure or Bar.Pressure Voltage supply
16490	P0106	Manifold Abs.Pressure or Bar.Pressure Range/Performance
16491	P0107	Manifold Abs.Pressure or Bar.Pressure Low Input
16492	P0108	Manifold Abs.Pressure or Bar.Pressure High Input
16495	P0111	Intake Air Temperature Sensor Circuit Range/Performance
16496	P0112	Intake Air Temp.Circ Low Input
16497	P0113	Intake Air Temp.Circ High Input
16500	P0116	Engine Coolant Temp.Circ Range/Performance
16501	P0117	Engine Coolant Temp.Circ Low Input
16502	P0118	Engine Coolant Temp.Circ High Input
16504	P0120	Throttle/Pedal Pos.Sensor A Circ Malfunction
16505	P0121	Throttle/Pedal Pos.Sensor A Circ Range/Performance
16506	P0122	Throttle/Pedal Pos.Sensor A Circ Low Input
16507	P0123	Throttle/Pedal Pos.Sensor A Circ High Input
16509	P0125	Insufficient Coolant Temp.for Closed Loop Fuel Control
16512	P0128	Coolant Thermostat/Valve Temperature below control range
16514	P0130	O2 Sensor Circ., B1S1 Malfunction
16515	P0131	O2 Sensor Circ., B1S1 Low Voltage
16516	P0132	O2 Sensor Circ., B1S1 High Voltage
16517	P0133	O2 Sensor Circ., B1S1 Slow Response
16518	P0134	O2 Sensor Circ., B1S1 No Activity Detected
16519	P0135	O2 Sensor Heater Circ.,Bank 1-Sensor 1 Malfunction
16520	P0136	O2 Sensor Circ., B1S2 Malfunction
16521	P0137	O2 Sensor Circ., B1S2 Low Voltage
16522	P0138	O2 Sensor Circ., B1S2 High Voltage
16523	P0139	O2 Sensor Circ., B1S2 Slow Response
16524	P0140	O2 Sensor Circ., B1S2 No Activity Detected
16525	P0141	O2 Sensor Heater Circ., B1S2 Malfunction
16526	P0142	O2 Sensor Circ., B1S3
16427	P0143	O2 Sensor Circ., Low Voltage B1S3
16428	P0144	O2 Sensor Circ., High Voltage B1S3
16429	P0145	O2 Sensor Circ., Slow Response B1S3

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
16530	P0146	O2 Sensor Circ., No Activity Detected B1S3
16531	P0147	O2 Sensor Heater Circ. B1S3
16534	P0150	O2 Sensor Circ.,Bank2-Sensor1 Malfunction
16535	P0151	O2 Sensor Circ.,Bank2-Sensor1 Low Voltage
16536	P0152	O2 Sensor Circ.,Bank2-Sensor1 High Voltage
16537	P0153	O2 Sensor Circ.,Bank2-Sensor1 Slow Response
16538	P0154	O2 Sensor Circ.,Bank2-Sensor1 No Activity Detected
16539	P0155	O2 Sensor Heater Circ.,Bank2-Sensor1 Malfunction
16540	P0156	O2 Sensor Circ.,Bank2-Sensor2 Malfunction
16541	P0157	O2 Sensor Circ.,Bank2-Sensor2 Low Voltage
16542	P0158	O2 Sensor Circ.,Bank2-Sensor2 High Voltage
16543	P0159	O2 Sensor Circ.,Bank2-Sensor2 Slow Response
16544	P0160	O2 Sensor Circ.,Bank2-Sensor2 No Activity Detected
16545	P0161	O2 Sensor Heater Circ.,Bank2-Sensor2 Malfunction
16554	P0170	Fuel Trim,Bank1 Malfunction
16555	P0171	Fuel Trim,Bank1 System too Lean
16556	P0172	Fuel Trim,Bank1 System too Rich
16557	P0173	Fuel Trim,Bank2 Malfunction
16558	P0174	Fuel Trim,Bank2 System too Lean
16559	P0175	Fuel Trim,Bank2 System too Rich
16565	P0181	Fuel temperature sender A Circuit Range/Performance
16566	P0182	Fuel temperature sender A Circuit Low
16567	P0183	Fuel temperature sender A Circuit High
16581	P0197	Engine Oil Temperature Circuit Low Input
16582	P0198	Engine Oil Temperature Circuit High Input
16584	P0200	Injector Circuit Open
16585	P0201	Cyl.1, Injector Circuit Fault in electrical circuit
16586	P0202	Cyl.2, Injector Circuit Fault in electrical circuit
16587	P0203	Cyl.3, Injector Circuit Fault in electrical circuit
16588	P0204	Cyl.4, Injector Circuit Fault in electrical circuit
16589	P0205	Cyl.5 Injector Circuit Fault in electrical circuit
16590	P0206	Cyl.6 Injector Circuit Fault in electrical circuit
16591	P0207	Cyl.7 Injector Circuit Fault in electrical circuit
16592	P0208	Cyl.8 Injector Circuit Fault in electrical circuit
16599	P0215	Engine Shut-Off Solenoid Malfunction

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
16600	P0216	Injector/Injection Timing Control Malfunction
16603	P0219	Engine Overspeed Condition
16605	P0221	Throttle Pos. Sensor -B- Circuit Range/Performance
16606	P0222	Throttle Pos. Sensor -B- Circuit Low Input
16607	P0223	Throttle Pos. Sensor -B- Circuit High Input
16609	P0225	Throttle Pos. Sensor -C- Circuit Voltage supply
16610	P0226	Throttle Pos. Sensor -C- Circuit Range/Performance
16611	P0227	Throttle Pos. Sensor -C- Circuit Low Input
16612	P0228	Throttle Pos. Sensor -C- Circuit High Input
16614	P0230	Fuel Pump Primary Circuit Fault in electrical circuit
16615	P0231	Fuel Pump Secondary Circuit Low
16616	P0232	Fuel Pump Secondary Circuit High
16618	P0234	Turbocharger Overboost Condition Control limit exceeded
16619	P0235	Turbocharger Boost Sensor (A) Circ Control limit not reached
16620	P0236	Turbocharger Boost Sensor (A) Circ Range/Performance
16621	P0237	Turbocharger Boost Sensor (A) Circ Low Input
16622	P0238	Turbocharger Boost Sensor (A) Circ High Input
16627	P0243	Turbocharger Wastegate Solenoid (A) Open/Short Circuit to Ground
16629	P0245	Turbocharger Wastegate Solenoid (A) Low Input/Short to ground
16630	P0246	Turbocharger Wastegate Solenoid (A) High Input/Short to B+
16535	P0251	Injection Pump Fuel Metering Control A (Cam/Rotor/Injector)
16636	P0252	Injection Pump Fuel Metering Control A Range/Performance (Cam/Rotor/Injector)
16645	P0261	Cyl.1 Injector Circuit Low Input/Short to ground
16646	P0262	Cyl.1 Injector Circuit High Input/Short to B+
16647	P0263	Cyl. 1 Contribution/Balance
16648	P0264	Cyl.2 Injector Circuit Low Input/Short to ground
16649	P0265	Cyl.2 Injector Circuit High Input/Short to B+
16650	P0266	Cyl. 2 Contribution/Balance
16651	P0267	Cyl.3 Injector Circuit Low Input/Short to ground
16652	P0268	Cyl.3 Injector Circuit High Input/Short to B+
16653	P0269	Cyl. 3 Contribution/Balance
16654	P0270	Cyl.4 Injector Circuit Low Input/Short to ground
16655	P0271	Cyl.4 Injector Circuit High Input/Short to B+
16656	P0272	Cyl.4 Contribution/Balance
16657	P0273	Cyl.5 Injector Circuit Low Input/Short to ground

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
16658	P0274	Cyl.5 Injector Circuit High Input/Short to B+
16660	P0276	Cyl.6 Injector Circuit Low Input/Short to ground
16661	P0277	Cyl.6 Injector Circuit High Input/Short to B+
16663	P0279	Cyl.7 Injector Circuit Low Input/Short to ground
16664	P0280	Cyl.7 Injector Circuit High Input/Short to B+
16666	P0282	Cyl.8 Injector Circuit Low Input/Short to ground
16667	P0283	Cyl.8 Injector Circuit High Input/Short to B+
16683	P0299	Turbo/Supercharger underboost
16684	P0300	Random/Multiple Cylinder Misfire Detected
16685	P0301	Cyl.1 Misfire Detected
16686	P0302	Cyl.2 Misfire Detected
16687	P0303	Cyl.3 Misfire Detected
16688	P0304	Cyl.4 Misfire Detected
16689	P0305	Cyl.5 Misfire Detected
16690	P0306	Cyl.6 Misfire Detected
16691	P0307	Cyl.7 Misfire Detected
16692	P0308	Cyl.8 Misfire Detected
16697	P0313	Misfire Detected Low Fuel Level
16698	P0314	Single Cylinder Misfire
16702	P0318	Rough Road Sensor "A" Signal Circuit
16705	P0321	Ign./Distributor Eng.Speed Inp.Circ Range/Performance
16706	P0322	Ign./Distributor Eng.Speed Inp.Circ No Signal
16708	P0324	Knock Control System Error
16709	P0325	Knock Sensor 1 Circuit Electrical Fault in Circuit
16710	P0326	Knock Sensor 1 Circuit Range/Performance
16711	P0327	Knock Sensor 1 Circ Low Input
16712	P0328	Knock Sensor 1 Circ High Input
16716	P0332	Knock Sensor 2 Circ Low Input
16717	P0333	Knock Sensor 2 Circ High Input
16719	P0335	Crankshaft Pos. Sensor (A) Circ Malfunction
16720	P0336	Crankshaft Pos. Sensor (A) Circ Range/Performance/Missing tooth
16721	P0337	Crankshaft Pos.Sensor (A) Circ Low Input
16724	P0340	Camshaft Pos. Sensor (A) Circ Incorrect allocation
16725	P0341	Camshaft Pos.Sensor Circ Range/Performance
16726	P0342	Camshaft Pos.Sensor Circ Low Input

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
16727	P0343	Camshaft Pos.Sensor Circ High Input
16729	P0345	Camshaft Position Sensor "A" Circuit Bank 2
16730	P0346	Camshaft Position Sensor "A" Circuit Range/Performance Bank 2
16731	P0347	Camshaft Position Sensor "A" Circuit Low Bank 2
16732	P0348	Camshaft Position Sensor "A" Circuit High Bank 2
16735	P0351	Ignition Coil (A) Cyl.1 Prim./Sec. Circ Malfunction
16736	P0352	Ignition Coil (B) Cyl.2 Prim./Sec. Circ Malfunction
16737	P0353	Ignition Coil (C) Cyl.3 Prim./Sec. Circ Malfunction
16738	P0354	Ignition Coil (D) Cyl.4 Prim./Sec. Circ Malfunction
16739	P0355	Ignition Coil (E) Cyl.5 Prim./Sec. Circ Malfunction
16740	P0356	Ignition Coil (F) Cyl.6 Prim./Sec. Circ Malfunction
16741	P0357	Ignition Coil (G) Cyl.7 Prim./Sec. Circ Malfunction
16742	P0358	Ignition Coil (H) Cyl.8 Prim./Sec. Circ Malfunction
16764	P0380	Glow Plug/Heater Circuit (A) Electrical Fault in Circuit
16765	P0381	Glow Plug/Heater indicator Circuit
16784	P0400	Exhaust Gas Recirc.Flow Malfunction
16785	P0401	Exhaust Gas Recirc.Flow Insufficient Detected
16786	P0402	Exhaust Gas Recirc.Flow Excessive Detected
16787	P0403	Exhaust Gas Recirc. Contr. Circ Malfunction
16788	P0404	Exhaust Gas Recirc. Contr. Circ Range/Performance
16789	P0405	Exhaust Gas Recirc. Sensor (A) Circ Low Input
16790	P0406	Exhaust Gas Recirc. Sensor (A) Circ High Input
16791	P0407	Exhaust Gas Recirc. Sensor (B) Circ Low Input
16792	P0408	Exhaust Gas Recirc. Sensor (B) Circ High Input
16794	P0410	Sec.Air Inj.Sys Malfunction
16795	P0411	Sec.Air Inj.Sys. Incorrect Flow Detected
16796	P0412	Sec.Air Inj.Sys.Switching Valve A Circ Malfunction
16797	P0413	Secondary Air Injection System Switching Valve "A" Circuit Open
16798	P0414	Secondary Air Injection System Switching Valve "A" Circuit Shorted
16802	P0418	Sec. Air Inj. Sys. Relay (A) Contr. Circ Malfunction
16804	P0420	Catalyst System,Bank1 Efficiency Below Threshold
16806	P0422	Main Catalyst,Bank1 Below Threshold
16811	P0427	Catalyst Temperature Sensor, Bank 1 Low Input/Short to ground
16812	P0428	Catalyst Temperature Sensor, Bank 1 High Input/Open/Short Circuit to B+
16814	P0430	Catalyst System Efficiency Below Threshold Bank 2

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
16816	P0432	Main Catalyst,Bank2 Efficiency Below Threshold
16820	P0436	Catalyst Temperature Sensor, Bank 2 Range/Performance
16821	P0437	Catalyst Temperature Sensor, Bank 2 Low Input/Short to ground
16822	P0438	Catalyst Temperature Sensor, Bank 2 High Input/Open/Short Circuit to B+
16824	P0440	EVAP Emission Contr.Sys. Malfunction
16825	P0441	EVAP Emission Contr.Sys.Incorrect Purge Flow
16826	P0442	EVAP Emission Contr.Sys.(Small Leak) Leak Detected
16827	P0443	EVAP Emiss. Contr. Sys. Purge Valve Circ Electrical Fault in Circuit
16828	P0444	Evaporative Emission System Purge Control Valve Circuit Open
16829	P0445	Evaporative Emission System Purge Control Valve Circuit Shorted
16833	P0449	Evaporative Emission System Vent Valve/Solenoid Circuit
16836	P0452	EVAP Emission Contr.Sys.Press.Sensor Low Input
16837	P0453	EVAP Emission Contr.Sys.Press.Sensor High Input
16839	P0455	EVAP Emission Contr.Sys. Gross Leak Detected
16840	P0456	EVAP Emission Contr.Sys.Very Small Leak Detected
16845	P0461	Fuel Level Sensor Circ Range/Performance
16846	P0462	Fuel Level Sensor Circuit Low Input
16847	P0463	Fuel Level Sensor Circuit High Input
16875	P0491	Secondary Air Injection System Insufficient Flow Bank 1
16876	P0492	Secondary Air Injection System Insufficient Flow Bank 2
16882	P0498	Evaporative Emission System Vent Valve Control Circuit Low
16883	P0499	Evaporative Emission System Vent Valve Control Circuit High
16885	P0501	Vehicle Speed Sensor Range/Performance
16887	P0503	Vehicle Speed Sensor Intermittent/Erratic/High Input
16889	P0505	Idle Control System Malfunction
16890	P0506	Idle Control System RPM Lower than Expected
16891	P0507	Idle Control System Higher than Expected
16894	P0510	Closed Throttle Pos.Switch Malfunction
16915	P0531	A/C Refrigerant Pressure Sensor Circuit Range/Performance
16916	P0532	A/C Refrigerant Pressure Sensor Circuit Low Input
16917	P0533	A/C Refrigerant Pressure Sensor Circuit High Input
16928	P0544	Exhaust Gas Temperature Sensor Circuit B1S1
16929	P0545	Exhaust Gas Temperature Sensor Circuit Low B1S1
16930	P0546	Exhaust Gas Temperature Sensor Circuit High B1S1
16935	P0551	Power Steering Pressure Sensor Circuit Range/Performance

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
16944	P0560	System Voltage Malfunction
16946	P0562	System Voltage Low Voltage
16947	P0563	System Voltage High Voltage
16952	P0568	Cruise Control Set Signal Incorrect Signal
16955	P0571	Cruise/Brake Switch (A) Circ Malfunction
16984	P0600	Serial Comm. Link (Data Bus) Message Missing
16985	P0601	Internal Contr.Module Memory Check Sum Error
16986	P0602	Control Module Programming Error/Malfunction
16987	P0603	Internal Contr.Module (KAM) Error
16988	P0604	Internal Contr.Module Random Access Memory (RAM) Error
16989	P0605	Internal Contr.Module ROM Test Error
16990	P0606	ECM/PCM Processor
16991	P0607	Control Module performance
16998	P0614	ECM/TCM Incompatible (mismatch)
17022	P0638	Throttle Actuator Control Range/Performance B1
17026	P0642	Sensor Reference Voltage “A” Circuit Low
17027	P0643	Sensor Reference Voltage “A” Circuit High
17029	P0645	A/C Clutch Relay Control Circuit
17034	P0650	MIL Control Circuit Electrical Fault in Circuit
17036	P0652	Sensor Reference Voltage “B” Circuit Low
17037	P0653	Sensor Reference Voltage “B” Circuit High
17038	P0654	Engine RPM Output Circuit Electrical Fault in Circuit
17040	P0656	Fuel Level Output Circuit Electrical Fault in Circuit
17044	P0660	Intake Manifold Tuning Valve Control Circuit Open Bank 1
17045	P0661	Intake Manifold Tuning Valve Control Circuit Low Bank 1
17046	P0662	Intake Manifold Tuning Valve Control Circuit High Bank 1
17054	P0670	Glow Plug Module Control Circuit
17055	P0671	Cylinder 1 Glow Plug Circuit
17056	P0672	Cylinder 2 Glow Plug Circuit
17057	P0673	Cylinder 3 Glow Plug Circuit
17058	P0674	Cylinder 4 Glow Plug Circuit
17068	P0684	Glow Plug Module to PCM Communication Circuit Range/Performance
17069	P0685	ECM/PCM Power Relay Control Circuit Open
17070	P0686	ECM/PCM Power Relay Control Low
17071	P0687	ECM/PCM Power Relay Control High

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
17072	P0688	ECM/PCM Power Relay Sense Circuit Open
17084	P0700	Transm.Contr.System Malfunction
17086	P0702	Transm.Contr.System Electrical
17087	P0703	Torque Converter/Brake Switch B Circ Malfunction
17088	P0704	Clutch Switch Input Circuit Malfunction
17089	P0705	Transm.Range Sensor Circ.(PRNDL Inop.) Malfunction
17090	P0706	Transm.Range Sensor Circ Range/Performance
17091	P0707	Transm.Range Sensor Circ Low Input
17092	P0708	Transm.Range Sensor Circ High Input
17094	P0710	Transm.Fluid Temp.Sensor Circ. Malfunction
17095	P0711	Transm.Fluid Temp.Sensor Circ. Range/Performance
17096	P0712	Transm.Fluid Temp.Sensor Circ. Low Input
17097	P0713	Transm.Fluid Temp.Sensor Circ. High Input
17099	P0715	Input Turbine/Speed Sensor Circ. Malfunction
17100	P0716	Input Turbine/Speed Sensor Circ. Range/Performance
17101	P0717	Input Turbine/Speed Sensor Circ. No Signal
17105	P0721	Output Speed Sensor Circ Range/Performance
17106	P0722	Output Speed Sensor Circ No Signal
17109	P0725	Engine Speed Inp.Circ. Malfunction
17110	P0726	Engine Speed Inp.Circ. Range/Performance
17111	P0727	Engine Speed Inp.Circ. No Signal
17114	P0730	Gear Incorrect Ratio
17115	P0731	Gear 1 Incorrect Ratio
17116	P0732	Gear 2 Incorrect Ratio
17117	P0733	Gear 3 Incorrect Ratio
17118	P0734	Gear 4 Incorrect Ratio
17119	P0735	Gear 5 Incorrect Ratio
17124	P0740	Torque Converter Clutch Circuit Malfunction
17125	P0741	Torque Converter Clutch Circuit Performance or Stuck Off
17127	P0743	Torque Converter Clutch Circuit Electrical
17130	P0746	Pressure Control Solenoid "A" Performance or Stuck On
17132	P0748	Pressure Control Solenoid "A" Electrical
17133	P0749	Pressure Control Solenoid "A" Intermittent
17134	P0750	Shift Solenoid A malfunction
17135	P0751	Shift Solenoid A Performance or Stuck Off

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
17136	P0752	Shift Solenoid A Stuck On
17137	P0753	Shift Solenoid A Electrical
17140	P0756	Shift Solenoid B Performance or Stuck Off
17141	P0757	Shift Solenoid B Stuck On
17142	P0758	Shift Solenoid B Electrical
17145	P0761	Shift Solenoid C Performance or Stuck Off
17146	P0762	Shift Solenoid C Stuck On
17147	P0763	Shift Solenoid C Electrical
17150	P0766	Shift Solenoid D Performance or Stuck Off
17152	P0768	Shift Solenoid D Electrical
17155	P0771	Shift Solenoid E Performance or Stuck Off
17157	P0773	Shift Solenoid E Electrical
17160	P0776	Pressure Control Solenoid B Performance or Stuck Off
17161	P0777	Pressure Control Solenoid B Stuck On
17162	P0778	Pressure Control Solenoid B Electrical
17169	P0785	Shift/Timing Solenoid "A" Electrical
17174	P0790	Normal/Performance Switch Circ Malfunction
17175	P0791	Intermediate Shaft Speed Sensor "A" Circuit
17180	P0796	Pressure Control Solenoid C Performance or Stuck Off
17181	P0797	Pressure Control Solenoid C Stuck On
17182	P0798	Pressure Control Solenoid C Electrical
17195	P0811	Excessive Clutch Slippage
17247	P0863	TCM Communication Circuit
17248	P0864	TCM Communication Circuit Range/Performance
17249	P0865	TCM Communication Circuit Low
17273	P0889	TCM Power Relay Sense Circuit Range/Performance
17274	P0890	TCM Power Relay Sense Circuit Low
17275	P0891	TCM Power Relay Sense Circuit High
17276	P0892	TCM Power Relay Sense Circuit Intermittent
17434	P1026	Activation intake manifold flap for airstream regulation, Short Circuit to B+
17435	P1027	Activation intake manifold flap for airstream regulation, Short Circuit to Ground
17436	P1028	Activation intake manifold flap for airstream regulation, Open Circuit
17509	P1101	O2 Sensor Circ.,Bank1-Sensor1Voltage too Low/Air Leak
17510	P1102	O2 Sensor Heating Circ.,Bank1-Sensor1 Short to B+
17511	P1103	O2 Sensor Heating Circ.,Bank1-Sensor1 Output too Low

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
17512	P1104	Bank1-Sensor2 Voltage too Low/Air Leak
17513	P1105	O2 Sensor Heating Circ.,Bank1-Sensor 2 High
17514	P1106	O2 Sensor Circ.,Bank2-Sensor1 Voltage too Low/Air Leak
17515	P1107	O2 Sensor Heating Circ.,Bank2-Sensor1 Short to B+
17516	P1108	O2 Sensor Heating Circ.,Bank2-Sensor1 Output too Low
17517	P1109	O2 Sensor Circ.,Bank2-Sensor2 Voltage too Low/Air Leak
17518	P1110	O2 Sensor Heating Circ.,Bank2-Sensor2 Short to B+
17519	P1111	O2 Control (Bank 1) System too lean
17520	P1112	O2 Control (Bank 1) System too rich
17521	P1113	Bank1-Sensor1 Internal Resistance too High
17522	P1114	Bank1-Sensor2 Internal Resistant too High
17523	P1115	O2 Sensor Heater Circ.,Bank1-Sensor1 Short to Ground
17524	P1116	O2 Sensor Heater Circ.,Bank1-Sensor1 Open
17525	P1117	O2 Sensor Heater Circ.,Bank1-Sensor2 Short to Ground
17526	P1118	O2 Sensor Heater Circ.,Bank1-Sensor2 Open
17527	P1119	O2 Sensor Heater Circ.,Bank2-Sensor1 Short to Ground
17528	P1120	O2 Sensor Heater Circ.,Bank2-Sensor1 Open
17529	P1121	O2 Sensor Heater Circ.,Bank2-Sensor2 Short to Ground
17530	P1122	O2 Sensor Heater Circ.,Bank2-Sensor2 Open
17531	P1123	Long Term Fuel Trim Add.Air.,Bank1 System too Rich
17532	P1124	Long Term Fuel Trim Add.Air.,Bank1 System too Lean
17533	P1125	Long Term Fuel Trim Add.Air.,Bank2 System too Rich
17534	P1126	Long Term Fuel Trim Add.Air.,Bank2 System too Lean
17535	P1127	Long Term Fuel Trim mult.,Bank1 System too Rich
17536	P1128	Long Term Fuel Trim mult.,Bank1 System too Lean
17537	P1129	Long Term Fuel Trim mult.,Bank2 System too Rich
17538	P1130	Long Term Fuel Trim mult.,Bank2 System too Lean
17539	P1131	Bank2-Sensor1 Internal Resistance too High
17540	P1132	O2 Sensor Heating Circ.,Bank1+2-Sensor1 Short to B+
17541	P1133	O2 Sensor Heating Circ.,Bank1+2-Sensor1 Electrical Malfunction
17542	P1134	O2 Sensor Heating Circ.,Bank1+2-Sensor2 Short to B+
17543	P1135	O2 Sensor Heating Circ.,Bank1+2-Sensor2 Electrical Malfunction
17544	P1136	Long Term Fuel Trim Add.Fuel,Bank1 System too Lean
17545	P1137	Long Term Fuel Trim Add.Fuel,Bank1 System too Rich
17546	P1138	Long Term Fuel Trim Add.Fuel,Bank2 System too Lean

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
17547	P1139	Long Term Fuel Trim Add.Fuel,Bank2 System too Rich
17548	P1140	Bank2-Sensor2 Internal Resistance too High
17549	P1141	Load Calculation Cross Check Range/Performance
17550	P1142	Load Calculation Cross Check Lower Limit Exceeded
17551	P1143	Load Calculation Cross Check Upper Limit Exceeded
17552	P1144	Mass or Volume Air Flow Circ Open/Short to Ground
17553	P1145	Mass or Volume Air Flow Circ Short to B+
17554	P1146	Mass or Volume Air Flow Circ Supply Malfunction
17555	P1147	O2 Control (Bank 2) System too lean
17556	P1148	O2 Control (Bank 2) System too rich
17557	P1149	O2 Control (Bank 1) Out of range
17558	P1150	O2 Control (Bank 2) Out of range
17559	P1151	Bank1, Long Term Fuel Trim, Range 1 Leanness Lower Limit Exceeded
17560	P1152	Bank1, Long Term Fuel Trim, Range 2 Leanness Lower Limit Exceeded
17562	P1154	Manifold Switch Over Malfunction
17563	P1155	Manifold Abs.Pressure Sensor Circ. Short to B+
17564	P1156	Manifold Abs.Pressure Sensor Circ. Open/Short to Ground
17565	P1157	Manifold Abs.Pressure Sensor Circ. Power Supply Malfunction
17566	P1158	Manifold Abs.Pressure Sensor Circ. Range/Performance
17568	P1160	Manifold Temp.Sensor Circ. Short to Ground
17569	P1161	Manifold Temp.Sensor Circ. Open/Short to B+
17570	P1162	Fuel Temp.Sensor Circ. Short to Ground
17571	P1163	Fuel Temp.Sensor Circ. Open/Short to B+
17572	P1164	Fuel Temperature Sensor Range/Performance/Incorrect Signal
17573	P1165	Bank1, Long Term Fuel Trim, Range 1 Rich Limit Exceeded
17574	P1166	Bank1, Long Term Fuel Trim, Range 2 Rich Limit Exceeded
17579	P1171	Throttle Actuation Potentiometer Sign.2 Range/Performance
17580	P1172	Throttle Actuation Potentiometer Sign.2 Signal too Low
17581	P1173	Throttle Actuation Potentiometer Sign.2 Signal too High
17582	P1174	Fuel Trim, Bank 1 Different injection times
17584	P1176	O2 Correction Behind Catalyst,B1 Limit Attained
17585	P1177	O2 Correction Behind Catalyst,B2 Limit Attained
17586	P1178	Linear 02 Sensor / Pump Current Open Circuit
17587	P1179	Linear 02 Sensor / Pump Current Short to ground
17588	P1180	Linear 02 Sensor / Pump Current Short to B+

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
17589	P1181	Linear 02 Sensor / Reference Voltage Open Circuit
17590	P1182	Linear 02 Sensor / Reference Voltage Short to ground
17591	P1183	Linear 02 Sensor / Reference Voltage Short to B+
17592	P1184	Linear 02 Sensor / Common Ground Wire Open Circuit
17593	P1185	Linear 02 Sensor / Common Ground Wire Short to ground
17594	P1186	Linear 02 Sensor / Common Ground Wire Short to B+
17595	P1187	Linear 02 Sensor / Compens. Resistor Open Circuit
17596	P1188	Linear 02 Sensor / Compens. Resistor Short to ground
17597	P1189	Linear 02 Sensor / Compens. Resistor Short to B+
17598	P1190	Linear 02 Sensor / Reference Voltage Incorrect Signal
17604	P1196	O2 Sensor Heater Circ.,Bank1-Sensor1 Electrical Malfunction
17605	P1197	O2 Sensor Heater Circ.,Bank2-Sensor1 Electrical Malfunction
17606	P1198	O2 Sensor Heater Circ.,Bank1-Sensor2 Electrical Malfunction
17607	P1199	O2 Sensor Heater Circ.,Bank2-Sensor2 Electrical Malfunction
17609	P1201	Cyl.1-Fuel Inj.Circ. Electrical Malfunction
17610	P1202	Cyl.2-Fuel Inj.Circ. Electrical Malfunction
17611	P1203	Cyl.3-Fuel Inj.Circ. Electrical Malfunction
17612	P1204	Cyl.4-Fuel Inj.Circ. Electrical Malfunction
17613	P1205	Cyl.5-Fuel Inj.Circ. Electrical Malfunction
17614	P1206	Cyl.6-Fuel Inj.Circ. Electrical Malfunction
17615	P1207	Cyl.7-Fuel Inj.Circ. Electrical Malfunction
17616	P1208	Cyl.8-Fuel Inj.Circ. Electrical Malfunction
17617	P1209	Intake valves for cylinder shut-off Short circuit to ground
17618	P1210	Intake valves for cylinder shut-off Short to B+
17619	P1211	Intake valves for cylinder shut-off Open circuit
17621	P1213	Cyl.1-Fuel Inj.Circ. Short to B+
17622	P1214	Cyl.2-Fuel Inj.Circ. Short to B+
17623	P1215	Cyl.3-Fuel Inj.Circ. Short to B+
17624	P1216	Cyl.4-Fuel Inj.Circ. Short to B+
17625	P1217	Cyl.5-Fuel Inj.Circ. Short to B+
17626	P1218	Cyl.6-Fuel Inj.Circ. Short to B+
17627	P1219	Cyl.7-Fuel Inj.Circ. Short to B+
17628	P1220	Cyl.8-Fuel Inj.Circ. Short to B+
17629	P1221	Cylinder shut-off exhaust valves Short circuit to ground
17630	P1222	Cylinder shut-off exhaust valves Short to B+

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
17631	P1223	Cylinder shut-off exhaust valves Open circuit
17633	P1225	Cyl.1-Fuel Inj.Circ. Short to Ground
17634	P1226	Cyl.2-Fuel Inj.Circ. Short to Ground
17635	P1227	Cyl.3-Fuel Inj.Circ. Short to Ground
17636	P1228	Cyl.4-Fuel Inj.Circ. Short to Ground
17637	P1229	Cyl.5-Fuel Inj.Circ. Short to Ground
17638	P1230	Cyl.6-Fuel Inj.Circ. Short to Ground
17639	P1231	Cyl.7-Fuel Inj.Circ. Short to Ground
17640	P1232	Cyl.8-Fuel Inj.Circ. Short to Ground
17645	P1237	Cyl.1-Fuel Inj.Circ. Open Circ.
17646	P1238	Cyl.2-Fuel Inj.Circ. Open Circ.
17647	P1239	Cyl.3-Fuel Inj.Circ. Open Circ.
17648	P1240	Cyl.4-Fuel Inj.Circ. Open Circ.
17649	P1241	Cyl.5-Fuel Inj.Circ. Open Circ.
17650	P1242	Cyl.6-Fuel Inj.Circ. Open Circ.
17651	P1243	Cyl.7-Fuel Inj.Circ. Open Circ.
17652	P1244	Cyl.8-Fuel Inj.Circ. Open Circ.
17653	P1245	Needle Lift Sensor Circ. Short to Ground
17654	P1246	Needle Lift Sensor Circ. Range/Performance
17655	P1247	Needle Lift Sensor Circ. Open/Short to B+
17656	P1248	Injection Start Control Deviation
17657	P1249	Fuel consumption signal Electrical Fault in Circuit
17658	P1250	Fuel Level Too Low
17659	P1251	Start of Injection Solenoid Circ Short to B+
17660	P1252	Start of Injection Solenoid Circ Open/Short to Ground
17661	P1253	Fuel consumption signal Short to ground
17662	P1254	Fuel consumption signal Short to B+
17663	P1255	Engine Coolant Temp.Circ Short to Ground
17664	P1256	Engine Coolant Temp.Circ Open/Short to B+
17665	P1257	Engine Coolant System Valve Open
17666	P1258	Engine Coolant System Valve Short to B+
17667	P1259	Engine Coolant System Valve Short to Ground
17688	P1280	Fuel Inj.Air Contr.Valve Circ. Flow too Low
17691	P1283	Fuel Inj.Air Contr.Valve Circ. Electrical Malfunction
17692	P1284	Fuel Inj.Air Contr.Valve Circ. Open

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
17693	P1285	Fuel Inj.Air Contr.Valve Circ. Short to Ground
17694	P1286	Fuel Inj.Air Contr.Valve Circ. Short to B+
17695	P1287	Turbocharger bypass valve open
17696	P1288	Turbocharger bypass valve short to B+
17697	P1289	Turbocharger bypass valve short to ground
17703	P1295	Bypass Turbocharger Throughput Faulty
17704	P1296	Cooling system malfunction
17705	P1297	Connection turbocharger - throttle valve pressure hose
17708	P1300	Misfire detected Reason: Fuel level too low
17721	P1319	Knock Sensor 1 Circ. Short to Ground
17728	P1320	Knock Sensor 2 Circ. Short to Ground
17729	P1321	Knock Sensor 3 Circ. Low Input
17730	P1322	Knock Sensor 3 Circ. High Input
17731	P1323	Knock Sensor 4 Circ. Low Input
17732	P1324	Knock Sensor 4 Circ. High Input
17733	P1325	Cyl.1-Knock Contr. Limit Attained
17734	P1326	Cyl.2-Knock Contr. Limit Attained
17735	P1327	Cyl.3-Knock Contr. Limit Attained
17736	P1328	Cyl.4-Knock Contr. Limit Attained
17737	P1329	Cyl.5-Knock Contr. Limit Attained
17738	P1330	Cyl.6-Knock Contr. Limit Attained
17739	P1331	Cyl.7-Knock Contr. Limit Attained
17740	P1332	Cyl.8-Knock Contr. Limit Attained
17743	P1335	Engine Torque Monitoring 2 Control Limit Exceeded
17744	P1336	Engine Torque Monitoring Adaptation at limit
17745	P1337	Camshaft Pos.Sensor,Bank1 Short to Ground
17746	P1338	Camshaft Pos.Sensor,Bank1 Open Circ./Short to B+
17747	P1339	Crankshaft Pos./Engine Speed Sensor Cross Connected
17748	P1340	Crankshaft-/Camshaft Pos.Sens.Signals Out of Sequence
17749	P1341	Ignition Coil Power Output Stage 1 Short to Ground
17750	P1342	Ignition Coil Power Output Stage 1 Short to B+
17751	P1343	Ignition Coil Power Output Stage 2 Short to Ground
17752	P1344	Ignition Coil Power Output Stage 2 Short to B+
17753	P1345	Ignition Coil Power Output Stage 3 Short to Ground
17754	P1346	Ignition Coil Power Output Stage 3 Short to B+

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
17755	P1347	Bank2,Crankshaft-/Camshaft os.Sens.Sign. Out of Sequence
17756	P1348	Ignition Coil Power Output Stage 1 Open Circuit
17757	P1349	Ignition Coil Power Output Stage 2 Open Circuit
17758	P1350	Ignition Coil Power Output Stage 3 Open Circuit
17762	P1354	Modulation Piston Displ.Sensor Circ. Malfunction
17763	P1355	Cyl. 1, ignition circuit Open Circuit
17764	P1356	Cyl. 1, ignition circuit Short to B+
17765	P1357	Cyl. 1, ignition circuit Short to ground
17766	P1358	Cyl. 2, ignition circuit Open Circuit
17767	P1359	Cyl. 2, ignition circuit Short Circuit to B+
17768	P1360	Cyl. 2, ignition circuit Short Circuit to Ground
17769	P1361	Cyl. 3, ignition circuit Open Circuit
17770	P1362	Cyl. 3, ignition circuit Short Circuit to B+
17771	P1363	Cyl. 3, ignition circuit Short Circuit to ground
17772	P1364	Cyl. 4 ignition circuit Open Circuit
17773	P1365	Cyl. 4 ignition circuit Short circuit to B+
17774	P1366	Cyl. 4 ignition circuit Short circuit to ground
17775	P1367	Cyl. 5, ignition circuit Open Circuit
17776	P1368	Cyl. 5, ignition circuit Short Circuit to B+
17777	P1369	Cyl. 5, ignition circuit short to ground
17778	P1370	Cyl. 6, ignition circuit Open Circuit
17779	P1371	Cyl. 6, ignition circuit Short Circuit to B+
17780	P1372	Cyl. 6, ignition circuit short to ground
17781	P1373	Cyl. 7, ignition circuit Open Circuit
17782	P1374	Cyl. 7, ignition circuit Short Circuit to B+
17783	P1375	Cyl. 7, ignition circuit short to ground
17784	P1376	Cyl. 8, ignition circuit Open Circuit
17785	P1377	Cyl. 8, ignition circuit Short Circuit to B+
17786	P1378	Cyl. 8, ignition circuit short to ground
17794	P1386	Internal Control Module Knock Control Circ.Error
17795	P1387	Internal Contr. Module altitude sensor error
17796	P1388	Internal Contr. Module drive by wire error
17799	P1391	Camshaft Pos.Sensor,Bank2 Short to Ground
17800	P1392	Camshaft Pos.Sensor,Bank2 Open Circ./Short to B+
17801	P1393	Ignition Coil Power Output Stage 1 Electrical Malfunction

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
17802	P1394	Ignition Coil Power Output Stage 2 Electrical Malfunction
17803	P1395	Ignition Coil Power Output Stage 3 Electrical Malfunction
17804	P1396	Engine Speed Sensor Missing Tooth
17805	P1397	Engine speed wheel Adaptation limit reached
17806	P1398	Engine RPM signal, TD Short to ground
17807	P1399	Engine RPM signal, TD Short Circuit to B+
17808	P1400	EGR Valve Circ Electrical Malfunction
17809	P1401	EGR Valve Circ Short to Ground
17810	P1402	EGR Valve Circ Short to B+
17811	P1403	EGR Flow Deviation
17812	P1404	EGR Flow Basic Setting not carried out
17814	P1406	EGR Temp.Sensor Range/Performance
17815	P1407	EGR Temp.Sensor Signal too Low
17816	P1408	EGR Temp.Sensor Signal too High
17817	P1409	Tank Ventilation Valve Circ. Electrical Malfunction
17818	P1410	Tank Ventilation Valve Circ. Short to B+
17819	P1411	Sec.Air Inj.Sys.,Bank2 Flow too Flow
17820	P1412	EGR Different.Pressure Sensor Signal too Low
17821	P1413	EGR Different.Pressure Sensor Signal too High
17822	P1414	Sec.Air Inj.Sys.,Bank2 Leak Detected
17825	P1417	Fuel Level Sensor Circ Signal too Low
17826	P1418	Fuel Level Sensor Circ Signal too High
17828	P1420	Sec.Air Inj.Valve Circ Electrical Malfunction
17829	P1421	Sec.Air Inj.Valve Circ Short to Ground
17830	P1422	Sec.Air Inj.Sys.Contr.Valve Circ Short to B+
17831	P1423	Sec.Air Inj.Sys.,Bank1 Flow too Low
17832	P1424	Sec.Air Inj.Sys.,Bank1 Leak Detected
17833	P1425	Evaporative Emission (EVAP) Canister Purge Regulator Valve 1 Short To Ground
17834	P1426	Evaporative Emission (EVAP) Canister Purge Regulator Valve 1 Open Circuit
17840	P1432	Sec.Air Inj.Valve Open
17841	P1433	Sec.Air Inj.Sys.Pump Relay Circ. open
17842	P1434	Sec.Air Inj.Sys.Pump Relay Circ. Short to B+
17843	P1435	Sec.Air Inj.Sys.Pump Relay Circ. Short to ground
17844	P1436	Sec.Air Inj.Sys.Pump Relay Circ. Electrical Malfunction
17847	P1439	EGR Potentiometer Error in Basic Setting

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
17848	P1440	EGR Valve Power Stage Open
17849	P1441	EGR Valve Circ Open/Short to Ground
17850	P1442	EGR Valve Position Sensor Signal too high
17851	P1443	EGR Valve Position Sensor Signal too low
17852	P1444	EGR Valve Position Sensor range/performance
17853	P1445	Catalyst Temp.Sensor 2 Circ. Range/Performance
17854	P1446	Catalyst Temp.Circ Short to Ground
17855	P1447	Catalyst Temp.Circ Open/Short to B+
17856	P1448	Catalyst Temp.Sensor 2 Circ. Short to Ground
17857	P1449	Catalyst Temp.Sensor 2 Circ. Open/Short to B+
17858	P1450	Sec.Air Inj.Sys.Circ Short to B+
17859	P1451	Sec.Air Inj.Sys.Circ Short to Ground
17860	P1452	Sec.Air Inj.Sys. Open Circ.
17861	P1453	Exhaust gas temperature sensor 1 open/short to B+
17862	P1454	Exhaust gas temperature sensor short 1 to ground
17863	P1455	Exhaust gas temperature sensor 1 range/performance
17864	P1456	Exhaust gas temperature control bank 1 limit attained
17865	P1457	Exhaust gas temperature sensor 2 open/short to B+
17866	P1458	Exhaust gas temperature sensor 2 short to ground
17867	P1459	Exhaust gas temperature sensor 2 range/performance
17868	P1460	Exhaust gas temperature control bank 2 limit attained
17869	P1461	Exhaust gas temperature control bank 1 Range/Performance
17870	P1462	Exhaust gas temperature control bank 2 Range/Performance
17873	P1465	Additive Pump Short Circuit to B+
17874	P1466	Additive Pump Open/Short to Ground
17875	P1467	EVAP Canister Purge Solenoid Valve Short Circuit to B+
17876	P1468	EVAP Canister Purge Solenoid Valve Short Circuit to Ground
17877	P1469	EVAP Canister Purge Solenoid Valve Open Circuit
17878	P1470	EVAP Emission Contr.LDP Circ Electrical Malfunction
17879	P1471	EVAP Emission Contr.LDP Circ Short to B+
17880	P1472	EVAP Emission Contr.LDP Circ Short to Ground
17881	P1473	EVAP Emission Contr.LDP Circ Open Circ.
17882	P1474	EVAP Canister Purge Solenoid Valve electrical malfunction
17883	P1475	EVAP Emission Contr.LDP Circ Malfunction/Signal Circ.Open
17884	P1476	EVAP Emission Contr.LDP Circ Malfunction/Insufficient Vacuum

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
17885	P1477	EVAP Emission Contr.LDP Circ Malfunction
17886	P1478	EVAP Emission Contr.LDP Circ Clamped Tube Detected
17898	P1490	Evaporative Emission (EVAP) Canister Purge Regulator Valve 2 Short To Ground
17899	P1491	Evaporative Emission (EVAP) Canister Purge Regulator Valve 2 Open Circuit
17908	P1500	Fuel Pump Relay Circ. Electrical Malfunction
17909	P1501	Fuel Pump Relay Circ. Short to Ground
17910	P1502	Fuel Pump Relay Circ. Short to B+
17911	P1503	Load signal from Alternator Term. DF Range/performance/Incorrect Signal
17912	P1504	Intake Air Sys.Bypass Leak Detected
17913	P1505	Closed Throttle Pos. Does Not Close/Open Circ
17914	P1506	Closed Throttle Pos.Switch Does Not Open/Short to Ground
17915	P1507	Idle Sys.Learned Value Lower Limit Attained
17916	P1508	Idle Sys.Learned Value Upper Limit Attained
17917	P1509	Idle Air Control Circ. Electrical Malfunction
17918	P1510	Idle Air Control Circ. Short to B+
17919	P1511	Intake Manifold Changeover Valve circuit electrical malfunction
17920	P1512	Intake Manifold Changeover Valve circuit Short to B+
17921	P1513	Intake Manifold Changeover Valve2 circuit Short to B+
17922	P1514	Intake Manifold Changeover Valve2 circuit Short to ground
17923	P1515	Intake Manifold Changeover Valve circuit Short to Ground
17924	P1516	Intake Manifold Changeover Valve circuit Open
17925	P1517	Main Relay Circ. Electrical Malfunction
17926	P1518	Main Relay Circ. Short to B+
17927	P1519	Intake Camshaft Contr.,Bank1 Malfunction
17928	P1520	Intake Manifold Changeover Valve2 circuit Open
17929	P1521	Intake Manifold Changeover Valve2 circuit electrical malfunction
17930	P1522	Intake Camshaft Contr.,Bank2 Malfunction
17931	P1523	Crash Signal from Airbag Control Unit range/performance
17933	P1525	Intake Camshaft Contr.Circ.,Bank1 Electrical Malfunction
17934	P1526	Intake Camshaft Contr.Circ.,Bank1 Short to B+
17935	P1527	Intake Camshaft Contr.Circ.,Bank1 Short to Ground
17936	P1528	Intake Camshaft Contr.Circ.,Bank1 Open
17937	P1529	Camshaft Control Circuit Short to B+
17938	P1530	Camshaft Control Circuit Short to ground
17939	P1531	Camshaft Control Circuit open

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
17941	P1533	Intake Camshaft Contr.Circ.,Bank2 Electrical Malfunction
17942	P1534	Intake Camshaft Contr.Circ.,Bank2 Short to B+
17943	P1535	Intake Camshaft Contr.Circ.,Bank2 Short to Ground
17944	P1536	Intake Camshaft Contr.Circ.,Bank2 Open
17945	P1537	Engine Shutoff Solenoid Malfunction
17946	P1538	Engine Shutoff Solenoid Open/Short to Ground
17947	P1539	Clutch Vacuum Vent Valve Switch Incorrect signal
17948	P1540	Vehicle Speed Sensor High Input
17949	P1541	Fuel Pump Relay Circ Open
17950	P1542	Throttle Actuation Potentiometer Range/Performance
17951	P1543	Throttle Actuation Potentiometer Signal too Low
17952	P1544	Throttle Actuation Potentiometer Signal too High
17953	P1545	Throttle Pos.Contr Malfunction
17954	P1546	Boost Pressure Contr.Valve Short to B+
17955	P1547	Boost Pressure Contr.Valve Short to Ground
17956	P1548	Boost Pressure Contr.Valve Open
17957	P1549	Boost Pressure Contr.Valve Short to Ground
17958	P1550	Charge Pressure Deviation
17959	P1551	Barometric Pressure Sensor Circ. Short to B+
17960	P1552	Barometric Pressure Sensor Circ. Open/Short to Ground
17961	P1553	Barometric/manifold pressure signal ratio out of range
17962	P1554	Idle Speed Contr.Throttle Pos. Basic Setting Conditions not met
17963	P1555	Charge Pressure Upper Limit exceeded
17964	P1556	Charge Pressure Contr. Negative Deviation
17965	P1557	Charge Pressure Contr. Positive Deviation
17966	P1558	Throttle Actuator Electrical Malfunction
17967	P1559	Idle Speed Contr.Throttle Pos. Adaptation Malfunction
17968	P1560	Maximum Engine Speed Exceeded
17969	P1561	Quantity Adjuster Deviation
17970	P1562	Quantity Adjuster Upper Limit Attained
17971	P1563	Quantity Adjuster Lower Limit Attained
17972	P1564	Idle Speed Contr.Throttle Pos. Low Voltage During Adaptation
17973	P1565	Idle Speed Control Throttle Position lower limit not attained
17974	P1566	Load signal from A/C compressor range/performance
17975	P1567	Load signal from A/C compressor no signal

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
17976	P1568	Idle Speed Contr.Throttle Pos. mechanical Malfunction
17977	P1569	Cruise control switch Incorrect signal
17978	P1570	Contr.Module Locked
17979	P1571	Left Eng. Mount Solenoid Valve Short to B+
17980	P1572	Left Eng. Mount Solenoid Valve Short to ground
17981	P1573	Left Eng. Mount Solenoid Valve Open circuit
17982	P1574	Left Eng. Mount Solenoid Valve Electrical fault in circuit
17983	P1575	Right Eng. Mount Solenoid Valve Short to B+
17984	P1576	Right Eng. Mount Solenoid Valve Short to ground
17985	P1577	Right Eng. Mount Solenoid Valve Open circuit
17986	P1578	Right Eng. Mount Solenoid Valve Electrical fault in circuit
17987	P1579	Idle Speed Contr.Throttle Pos. Adaptation not started
17988	P1580	Throttle Actuator B1 Malfunction
17989	P1581	Idle Speed Contr.Thrcttle Pos. Basic Setting Not Carried Out
17990	P1582	Idle Adaptation at Limit
17991	P1583	Transmission mount valves Short to B+
17992	P1584	Transmission mount valves Short to ground
17993	P1585	Transmission mount valves Open circuit
17994	P1586	Engine mount solenoid valves Short to B+
17995	P1587	Engine mount solenoid valves Short to ground
17996	P1588	Engine mount solenoid valves Open circuit
18008	P1600	Power Supply (B+) Terminal 15 Low Voltage
18010	P1602	Power Supply (B+) Terminal 30 Low Voltage
18011	P1603	Internal Control Module Malfunction
18012	P1604	Internal Control Module Driver Error
18013	P1605	Rough Road/Acceleration Sensor Electrical Malfunction
18014	P1606	Rough Road Spec Engine Torque ABS-ECU Electrical Malfunction
18015	P1607	Vehicle speed signal Error message from instrument cluster
18016	P1608	Steering angle signal Error message from steering angle sensor
18017	P1609	Crash shut-down activated
18019	P1611	MIL Call-up Circ./Transm.Contr.Module Short to Ground
18020	P1612	Electronic Control Module Incorrect Coding
18021	P1613	MIL Call-up Circ Open/Short to B+
18022	P1614	MIL Call-up Circ./Transm.Contr.Module Range/Performance
18023	P1615	Engine Oil Temperature Sensor Circuit range/performance

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
18024	P1616	Glow Plug/Heater Indicator Circ. Short to B+
18025	P1617	Glow Plug/Heater Indicator Circ. Open/Short to Ground
18026	P1618	Glow Plug/Heater Relay Circ. Short to B+
18027	P1619	Glow Plug/Heater Relay Circ. Open/Short to Ground
18028	P1620	Engine coolant temperature signal open/short to B+
18029	P1621	Engine coolant temperature signal short to ground
18030	P1622	Engine coolant temperature signal range/performance
18031	P1623	Data Bus Powertrain No Communication
18032	P1624	MIL Request Sign.active
18033	P1625	Data-Bus Powertrain Implausible Message from Transm.Contr.
18034	P1626	Data-Bus Powertrain Missing Message from Transm.Contr.
18035	P1627	Data-Bus Powertrain missing message from fuel injection pump
18036	P1628	Data-Bus Powertrain missing message from steering sensor
18037	P1629	Data-Bus Powertrain missing message from distance control
18038	P1630	Accelera.Pedal Pos.Sensor 1 Signal too Low
18039	P1631	Accelera.Pedal Pos.Sensor 1 Signal too High
18040	P1632	Accelera.Pedal Pos.Sensor 1 Power Supply Malfunction
18041	P1633	Accelera.Pedal Pos.Sensor 2 Signal too Low
18042	P1634	Accelera.Pedal Pos.Sensor 2 Signal too High
18043	P1635	Data Bus Powertrain missing message f.air condition control
18044	P1636	Data Bus Powertrain missing message from Airbag control
18045	P1637	Data Bus Powertrain missing message f.central electr.control
18046	P1638	Data Bus Powertrain missing message from clutch control
18047	P1639	Accelera.Pedal Pos.Sensor 1+2 Range/Performance
18048	P1640	Internal Contr.Module (EEPROM) Error
18049	P1641	Please check DTC Memory of Air Condition ECU
18050	P1642	Please check DTC Memory of Airbag ECU
18051	P1643	Please check DTC Memory of central electric ECU
18052	P1644	Please check DTC Memory of clutch ECU
18053	P1645	Data Bus Powertrain missing message f.all wheel drive contr.
18054	P1646	Please Check DTC Memory of all wheel drive ECU
18055	P1647	Please check coding of ECUs in Data Bus Powertrain
18056	P1648	Data Bus Powertrain Malfunction
18057	P1649	Data Bus Powertrain Missing message from ABS Control Module
18058	P1650	Data Bus Powertrain Missing message fr.instrument panel ECU

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
18059	P1651	Data Bus Powertrain missing messages
18060	P1652	Please check DTC Memory of transmission ECU
18061	P1653	Please check DTC Memory of ABS Control Module
18062	P1654	Please check DTC Memory of control panel ECU
18063	P1655	Please check DTC Memory of ADR Control Module
18064	P1656	A/C clutch relay circuit short to ground
18065	P1657	A/C clutch relay circuit short to B+
18066	P1658	Data Bus Powertrain Incorrect signal from ADR Control Module
18084	P1676	Drive by Wire-MIL Circ. Electrical Malfunction
18085	P1677	Drive by Wire-MIL Circ. Short to B+
18086	P1678	Drive by Wire-MIL Circ. Short to Ground
18087	P1679	Drive by Wire-MIL Circ. Open
18089	P1681	Contr.Unit Programming, Programming not Finished
18092	P1684	Contr.Unit Programming Communication Error
18094	P1686	Contr.Unit Error Programming Error
18098	P1690	Malfunction Indication Light Malfunction
18099	P1691	Malfunction Indication Light Open
18100	P1692	Malfunction Indication Light Short to Ground
18101	P1693	Malfunction Indication Light Short to B+
18102	P1694	Malfunction Indication Light Open/Short to Ground
18112	P1704	Kick Down Switch Malfunction
18113	P1705	Gear/Ratio Monitoring Adaptation limit reached
18119	P1711	Wheel Speed Signal 1 Range/Performance
18124	P1716	Wheel Speed Signal 2 Range/Performance
18129	P1721	Wheel Speed Signal 3 Range/Performance
18131	P1723	Starter Interlock Circ. Open
18132	P1724	Starter Interlock Circ. Short to Ground
18134	P1726	Wheel Speed Signal 4 Range/Performance
18136	P1728	Different Wheel Speed Signals Range/Performance
18137	P1729	Starter Interlock Circ. Short to B+
18141	P1733	Tiptronic Switch Down Circ. Short to Ground
18147	P1739	Tiptronic Switch up Circ. Short to Ground
18148	P1740	Clutch temperature control
18149	P1741	Clutch pressure adaptation at limit
18150	P1742	Clutch torque adaptation at limit

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
18151	P1743	Clutch slip control signal too high
18152	P1744	Tiptronic Switch Recognition Circ. Short to Ground
18153	P1745	Transm.Contr.Unit Relay Short to B+
18154	P1746	Transm.Contr.Unit Relay Malfunction
18155	P1747	Transm.Contr.Unit Relay Open/Short to Ground
18156	P1748	Transm.Contr.Unit Self-Check
18157	P1749	Transm.Contr.Unit Incorrect Coded
18158	P1750	Power Supply Voltage Low Voltage
18159	P1751	Power Supply Voltage High Voltage
18160	P1752	Power Supply Malfunction
18168	P1760	Shift Lock Malfunction
18169	P1761	Shift Lock Short to Ground
18170	P1762	Shift Lock Short to B+
18171	P1763	Shift Lock Open
18172	P1764	Transmission temperature control
18173	P1765	Hydraulic Pressure Sensor 2 adaptation at limit
18174	P1766	Throttle Angle Signal Stuck Off
18175	P1767	Throttle Angle Signal Stuck On
18176	P1768	Hydraulic Pressure Sensor 2 Too High
18177	P1769	Hydraulic Pressure Sensor 2 Too Low
18178	P1770	Load Signal Range/Performance
18179	P1771	Load Signal Stuck Off
18180	P1772	Load Signal Stuck On
18181	P1773	Hydraulic Pressure Sensor 1 Too High
18182	P1774	Hydraulic Pressure Sensor 1 Too Low
18183	P1775	Hydraulic Pressure Sensor 1 adaptation at limit
18184	P1776	Hydraulic Pressure Sensor 1 range/performance
18185	P1777	Hydraulic Pressure Sensor 2 range/performance
18186	P1778	Solenoid EV7 Electrical Malfunction
18188	P1780	Torque retraction malfunctioning
18189	P1781	Engine Torque Reduction Open/Short to Ground
18190	P1782	Engine Torque Reduction Short to B+
18192	P1784	Shift up/down Wire Open/Short to Ground
18193	P1785	Shift up/down Wire Short to B+
18194	P1786	Reversing Light Circ. Open

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
18195	P1787	Reversing Light Circ. Short to Ground
18196	P1788	Reversing Light Circ. Short to B+
18197	P1789	Idle Speed Intervention Circ. Error Message from Engine Contr.
18198	P1790	Transmission Range Display Circ. Open
18199	P1791	Transmission Range Display Circ. Short to Ground
18200	P1792	Transmission Range Display Circ. Short to B+
18201	P1793	Output Speed Sensor 2 Circ. No Signal
18203	P1795	Vehicle Speed Signal Circ. Open
18204	P1796	Vehicle Speed Signal Circ. Short to Ground
18205	P1797	Vehicle Speed Signal Circ. Short to B+
18206	P1798	Output Speed Sensor 2 Circ. Range/Performance
18207	P1799	Output Speed Sensor 2 Circ. Rpm too High
18221	P1813	Pressure Contr.Solenoid 1 Electrical
18222	P1814	Pressure Contr.Solenoid 1 Open/Short to Ground
18223	P1815	Pressure Contr.Solenoid 1 Short to B+
18226	P1818	Pressure Contr.Solenoid 2 Electrical
18227	P1819	Pressure Contr.Solenoid 2 Open/Short to Ground
18228	P1820	Pressure Contr.Solenoid 2 Short to B+
18231	P1823	Pressure Contr.Solenoid 3 Electrical
18232	P1824	Pressure Contr.Solenoid 3 Open/Short to Ground
18233	P1825	Pressure Contr.Solenoid 3 Short to B+
18236	P1828	Pressure Contr.Solenoid 4 Electrical
18237	P1829	Pressure Contr.Solenoid 4 Open/Short to Ground
18238	P1830	Pressure Contr.Solenoid 4 Short to B+
18242	P1834	Pressure Contr.Solenoid 5 Open/Short to Ground
18243	P1835	Pressure Contr.Solenoid 5 Short to B+
18249	P1841	Engine/Transmission Control Modules Versions do not match
18250	P1842	Please check DTC Memory of instrument panel ECU
18251	P1843	Please check DTC Memory of ADR Control Module
18252	P1844	Please check DTC Memory of central electric control ECU
18255	P1847	Please check DTC Memory of brake system ECU
18256	P1848	Please check DTC Memory of engine ECU
18257	P1849	Please check DTC Memory of transmission ECU
18258	P1850	Data-Bus Powertrain Missing Message from Engine Contr.
18259	P1851	Data-Bus Powertrain Missing Message from Brake Contr.

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
18260	P1852	Data-Bus Powertrain Implausible Message from Engine Contr.
18261	P1853	Data-Bus Powertrain Implausible Message from Brake Contr.
18262	P1854	Data-Bus Powertrain Hardware Defective
18263	P1855	Data-Bus Powertrain Software version Contr.
18264	P1856	Throttle/Pedal Pos.Sensor A Circ. Error Message from Engine Contr.
18265	P1857	Load Signal Error Message from Engine Contr.
18266	P1858	Engine Speed Input Circ. Error Message from Engine Contr.
18267	P1859	Brake Switch Circ. Error Message from Engine Contr.
18268	P1860	Kick Down Switch Error Message from Engine Contr.
18269	P1861	Throttle Position (TP) sensor Error Message from ECM
18270	P1862	Data Bus Powertrain Missing message from instr. panel ECU
18271	P1863	Data Bus Powertrain Missing Message from St. Angle Sensor
18272	P1864	Data Bus Powertrain Missing message from ADR control module
18273	P1865	Data Bus Powertrain Missing message from central electronics
18274	P1866	Data Bus Powertrain Missing messages
18320	P1912	Brake Booster pressure Sensor Short To Positive
18321	P1913	Brake Booster pressure Sensor Short To Ground
18322	P1914	Brake Booster pressure Sensor Implausible Signal
18522	P2090	"B" Camshaft Position Actuator Control Circuit Low Bank 1
18523	P2091	"B" Camshaft Position Actuator Control Circuit High Bank 1
18528	P2096	Post Catalyst Fuel Trim System Too Lean Bank 1
18529	P2097	Post Catalyst Fuel Trim System Too Rich Bank 1
18532	P2100	Throttle Actuator Control Motor Circuit Open (Motor for Intake Flap V157 implausible signal)
18533	P2101	Throttle Actuator Control Motor Circuit Range/Performance
18534	P2102	Throttle Actuator Control Motor Circuit Low (Motor for Intake Flap V157 signal Too Low)
18535	P2103	Throttle Actuator Control Motor Circuit High (Motor for Intake Flap V157 signal Too High)
18538	P2106	Throttle Actuator Control Motor Circuit Forced Limited Power
18540	P2108	Throttle Actuator Control Module Performance (Motor for Intake Flap V157 Malfunction)
18554	P2122	Throttle/Pedal position Sensor/Switch "D" Circuit Low Input
18555	P2123	Throttle/Pedal position Sensor/Switch "D" Circuit High Input
18559	P2127	Throttle/Pedal position Sensor/Switch "E" Circuit Low Input
18560	P2128	Throttle/Pedal position Sensor/Switch "E" Circuit High Input
18565	P2133	Throttle/Pedal position Sensor/Switch "F" Circuit Low Input
18570	P2138	Throttle/Pedal position Sensor/Switch "D"/"F" Circuit Voltage Correlation
18609	P2177	System Too Lean Off Idle, Bank 1

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
18610	P2178	System Too Rich Off Idle, Bank 1
18611	P2179	System Too Lean Off Idle, Bank 2
18612	P2180	System Too Rich Off Idle, Bank 3
18613	P2181	Cooling System Performance
18619	P2187	System Too Lean At Idle, Bank 1
18620	P2188	System Too Rich At Idle, Bank 1
18621	P2189	System Too Lean At Idle, Bank 2
18622	P2190	System Too Rich At Idle, Bank 2
18623	P2191	System Too Lean At Higher Load, Bank 1
18624	P2192	System Too Rich At Higher Load, Bank 1
18625	P2193	System Too Lean At Higher Load, Bank 2
18626	P2194	System Too Rich At Higher Load, Bank 2
18627	P2195	O2 Sensor Signal Stuck Lean B1S1
18628	P2196	O2 Sensor Signal Stuck Rich B1S1
18663	P2231	O2 Sensor Signal Circuit Shorted to Heater Circuit B1S1
18666	P2234	O2 Sensor Signal Circuit Shorted to Heater Circuit B2S1
18669	P2237	O2 Sensor Positive Current Control Circuit Open B1S1
18670	P2238	O2 Sensor Positive Current Control Circuit Low B1S1
18671	P2239	O2 Sensor Positive Current Control Circuit High B1S1
18672	P2240	O2 Sensor Positive Current Control Circuit Open B2S1
18675	P2243	O2 Sensor Reference Voltage Circuit Open B1S1
18677	P2245	O2 Sensor Reference Voltage Circuit Low B1S1
18678	P2246	O2 Sensor Reference Voltage Circuit High B1S1
18679	P2247	O2 Sensor Reference Voltage Circuit Open B2S1
18683	P2251	O2 Sensor Negative Current Control Circuit Open B1S1
18684	P2252	O2 Sensor Negative Current Control Circuit Low B1S1
18685	P2253	O2 Sensor Negative Current Control Circuit High B1S1
18686	P2254	O2 Sensor Negative Current Control Circuit Open B2S1
18689	P2257	Secondary Air Injection System Control "A" Circuit Low
18690	P2258	Secondary Air Injection System Control "A" Circuit High
18693	P2261	Turbo Boost Pressure Not Detected, Mechanical
18702	P2270	O2 Sensor Signal Stuck Lean B1S2
18703	P2271	O2 Sensor Signal Stuck Rich B1S2
18704	P2272	O2 Sensor Signal Stuck Lean B2S2
18706	P2274	O2 Sensor Signal Stuck Lean B1S3

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
18707	P2275	O2 Sensor Signal Stuck Rich B1S3
18711	P2279	Intake Air System Leak
18768	P2336	Cylinder #1 Above Knock Threshold
18769	P2337	Cylinder #2 Above Knock Threshold
18770	P2338	Cylinder #3 Above Knock Threshold
18771	P2339	Cylinder #4 Above Knock Threshold
18772	P2340	Cylinder #5 Above Knock Threshold
18773	P2341	Cylinder #6 Above Knock Threshold
18832	P2400	Evaporative Emission System Leak Detection Pump Control Circuit Open
18833	P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low
18834	P2402	Evaporative Emission System Leak Detection Pump Control Circuit High
18835	P2403	Evaporative Emission System Leak Detection Pump Sense Circuit Open
18836	P2404	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance
18845	P2413	Exhaust Gas Recirculation System Performance
18846	P2414	O2 Sensor Exhaust Sample Error B1S1
18854	P2422	Evaporative Emission System Vent Valve Stuck Closed
18857	P2425	Exhaust Gas Recirculation Cooling Valve Control Circuit Open
18858	P2426	Exhaust Gas Recirculation Cooling Valve Control Circuit Low
18859	P2427	Exhaust Gas Recirculation Cooling Valve Control Circuit High
19058	P2626	O2 Sensor Pumping Current Trim Circuit Open B1S1
19061	P2629	O2 Sensor Pumping Current Trim Circuit Open B2S1
19069	P2637	Torque Management Feedback Signal “A”
19473	P3017	Electronic Differential Lock Intake Valve for Left Front and Right Rear Short to Positive
19474	P3018	Exhaust Flap Valve 1 Short to Ground
19475	P3019	Exhaust Flap Valve 1 Open Circuit
19503	P3047	Activation Starter Relay 2, Short to Positive
19504	P3048	Activation Starter Relay 2, Short to Negative
19505	P3049	Activation Starter Relay 2, Open Circuit
19506	P3050	Starter Relay 2 Electrical Malfunction in Circuit (Stuck/Inoperative Relay)
19537	P3081	Engine Temperature Too Low
19667	P3211	Exhaust B1S1 Heater return Connection
28673	U0001	High Speed CAN Communication Bus
28772	U0100	Lost Communication With ECM/PCM "A"
28773	U0101	Lost Communication with Transmission Control Module (TCM)
28775	U0103	Lost Communication With Gear Shift Module

Diagnostic Trouble Codes (Powertrain)

V.A.G. code	SAE P-code	Description
28793	U0121	Lost Communication with Anti-Lock Brake System (ABS) Control Module
28827	U0155	Lost Communication with Instrument panel Cluster (IPC) Control Module
28974	U0302	Software Incompatibility with Transmission Control Module (TCM)
28987	U0315	Software Incompatibility with Anti-Lock Brake System (ABS) Control Module
29074	U0402	Invalid Data Received From Transmission Control (TCM) Module
29076	U0404	Invalid Data Received From Gear Shift Control Module
29087	U0415	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module

DIAGNOSTIC SCAN TOOL SUPPLIERS

The following suppliers offer diagnostic scan tools or computerized scan tool programs. Some of them also offer special tools and equipment for specialized repair work.

Assenmacher Specialty
Tools, Inc.
6440 Odell Place
Boulder, CO 80301
(800) 525-2943
www.asttool.com

Baum Tools Unlimited, Inc.
PO Box 5867
Sarasota, FL 34277
(800) 848-6657
www.baumtools.com

Equipment Solutions
P.O. Box 1450
Kenosha, WI 53141-1450
(800) 892-9650

Metalnerd
5113 Crestview Drive, Suite B
Greensburg, PA, 15601 USA
(412) 601-4270
www.metalnerd.com

Ross-Tech
920 South Broad Street
Lansdale, PA 19446
215-361-8942
www.ross-tech.com

Samstag Sales
115 Main St. N., Suite 216
Carthage, TN 37030
(615) 735-3388
www.samstagsales.com

Shade Tree Software
4186 Culebra Ct.
Boulder, CO 80301
(303) 449-1664
(303) 940-2468
www.shadetreesoftware.com

ZDMAK Tools
P.O. Box 5100
Sarasota, FL 34277
(877) 938-6657
www.zdmak.com

Zelenda Automotive, Inc.
66-02 Austin St.
Forest Hills, NY 11374
(888) 892-8348
www.zelenda.com

CONTROL MODULE CODING

Control modules are produced in a few major variations and electronically matched to the exact system needs through a process known as coding. Coding is automatically displayed when the control module responds to the scan tool inquiry and can also be called up through Function 01 of the Function Menu of the VAG 1551/1552. The coding process requires a properly set-up scan tool or scan tool computer program and is accessed through Function 07.

Most codes are 5 digits and require assembly from the tables in this section. Careful attention must be paid to assemble accurate codes. Failure to code, or insertion of an incorrect code can cause any or all of the following conditions:

- Driveability problems
- Increased fuel consumption
- Increased emissions
- Storage of non-existent or erroneous DTCs resulting in Malfunction Indicator Light (MIL) illumination.
- Necessary functions not being performed (oxygen sensor regulation, activation of the EVAP canister system, non-functioning of anti-slip regulation (ASR) etc.).
- Necessary functions being performed incorrectly (mileage recorded instead of kilometers, warning light failure, etc.).
- Reduction in component service life.

NOTE —

- *New or replacement control units will usually require coding of the control module before they will function properly.*
- *In some instances, a control module will require input of a 7 digit code, but the table lists only a 5 digit code. In these instances, enter 00 before the correct code to satisfy the 7 digit requirement.*
- *After a new code is entered it will usually be necessary to switch the ignition off and back on for the new code to be recorded.*

NOTE —

The Control Module Coding function for later production vehicles can only be accomplished through the use of a properly configured VAS 5051 or VAS 5052. The data required for this procedure is stored on these diagnostic computers and is only accessible by them.

Engine Control Module (ECM) Coding Tables

Engine Control Module Coding Variations, AWD (1.8L turbo)			
Country or Emission Level	**Drive or Additional Functions**	**Transmission**	**Vehicle Type**
00 =	**0** = Front Wheel Drive	**0** = 5-Speed Manual	**0** = A Class (A4 Golf & Jetta)
01 =	**1** =	**1** =	**1** =
02 =	**2** =	**2** =	**2** =
03 =	**3** =	**3** = 4-Speed Automatic 01M	**3** =
04 =	**4** =	**4** =	**4** =
05 =	**5** = Front Wheel Drive with Traction Control (TC), Data Bus	**5** =	**5** =
06 = Emission Standard TLEV	**6** =	**6** =	**6** =
07 =	**7** =	**7** =	**7** =
08 =	**8** =	**8** =	**8** =
Notes: Disregard empty table cells. ECM will only recognize the values listed above as valid. Access through Address Word 01.			

Example, Engine Code AWD				
Golf				0
5-Speed Manual Transmission			0	
Front Wheel Drive with Traction Control and Data Bus		5		
TLEV Emission Standard	06			
The correct code number for the above vehicle is: **06500**				

Engine Control Module Coding Variations, AWW and AWP (1.8L turbo)			
Country or Emission Level	**Drive or Additional Functions**	**Transmission**	**Vehicle Type**
00 =	**0** = Front Wheel Drive	**0** = 5-Speed Manual	**0** = A Class (A4 Golf & Jetta)
01 =	**1** =	**1** = 6-Speed Manual	**1** =
02 =	**2** = All Wheel Drive (4Motion)	**2** =	**2** =
03 =	**3** =	**3** = 4-Speed Automatic 01M	**3** =
04 =	**4** = All Wheel Drive (4Motion) w/out Traction Control, w/Data Bus	**4** =	**4** =
05 =	**5** = Front Wheel Drive with Traction Control (TC), Data Bus	**5** = 5-Speed Automatic 09A	**5** =
06 = Emission Standard TLEV	**6** = All Wheel Drive (4Motion) w/out Anti-Slip Regulation, w/Data Bus	**6** =	**6** =
07 = Emission Standard LEV	**7** = All Wheel Drive (4Motion) w/out Anti-Slip Regulation, w/Data Bus	**7** =	**7** =
08 =	**8** =	**8** =	**8** =
Notes: Disregard empty table cells. ECM will only recognize the values listed above as valid. Access through Address Word 01.			

Example, Engine Codes AWW/AWP				
Jetta				0
5-Speed Automatic Transmission			5	
Front Wheel Drive with Traction Control and Data Bus		5		
LEV Emission Standard	07			
The correct code number for the above vehicle is: **07550**	**07**	**5**	**5**	**0**

Engine Control Module Coding Variations, ALH (1.9L TDI)		
Part Number	**Equipment Level**	**Code**
038 906 012 FD, 038 906 012 BD	Automatic Transmission, ABS, Airbag	00001
	Manual Transmission, ABS, Airbag	00002
	Automatic Transmission, Airbag	00004
038 906 012 FR, 038 906 012 BC	Manual Transmission, Airbag	00002
	Manual Transmission	00005
038 906 012 FE, 038 906 012 BR	Automatic Transmission, ABS	00001
	Manual Transmission, ABS	00002
	Automatic Transmission	00004
Notes: Specific ECM part numbers will only recognize the values listed above as valid. Access through Address Word 01.		

Engine Control Module Coding Variations, AEG (2.0L)		
Model Year	**Equipment Level**	**Code**
1999	Manual Transmission, ABS	00000
	Automatic Transmission, ABS	00001
	Manual Transmission	00040
	Automatic Transmission	00041
2000	Manual Transmission	00001
	Manual Transmission, ABS	00011
	Manual Transmission, Airbag	00021
	Manual Transmission, ABS, Airbag	00031
	Automatic Transmission	00003
	Automatic Transmission, ABS	00013
	Automatic Transmission, Airbag	00023
	Automatic Transmission, ABS, Airbag	00033
Notes: **ECM will only recognize the codes listed above as valid. Access through Address Word 01.**		

Engine Control Module Coding Variations, AVH, AZG (2.0L)
Note: ECM coding is not a supported function on 2.0 liter AVH and AZG engines. If it becomes necessary to replace an ECM on an AVH or and AZG engine, you will need to supply the VIN, the transmission type, and the Emission Standard (Tier 1, LEV, California, Canada, or 49 States). Emission information is usually listed on the underhood labels and/or the certification label on the "B" post on the driver's side. It is also helpful to have the part number from the original ECM from the identification sticker or from a scan tool printout. Replacement ECM will have correct functionality provided all of the above information is supplied. Coding information displayed in the appropriate area of the scan tool will usually be 00000.

Engine Control Module Coding Variations, AFP (2.8L VR6 2V)		
Vehicle Type	**Equipment Level**	**Code**
Golf and Jetta	Manual Transmission	00031
	Automatic Transmission	00033
Notes: Only the 2 codes listed above are recognized as valid. Access through Address Word 01.		

Engine Control Module Coding Variations, BDF (2.8L VR6 4V)				
Position 1: Vehicle Code	**Position 2: Emission Code**	**Position 3: Sensor Code**	**Position 4: CAN-BUS**	**Position 5: Transmission Code**
0 = No coding	**0** = No coding	**0** = No coding	**0** = No coding	**0** = No coding
1 =	**1** =	**1** =	**1** = ABS	**1** = 5-speed Manual Transmission
2 =	**2** =	**2** =	**2** = Airbag	**2** = 6-speed Manual Transmission
3 =	**3** =	**3** =	**3** = ABS and Airbag	**3** = Automatic Transmission
4 =	**4** =	**4** =	**4** =	**4** =
5 =	**5** =	**5** =	**5** =	**5** =
Notes: If no specific code is assigned, place is held by 0. Disregard other empty table cells. ECM will only recognize the values listed above as valid. Access through Address Word 01.				

Example, Engine Code BDF					
Position 1: Vehicle Code (no code assigned)	**0**				
Position 2: Emission Code (no code assigned)		**0**			
Position 3: Sensor Code (no code assigned)			**0**		
Position 4: CAN-BUS Code (vehicle with ABS and Airbag)				**3**	
Position 5: Transmission Code (6-speed Manual Transmission)					**2**
The correct code number for the above vehicle is:	**0**	**0**	**0**	**3**	**2**

TCM Coding

Transmission Control Modules (TCM) for 01M and 09A automatic transmissions do not require coding at this time. They will function properly when the Engine Control Module is properly coded (where required). Coding information, if displayed in the appropriate area of the scan tool, will usually be 00000.

ABS/EDL/ASR/ESP Coding Tables

ABS Control Module Coding Variations, ITT Mk 20 IE		
Engine Code	**Equipment Level**	**Code**
2.0L (AEG)	ABS	03504
2.0L (AEG)	ABS/EDL	13504
2.8L (AFP)	ABS	03504
2.8L (AFP)	ABS/EDL	13504
2.8L (AFP)	ABS/EDL/ASR	13204
1.9L (ALH)	ABS	03504
1.9L (ALH)	ABS/EDL	13504
Notes: Only the codes listed above are recognized as valid. Access through Address Word 03.		

ABS Control Module Coding Variations[4], Mark 60				
Part Number[3]	**Engine Codes, Equipment Level**	**Brake Type 1**	**H.D. Susp. [2]**	**Code**
ABS 1C0 907 375 C, 1C0 907 375 J, 1C0 907 379 C, 1C0 907 379 J	Front Wheel Drive 1.8L - AWD, AWW, AWP 1.9L - ALH 2.0L - AEG, AVH, AZG 2.8L - AFP	n/a	n/a	04097
ABS/EDL/ASR 1C0 907 375 D, 1C0 907 375 K, 1C0 907 379 D,	Front Wheel Drive 1.8L - AWD, AWW, AWP 2.8L - AFP	n/a	n/a	18945
ABS/EDL/ASR/ESP 1C0 907 379 E, 1C0 907 379 G	Front Wheel Drive 1.8L - AWD, AWW, AWP 1.8L - AWD, AWW, AWP 1.9L - ALH 1.9L - ALH 2.0L - AEG, AVH, AZG 2.0L - AEG, AVH, AZG 2.8L - AFP, BDF 2.8L - AFP, BDF	 FN 3 FN 3 FS III FS III FS III FS III FN 3 FN 3	 without with without with without with without with	 19970 20098 19458 19586 22530 22658 19970 20098
ABS/EDL/ASR/ESP 1C0 907 379 E, 1C0 907 379 G	All Wheel Drive 4Motion 2.8L - AQP, AUE 2.8L - AQP, AUE	 FN 3 FN 3	 without with	 23046 23174

Notes:

1. Brake type is determined from Vehicle Data Plate (Vehicle Identification Label) in rear compartment near spare tire well. **See 0 Maintenance, Identification Plates and Labels**. Compare data to tables below.
2. Suspension type is determined from Vehicle Data Plate (Vehicle Identification Label) in rear compartment near spare tire well. **See 0 Maintenance, Identification Plates and Labels**. Compare data to tables below.
3. Specific ECM part numbers will only recognize the values listed above as valid.
4. Access through Address Word 03.

Factory (PR) Code Identification, Front Brakes	
Brake Type	**Factory (PR) Codes**
FS III	1LS, 1LQ, 1ZM, 1ZF, 1ZP
FN 3	1LE, 1LJ, 1ZE, 1ZD

Factory (PR) Code Identification, Suspension	
Suspension Type	**Factory (PR) Codes**
Basic Suspension	1GA, 1GJ, 1GU, 1GC, 1GG, G08, G09, G27, G28, G29,G34, G36, G37, G41G44, G45, G46, G47, G76, G81, G82
Sport Suspension	GD, 1GV, 1GT G16, G72, G73, G75, G84, G86, G87, G88
Sport Suspension (GTI w/132KW (180 hp) engine)	G70
Heavy Duty Suspension	1GB, 1GW, G10, G39, G48

Convenience System Coding Tables

Convenience System Control Module Coding Variations, ➤05.01		
Vehicle Equipment	**Code, 2-door vehicles**	**Code, 4-door vehicle**
Electric Windows, one door	00256	04096
Electric Windows, all doors	00257	04097
Electric Windows, one door, with seat memory	00258	04098
Electric Windows, all doors, with seat memory	00259	04099
Notes: Only the codes listed above are recognized as valid. Access through Address Word 46.		

Convenience System Control Module Coding Variations, 06.01➤		
Vehicle Equipment	**Code, 2-door vehicles**	**Code, 4-door vehicle**
Electric Windows, one door	00064	00258
Electric Windows, all doors	00065	00259
Electric Windows, one door, with seat memory	n/a	00258
Electric Windows, all doors, with seat memory	n/a	00259
Notes: Only the codes listed above are recognized as valid. Access through Address Word 46.		

Convenience System Control Module Coding Variations, ➤05.01		
Vehicle Equipment	**Code, 2-door vehicles**	**Code, 4-door vehicle**
Manual Windows, one door	00256	04096
Manual Windows, all doors	00257	04097
Notes: Only the codes listed above are recognized as valid. Access through Address Word 35.		

Convenience System Control Module Coding Variations, 06.01➤		
Vehicle Equipment	**Code, 2-door vehicles**	**Code, 4-door vehicle**
Manual Windows, one door	00016	00018
Manual Windows, all doors	00017	00019
Notes: Only the codes listed above are recognized as valid. Access through Address Word 35		

Airbag System Coding Tables

Airbag System Electronic Control Unit Coding Variations			
Vehicle Equipment Level	**ECU Part Number**	**Index Code**	**ECU Code**
Driver's airbag only	1C0 909 603	AP	16720
Driver's airbag only	6Q0 909 601	0B	12354
Driver's/Passenger's airbag	1J0 909 603	AN	16718
Driver's/Passenger's airbag	6Q0 909 601	0C	12355
Driver's/Passenger's airbag	6Q0 909 601	12	12594
Driver's/Passenger's airbag, USA	6Q0 909 601	0D	12356
Driver's/Passenger's airbag, USA	1J0 909 603	J	00074
Driver's/Passenger's airbag, USA (Mexico production)	6Q0 909 601	0M	12365
Driver's/Passenger's airbag	6Q0 909 601	1F	12614
Driver's/Passenger's airbag, USA	6Q0 909 601	1G	12615
Driver's/Passenger's airbag, USA (Brazil production)	6Q0 909 601	1H	12616
Driver's/Passenger's airbag, with seat belt detection for switch-over activation limit	6Q0 909 601	1J	12618
Driver's/Passenger's airbag, USA	6Q0 909 601	1K	12619
Driver's/Passenger's airbag, with seat belt detection for switch-over activation limit, USA (Brazil production)	6Q0 909 601	1L	12620
Driver's/Passenger's airbag	6Q0 909 601	21	12849
Driver's/Passenger's airbag, USA	6Q0 909 601	22	12850
Driver's/Passenger's airbag, USA	6Q0 909 601	23	12851
Driver's/Passenger's airbag, USA (Brazil production)	6Q0 909 601	13	12595
Driver's and side airbags	1J0 909 608	AS	16723
Driver's/Passenger's and side airbag	1J0 909 608	AR	16722
Driver's and side airbags with electric belt tensioner	1J0 909 609	B	00066
Driver's and side airbags with electric belt tensioner, USA	1J0 909 609	C	00067
Driver's and side airbags with electric belt tensioner	6Q0 909 605 A	01	12337
Driver's/Passenger's and side airbags with electric belt tensioner	6Q0 909 605 A	2B	12866
Driver's and side airbags with electric belt tensioner	6Q0 909 605 A	0E	12357
Driver's and side airbags with electric belt tensioner (Brazil production)	6Q0 909 605 A	2D	12868
Driver's/Passenger's and side airbags with electric belt tensioner	6Q0 909 605 A	2E	12869
Driver's/Passenger's and side airbags with electric belt tensioner	1J0 909 609	A	00065
Driver's/Passenger's and side airbags with electric belt tensioner	6Q0 909 605 A	02	12338
Driver's/Passenger's and side airbags with electric belt tensioner	6Q0 909 605 A	0F	12358
Driver's/Passenger's and side airbag, with electric belt tensioner, with seat belt detection for switch-over activation limit	6Q0 909 605 A	0G	12359
Driver's/Passenger's and side airbags with electric belt tensioner	6Q0 909 605 A	0T	12372

Airbag System Electronic Control Unit Coding Variations			
Vehicle Equipment Level	**ECU Part Number**	**Index Code**	**ECU Code**
Driver's/Passenger's and side airbags with electric belt tensioner (Brazil production)	6Q0 909 605 A	13	12595
Driver's/Passenger's and side airbags with electric belt tensioner, USA	6Q0 909 605 A	03	12339
Driver's/Passenger's and side airbags with electric belt tensioner (Mexico production)	6Q0 909 605 A	09	12345
Driver's/Passenger's and side airbags with electric belt tensioner, USA (Brazil production)	6Q0 909 605 A	11	12593
Driver's/Passenger's and side airbags with electric belt tensioner, USA	6Q0 909 605 A	12	12594
Driver's/Passenger's and side airbags with electric belt tensioner, USA (Brazil production)	6Q0 909 605 A	14	12596
Driver's/Passenger's and side airbags with electric belt tensioner, USA	6Q0 909 605 A	21	12849
Driver's/Passenger's and side airbags with electric belt tensioner (Brazil production)	6Q0 909 605 A	22	12850
Driver's/Passenger's and side airbags with electric belt tensioner	6Q0 909 605 A	23	12851
Driver's/Passenger's and side airbags with electric belt tensioner (Mexico production)	6Q0 909 605 A	15	12597
Driver's/Passenger's and side airbag, with electric belt tensioner, with seat belt detection for switch-over activation limit, USA (Brazil production)	6Q0 909 605 A	UM	21837
Driver's/Passenger's and side airbag, with electric belt tensioner, with seat belt detection for switch-over activation limit, USA (Mexico production)	6Q0 909 605 A	UN	21838
Driver's/Passenger's and side airbag, with electric belt tensioner, with seat belt detection for switch-over activation limit, USA (Mexico production)	6Q0 909 605 A	1N	12622
Driver's/Passenger's and side airbag, with electric belt tensioner, USA	6Q0 909 605 A	0M	12345
Driver's/Passenger's and side airbag, with electric belt tensioner, with seat belt detection for switch-over activation limit, USA (Brazil production)	6Q0 909 605 A	1M	12621
Driver's and side airbag, with electric belt tensioner	6Q0 909 605 F	01	12337
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner	6Q0 909 605 F	02	12338
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner	6Q0 909 605 F	X1	12337
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner, USA	6Q0 909 605 F	X4	22580
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner, with seat belt detection for switch-over activation limit, USA	6Q0 909 605 F	Y3	22835
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner, with seat belt detection for switch-over activation limit, USA	6Q0 909 605 F	Y4	22836
Driver's/Passenger's airbag, side and side curtain airbags,	6Q0 909 608	AT	16724
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner	6Q0 909 605 F	02	12338
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner, USA	6Q0 909 605 F	03	12339
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner, with seat belt detection for switch-over activation limit, USA (Mexico production)	6Q0 909 605 F	04	12340

Airbag System Electronic Control Unit Coding Variations			
Vehicle Equipment Level	**ECU Part Number**	**Index Code**	**ECU Code**
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner, USA (Mexico production)	6Q0 909 605 F	05	12341
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner, USA	6Q0 909 605 F	06	12342
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner, USA (Brazil production)	6Q0 909 605 F	07	12343
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner, with seat belt detection for switch-over activation limit, USA (Brazil production)	6Q0 909 605 F	08	12344
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner, USA (Mexico production)	6Q0 909 605 F	09	12345
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner	6Q0 909 605 F	0A	12353
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner, USA (Brazil production)	6Q0 909 605 F	0B	12354
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner	6Q0 909 605 F	21	12849
Driver's/Passenger's airbag, side airbags, with electric belt tensioner (Brazil production)	6Q0 909 605 A	22	12850
Driver's/Passenger's airbag, side airbags, with electric belt tensioner	6Q0 909 605 A	23	12851
Driver's/Passenger's airbag	1C0 909 601	1F	12614
Driver's/Passenger's airbag (Mexico production)	1C0 909 601	1G	12615
Driver's/Passenger's airbag (Brazil production)	1C0 909 601	1H	12616
Driver's/Passenger's airbag	1C0 909 601	1J	12618
Driver's/Passenger's airbag, with seat belt detection for switch-over activation limit, USA (Mexico production)	1C0 909 601	1K	12619
Driver's/Passenger's airbag, with seat belt detection for switch-over activation limit, USA (Brazil production)	1C0 909 601	1L	12620
Driver's/Passenger's airbag	1C0 909 601	21	12849
Driver's/Passenger's airbag (Brazil production)	1C0 909 601	22	12850
Driver's/Passenger's airbag	1C0 909 605 A	23	12851
Driver's/Passenger's airbag, side airbags, with electric belt tensioner	1C0 909 605 A	12	12549
Driver's/Passenger's airbag, side airbags, with electric belt tensioner (Brazil production)	1C0 909 605 A	14	12596
Driver's/Passenger's airbag, side airbags, with electric belt tensioner (Mexico production)	1C0 909 605 A	15	12597
Driver's/Passenger's airbag, side airbags, with electric belt tensioner, with seat belt detection for switch-over activation limit, USA (Brazil production)	1C0 909 605 A	1M	12621
Driver's/Passenger's airbag, side airbags, with electric belt tensioner, with seat belt detection for switch-over activation limit, USA (Mexico production)	1C0 909 605 A	1N	12622
Driver's/Passenger's airbag, side airbags, with electric belt tensioner, with seat belt detection for switch-over activation limit	1C0 909 605 A	0G	12359

Airbag System Electronic Control Unit Coding Variations			
Vehicle Equipment Level	**ECU Part Number**	**Index Code**	**ECU Code**
Driver's/Passenger's airbag, side airbags, with electric belt tensioner	1C0 909 605 A	21	12849
Driver's/Passenger's airbag, side airbags, with electric belt tensioner (Brazil production)	1C0 909 605 A	22	12850
Driver's/Passenger's airbag, side airbags, with electric belt tensioner (Mexico production)	1C0 909 605 A	23	12851
Driver's/Passenger's airbag, side airbags, with electric belt tensioner	1C0 909 605 A	2B	12866
Driver's/Passenger's airbag, side airbags, with electric belt tensioner (Brazil production	1C0 909 605 A	2D	12868
Driver's/Passenger's airbag, side airbags, with electric belt tensioner (Mexico production)	1C0 909 605 A	2E	12869
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner	1C0 909 605 F	0A	12353
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner (Brazil production)	1C0 909 605 F	0B	12354
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner, with seat belt detection for switch-over activation limit	1C0 909 605 F	03	12339
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner, with seat belt detection for switch-over activation limit (Mexico production)	1C0 909 605 F	04	12340
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner (Mexico production)	1C0 909 605 F	05	12341
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner	1C0 909 605 F	06	12342
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner (Brazil production)	1C0 909 605 F	07	12343
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner, with seat belt detection for switch-over activation limit (Brazil production)	1C0 909 605 F	08	12344
Driver's/Passenger's airbag, side and side curtain airbags, with electric belt tensioner (Mexico production)	1C0 909 605 F	09	12345
Notes: **Airbag ECU will only recognize the values listed above as valid. Access through Address Word 15.**			

Climatronic Coding Tables

Climatronic Electronic Control Unit Coding		
Vehicle Type	**Equipment Level**	**Code**
Golf and Jetta (all)	Automatic Climate Control (Climatronic)	01000
Notes: Only the code listed above is recognized as valid. Access through Address Word 08.		

Instrument Cluster Coding Tables

Instrument Cluster Control Module Coding Variations[6], Model Years 1999 and 2000				
Designations	**Code Assembly Position[5]**			
	1 + 2[1]	**3[2]**	**4[3]**	**5[4]**
Available Equipment				
None	00			
Brake pad wear warning	01			
Seat belt warning	02			
Washer fluid level warning	04			
Market Version				
USA		2		
Canada		3		
Engine Cylinders				
4-cylinder			4	
6-cylinder			6	
Distance Impulse Number (K number)				
3538				2

Notes:

1. Values in this column are added together where applicable to determine value. For example, if vehicle in question has seat belt warning (02) and washer fluid warning (04), values are added together (02 + 04 = 06) to get a value of 06 for positions 1 and 2 of the instrument cluster code. If vehicle has all of the equipment listed, add all of the values together.
2. Only select from the listed codes.
3. Only select from the listed codes.
4. Distance impulse number is a constant used by the speedometer to calculate speed indication and distance travelled. Code for USA and Canadian Golf/Jetta is always a 2. Distance impulse number can only be read/confirmed using Scan Tool function 10, "Adaptation".
5. Code will be 5 digits. For example, a Jetta GLX with brake pad wear warning, seat belt warning, and washer fluid level warning, for the USA market, with a VR6 engine, and a speedometer impulse number of 3538, will have a code of 07262.
6. Access through Address Word 17.

Instrument Cluster Control Module Coding Variations[6], Model Year 2001				
Designations	**Code Assembly Position[5]**			
	1 + 2[1]	**3[2]**	**4[3]**	**5[4]**
Available Equipment				
None	00			
Brake pad wear warning	01			
Seat belt warning	02			
Washer fluid level warning	04			
Market Version				
USA		2		
Canada		3		
Service Interval Display				
USA and Canadian vehicles without Service Interval Display			3	
Distance Impulse Number (K number)				
3538				2
3648				4

Notes:

1. Values in this column are added together where applicable to determine value. For example, if vehicle in question has seat belt warning (02) and washer fluid warning (04), values are added together (02 + 04 = 06) to get a value of 06 for positions 1 and 2 of the instrument cluster code. If vehicle has all of the equipment listed, add all of the values together.
2. Only select from the listed codes.
3. Only select from the listed codes.
4. Distance impulse number is a constant used by the speedometer to calculate speed indication and distance travelled. Distance impulse number can only be read/confirmed using Scan Tool function 10, "Adaptation".
5. Code will be 5 digits. For example, a Jetta GLX with brake pad wear warning, seat belt warning, and washer fluid level warning, for the USA market, without a Service Interval Display, and with a speedometer impulse number of 3648, will have a code of 07234.
6. Access through Address Word 17.

Instrument Cluster Control Module Coding Variations[6], Model Year 2002➤				
Designations	**Code Assembly Position[5]**			
	1 + 2[1]	**3[2]**	**4[3]**	**5[4]**
Available Equipment				
None	00			
Brake pad wear warning	01			
Seat belt warning	02			
Washer fluid level warning	04			
Market Version				
USA		2		
Canada		3		
Service Interval Display				
USA and Canadian vehicles without Service Interval Display			3	
Distance Impulse Number (K number)				
4-speed Automatic Transmission (01M)				2
5-speed Manual Transmission (02J)				2
5-speed Automatic Transmission (09A)				4
6-speed Manual Transmission (02M)				4

Notes:

1. Values in this column are added together where applicable to determine value. For example, if vehicle in question has seat belt warning (02) and washer fluid warning (04), values are added together (02 + 04 = 06) to get a value of 06 for positions 1 and 2 of the instrument cluster code. If vehicle has all of the equipment listed, add all of the values together.
2. Only select from the listed codes.
3. Only select from the listed codes.
4. Distance impulse number is a constant used by the speedometer to calculate speed indication and distance travelled. Distance impulse number is derived from transmission type.
5. Code will be 5 digits. For example, a Jetta GLX with brake pad wear warning, seat belt warning, and washer fluid level warning, for the USA market, without a Service Interval Display, and with a 09A 5-speed automatic transmission will have a code of 07234.
6. Access through Address Word 17.

Gateway OnBoard Diagnostic Data Bus Interface Coding Tables

Gateway Data Bus Interface Coding[3], Model Years 2000 and 2001		
Vehicle Type[1]	**Control Modules on "Powertrain" CAN-BUS**	**Code[2]**
Golf and Jetta (all)	Automatic Transmission (TCM)	00001
	Anti-Lock Brakes System (ABS)	00002
	Airbag	00004

Notes:

1. Only the codes listed above are recognized as valid.
2. Values in this column are added together where applicable to determine value. For example, if vehicle in question has ABS (00002) and airbag (00004), values are added together (00002 + 00004 = 00006) to get a value of 00006 for the code. If vehicle has all of the equipment listed, add all of the values together.
3. Access through Address Word 19.

Gateway Data Bus Interface Coding[3], Model Year 2002➤		
Vehicle Type[1]	**Control Modules on "Powertrain" CAN-BUS[2]**	**Code[3]**
Golf and Jetta (all)	Anti-Lock Brakes System (ABS)	00002
	Airbag	00004

Notes:

1. Only the codes listed above are recognized as valid.
2. From m.y. 2002, the presence of an Automatic Transmission Control Module (TCM) is automatically detected by the On Board Diagnostic Data Bus Interface and therefore does not need to be coded separately.
3. Values in this column are added together where applicable to determine value. For example, if vehicle in question has ABS (00002) and airbag (00004), values are added together (00002 + 00004 = 00006) to get a value of 00006 for the code. If vehicle has all of the equipment listed, add all of the values together.
4. Access through Address Word 19.

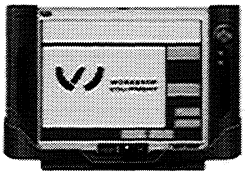
Radio and Sound System Coding Tables

Radio Head Unit Coding Variations[6], Premium IV and V, including Monsoon				
Designations	**Code Assembly Position[4,5]**			
	1 + 2	**3**	**4**	**5**
Sound Field Tuning[1]				
Golf and GTI	01			
Jetta	02			
Jetta Wagon (Variant)	03			
Radio/Speaker System				
Premium V - Monsoon		0		
Premium IV and V		4		
Sound System Correction[2]				
Premium IV and V, no correction			0	
Premium V - Monsoon, 2-door			3	
Premium V - Monsoon, 4-door			4	
Radio System Equipment Configuration[3]				
Without CD changer/player				1
With CD changer/player				3

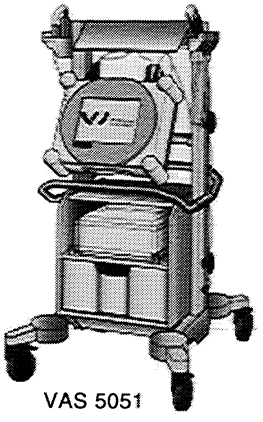
Notes:
1. Sound field tuning provides various frequency response characteristics that are matched to the vehicle interior volume.
2. Sound system correction provides various frequency response characteristics that are matched to the vehicle interior shape.
3. Sound system can have in-dash player or rear-mounted changer or both.
4. Code will be 5 digits. For example, a 4-door Jetta sedan with "Premium V Monsoon and CD changer is coded 02043.
5. Only select from the listed codes.
6. Access through Address Word 56.

Radio Head Unit Coding Variations[5], Premium VI, including Monsoon				
Designations	**Code Assembly Position[3,4]**			
	1 + 2	**3**	**4**	**5**
Radio System Control Configuration				
Without multi-function steering wheel	00			
With multi-function steering wheel	04			
Radio/Speaker System				
Premium VI - Monsoon		0		
Premium VI		4		
Sound System Correction[1]				
Premium VI, no correction			0	
Premium VI - Monsoon			3	
Radio System Equipment Configuration[2]				
Without CD changer/player				1
With CD changer/player				3

Notes:
1. Sound system correction provides various frequency response characteristics that are matched to the vehicle interior shape.
2. Sound system can have in-dash player or rear-mounted changer or both.
3. Code will be 5 digits. For example, a vehicle with multi-function steering wheel, Premium VI-Monsoon and CD changer is coded 04033.
4. Only select from the listed codes.
5. Access through Address Word 56.



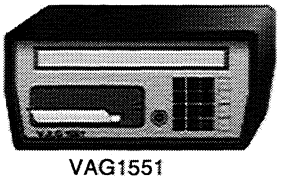
VAS 5052



VAS 5051



VAG 1552



VAG1551

0024463

BASIC SETTINGS

Throttle valve control module, adapting

The Engine Control Module (ECM) and the throttle valve control Module share data concerning engine operation. Under certain circumstances, data that is shared may be lost. The procedure for "teaching" or "reteaching" the ECM the various positions of the throttle valve control module is known as adaption or adaptation. This position data is stored in the ECM and remains stored. Adaptation data influences engine operation and is set at the time that the vehicle is new. In some circumstances, adaptation data can be lost and must be restored using the VAG 1551/1552, VAS 5051/5052 or equivalent, or an appropriate scan tool program to insure proper engine operation. Procedures differ slightly depending on engine management system version.

Engine codes: AWD, AWW, AWP, AVH, AZG, AFP

The following circumstances will cause the adaptation to be lost. It should be reset after completion of the following repairs:

- Throttle valve control unit removing and installing (replacement with new or used).
- Replacing or coding the Engine Control Module (ECM).
- The voltage supply is interrupted.

The following conditions must be observed prior to starting this procedure:

- No DTCs stored in memory.
- Battery voltage at least 11.5 volts
- All electrical consumers switched off.
- Throttle valve at idle position.
- Throttle not operated during procedure.
- Throttle valve must not be damaged, dirty or contaminated with carbon build up.
- Coolant temperature must be between 5°C and 95°C (AVH, AZG, 5°C and 110°C)
- Intake air temperature at least 6°C (AVH and AZG only).
- Cruise control (if installed) must be functional.

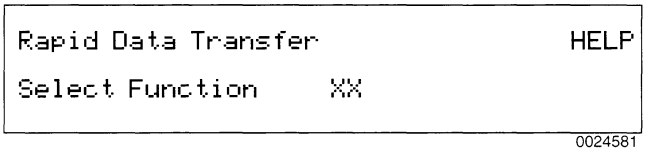
Adaptation can be initiated or restored using a suitable scan tool. Follow the scan tool manufacturer's instructions and/or use the procedure outlined below. Shown here is the display from the VAG 1551. Others scan tool displays are similar.

– Connect scan tool to DLC and switch on ignition, but **do not** start engine and **do not** depress accelerator pedal.

➢ Advance scan tool to address word menu and enter **01** for engine electronics.

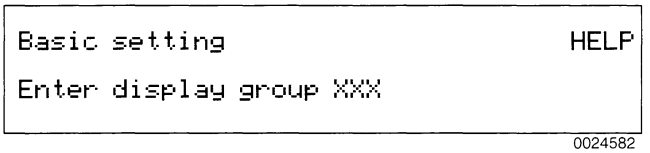
```
Rapid Data Transfer                HELP
Enter Address Word  XX
```

0024580



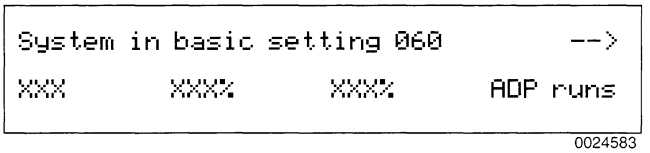
0024581

➢ Advance scan tool to function menu and enter **04** for basic setting.



0024582

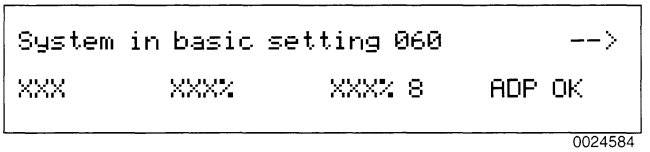
➢ Advance scan tool to display group menu and enter **060.**



0024583

➢ Advance scan tool until system confirms that it is in basic setting mode with four display fields as shown. Display field four should indicate that adaptation is running.

– Depress the **Q** button to confirm the display. During this time, the ECM switches off the voltage to the throttle valve control module to take a measurement and then switches back on to take additional measurements. Voltage will again be switched off allowing a spring to pull the throttle back to a previously measured position.



0024584

➢ At the conclusion of this procedure, the ECM will confirm proper stored values from the throttle position sensors in the throttle valve control module with the value in the fourth display field as shown. Display field three should show a value between 0 an 8. Display field four should indicate that adaptation is OK.

– Advance scan tool with **-->** button to function menu and enter **06** to end output.

– Switch off ignition to store values in ECM.

– Remove scan tool.

NOTE —
If display reads ADP ERROR, test conditions may not have been met or procedure was interrupted while running. Confirm proper test conditions and rerun procedure.

Engine code: BDF

Engine code BDF differs slightly from other version because old values must first be cleared. The adaptation should be reset after completion of the following repairs:

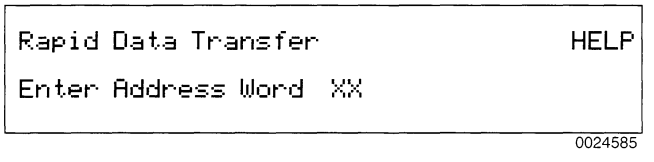
- Throttle valve control unit or ECM removing and installing (replacement with new or used).
- Replacing or coding the Engine Control Module (ECM).
- The voltage supply is interrupted.
- Malfunctioning components such as heated oxygen sensors or fuel injectors have been replaced.

The following conditions must be observed prior to starting this procedure:

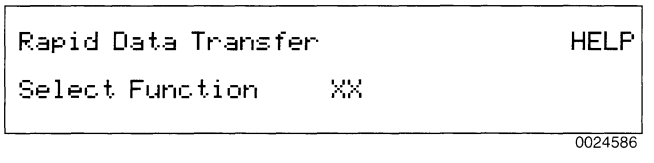
- No DTCs stored in memory.
- Battery voltage at least 11.5 volts
- All electrical consumers switched off.
- All fuses in fuse box OK.
- Transmission in **N** (**P** or **N** for automatic transmission)
- Throttle valve at idle position.
- Throttle not operated during procedure.
- Throttle valve must not be damaged, dirty or contaminated with carbon build up.
- Coolant temperature must be between 5°C and 110°C.

Adaptation can be initiated or restored using a suitable scan tool. Follow the scan tool manufacturer's instructions and/or use the procedure outlined below. Shown here is the display from the VAG 1551. Others scan tool displays are similar.

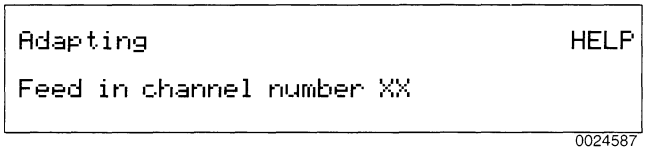
– Connect scan tool to DLC and switch on ignition, but **do not** start engine and **do not** depress accelerator pedal.



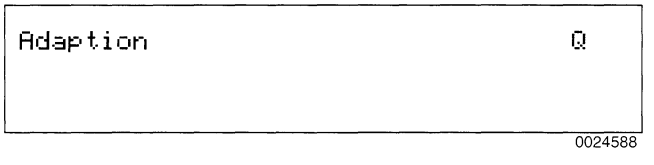
➤ Advance scan tool to address word menu and enter **01** for engine electronics.



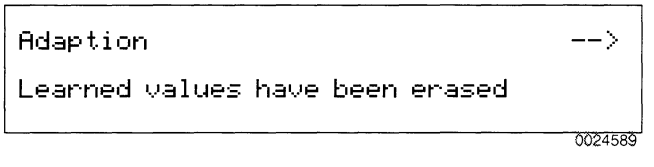
➤ Advance scan tool to function menu and enter **10** for Adaptation.



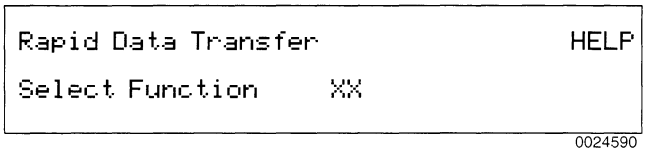
➤ Advance scan tool to channel number menu and enter **00.**



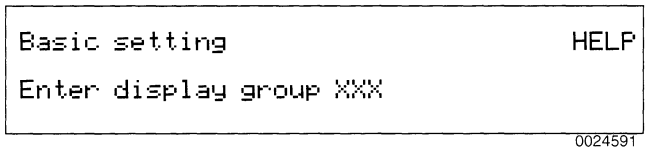
➤ Depress the **Q** button to confirm the display.



➤ Depress the **-->** button to return to the function menu.

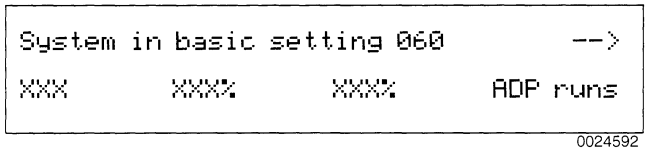


➤ At the function menu and enter **04** for basic setting.



0024591

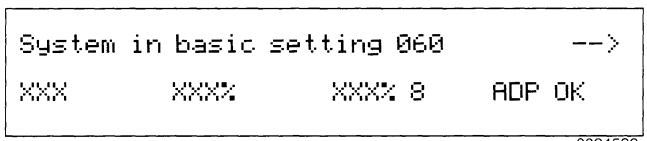
➤ Advance scan tool to display group menu and enter **060.**



0024592

➤ Advance scan tool until system confirms that it is in basic setting mode with four display fields as shown. Display field four should indicate that adaptation is running.

– Depress the **Q** button to confirm the display. During this time, the ECM switches off the voltage to the throttle valve control module to take a measurement and then switches back on to take additional measurements. Voltage will again be switched off allowing a spring to pull the throttle back to a previously measured position.



0024593

➤ At the conclusion of this procedure, the ECM will confirm proper stored values from the throttle position sensors in the throttle valve control module with the value in the fourth display field as shown. Display field three should show a value between 0 an 8. Display field four should indicate that adaptation is OK.

– Advance scan tool with **-->** button to function menu and enter **06** to end output.

– Switch off ignition to store values in ECM.

NOTE —
If display reads ADP ERROR, test conditions may not have been met or procedure was interrupted while running. Confirm proper test conditions and rerun procedure.

– Exit program and disconnect scan tool.

Engine code: AEG

The following circumstances will cause the adaptation to be lost. It should be reset after completion of the following repairs:

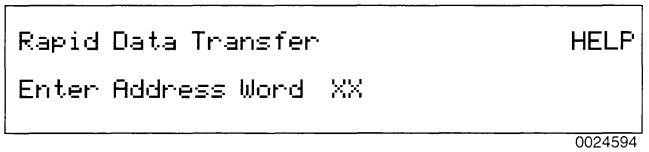
- Throttle valve control unit removing and installing (replacement with new or used).
- Replacing or coding the Engine Control Module (ECM).
- The voltage supply is interrupted.

The following conditions must be observed prior to starting this procedure:

- No DTCs stored in memory.
- Battery voltage at least 11.5 volts
- All electrical consumers switched off.
- Throttle valve at idle position.
- Throttle not operated during procedure.
- Throttle valve must not be damaged, dirty or contaminated with carbon build up.
- Cruise control (if installed) must be functional.

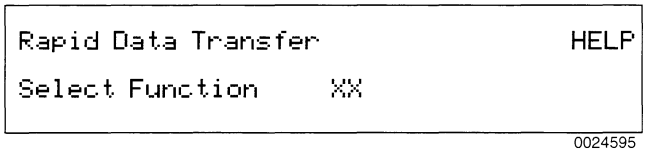
Adaptation can be initiated or restored using a suitable scan tool. Follow the scan tool manufacturer's instructions and/or use the procedure outlined below. Shown here is the display from the VAG 1551. Others scan tool displays are similar.

– Connect scan tool to DLC and switch on ignition, but **do not** start engine and **do not** depress accelerator pedal.



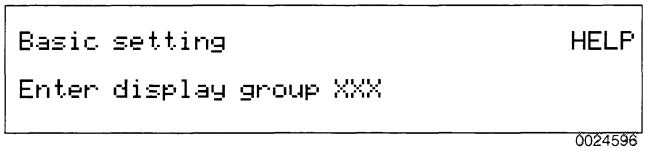
0024594

➤ Advance scan tool to address word menu and enter **01** for engine electronics.



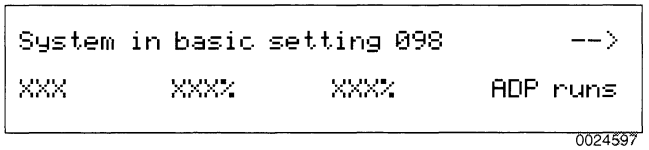
0024595

➤ Advance scan tool to function menu and enter **04** for basic setting.



0024596

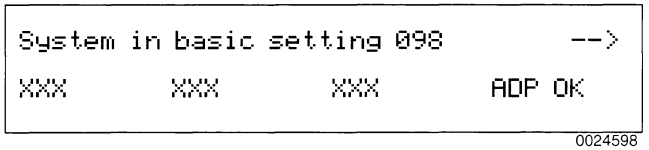
➤ Advance scan tool to display group menu and enter **098.**



0024597

➤ Advance scan tool until system confirms that it is in basic setting mode with four display fields as shown. Display field four should indicate that adaptation is running.

– Depress the **Q** button to confirm the display. During this time, the ECM switches off the voltage to the throttle valve control module to take a measurement and then switches back on to take additional measurements. Voltage will again be switched off allowing a spring to pull the throttle back to a previously measured position.



0024598

➤ At the conclusion of this procedure, the ECM will confirm proper stored values from the throttle position sensors in the throttle valve control module with the value in the fourth display field as shown. Display field four should indicate that adaptation is OK.

– Advance scan tool with **-->** button to function menu and enter **06** to end output.

– Switch off ignition to store values in ECM.

– Remove scan tool.

NOTE —

If display reads ADP ERROR, test conditions may not have been met or procedure was interrupted while running. Confirm proper test conditions and rerun procedure.

Transmission control module, adapting

The Transmission Control Module (TCM) and the Engine Control Module (ECM) share data concerning engine and transmission operation. Data that the TCM may not always precisely "know" is throttle range and full throttle position. The acquisition of this data is known as basic setting. The basic setting influences automatic transmission shifting and is set at the time that the vehicle is new.

The basic setting will be lost and should be initiated after completion of the following repairs:

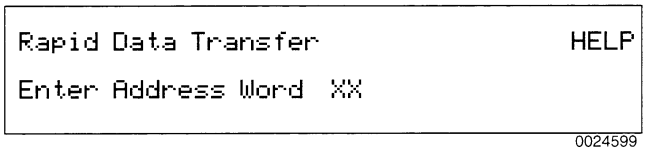
- Engine removing and installing (replacement).
- Transmission removing and installing.
- Replacing or coding the Engine Control Module (ECM).
- Replacing the Transmission Control Module (TCM).
- Removing, installing, adjusting, and/or replacing electronic throttle components at pedal or throttle housing.
- If the battery is disconnected or runs down.
- If the TCM is disconnected.

In these circumstances, the basic settings must be restored to insure proper automatic transmission operation.

Basic settings, initiating

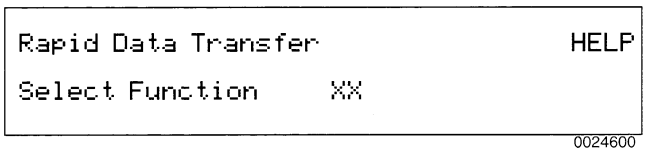
Basic settings can be initiated or restored using a suitable scan tool. Follow the scan tool manufacturer's instructions and/or use the procedure outlined below. In either case, the kickdown switch on the accelerator cable (where applicable) must function properly. Shown here is the display from the VAG 1551. Others scan tool displays are similar.

– Connect scan tool to DLC and switch **on** ignition, but **do not** start engine.



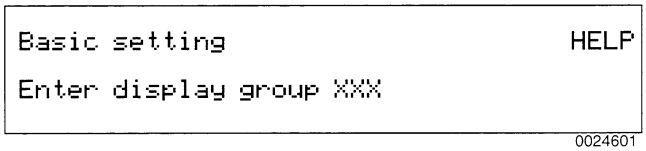
0024599

➤ Advance scan tool to address word menu and enter **02** for transmission electronics.



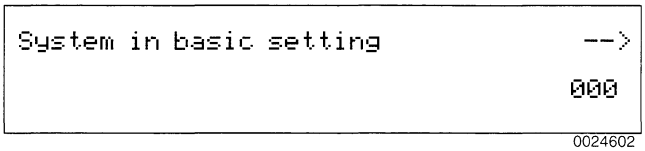
0024600

➤ Advance scan tool to function menu and enter **04** for basic setting.



0024601

➤ Advance scan tool to display group menu and enter **000.**



0024602

➢ Advance scan tool until system confirms that it is in basic setting mode as shown.

– Push accelerator pedal all the way to the floor (past kick-down) and hold it there for a minimum of 3 seconds.

NOTE —
Most scan tools and scan tool programs will not confirm completion of basic settings by any on-screen display.

– Release accelerator pedal.

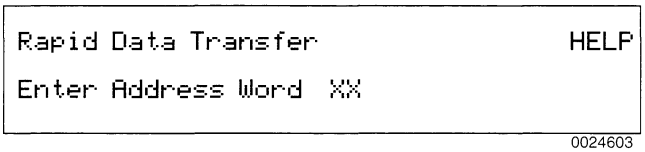
– Exit program and disconnect scan tool.

– Switch off the ignition.

Kick-down point, adapting

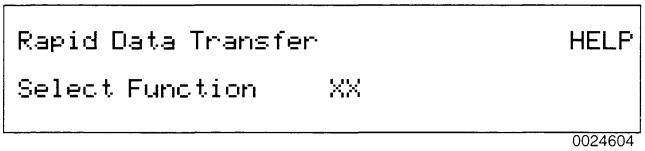
Following replacement of the engine control module or the accelerator pedal, vehicles with automatic transmissions must relearn the kick-down point.

– Connect scan tool to DLC and switch **on** ignition, but **do not** start engine.



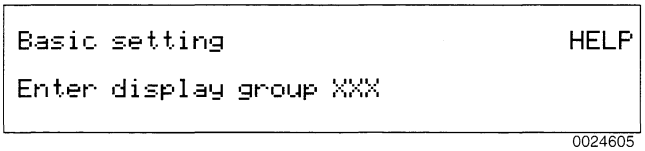
0024603

➢ Advance scan tool to address word menu and enter **02** for transmission electronics.



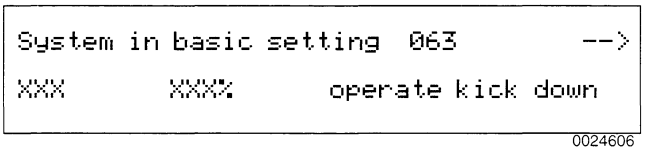
0024604

➢ Advance scan tool to function menu and enter **04** for basic setting.



0024605

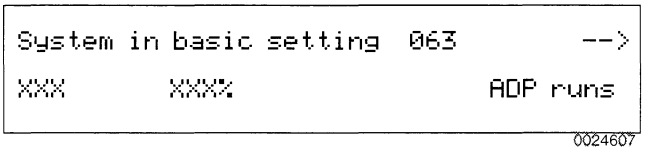
➢ Advance scan tool to display group menu and enter **063.**



0024606

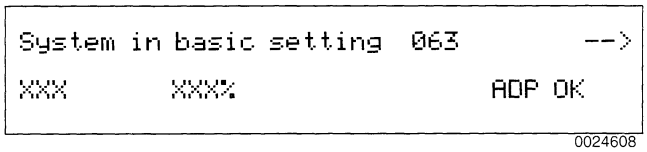
➢ Advance scan tool until system confirms that it is in basic setting mode as shown.

– Depress the accelerator pedal fully to the floor so that the kickdown detent is pushed. Hold in this position for a minimum of 10 seconds.



0024607

➢ During this procedure, the ECM will confirm operation as shown.



At the conclusion of this procedure, the ECM will confirm proper stored values as shown. Display field four should indicate that adaptation is OK.

- Advance scan tool with --> button to function menu and enter **06** to end output.
- Switch off ignition to store values in ECM.
- Remove scan tool.

NOTE —

If display reads ADP ERROR, test conditions may not have been met or procedure was interrupted while running. Confirm proper test conditions and rerun procedure.

V.A.G. 1551/1552 OPERATING OVERVIEW FLOW CHART

MODE MENU

1 - Rapid Data =>
2 - Blink Code
3 - Self Test
4 - Dealership Code
5 - LT - Diagnosis

ADDRESS WORDS MENU (V9+)

01 - Engine Electronics =>
11 - Engine Electronics II
41 - Diesel Pump Electronics
51 - Electric Drive
61 - Battery Control
71 - Battery Charger
02 - Transmission Electronics
12 - Clutch Electronics
22 - 4 Wheel Drive Electronics
03 - Brake Electronics
13 - Distance Control
33 - OBD II
14 - Suspension Electronics
24 - Anti - Slip Control
34 - Level Control
44 - Steering Assist
54 - Rear Spoiler
15 - Airbag
25 - Anti-Theft Immobilizer Sensor
35 - Central Locking
45 - Interior Monitor
55 - Headlamp Vert. Aim Control
65 - Tire Pressure Monitoring
75 - Telematics
16 - Steering Wheel Electronics
26 - Automatic Roof Control
36 - Seat Adjustment Driver's Side
46 - Comfort System (AC CM)
56 - Radio
66 - Seat & Mirror Adjustment
76 - Parking Aid
17 - Instrument Cluster
37 - Navigation System
47 - Sound System
57 - Airbag (Cabriolet only)
67 - Language Control
08 - A/C & Heating Electronics
18 - Auxiliary Heater
38 - Roof Electronics
09 - Electronic Control Module
19 - Diagnostic Interface for Data Bus
29 - Left Light Control
39 - Right Light Control
49 - Auto Light Switch
00 - Automatic Test Sequence

FUNCTIONS MENU

01 - Check Control Module Versions
02 - Check DTC Memory
03 - Output Diagnostic Test Mode
04 - Basic Setting
Display Group xxx =>
05 - Erase DTC Memory
06 - End Output
07 - Code Control Module
08 - Read Measuring Value Block
Display Group xxx =>
09 - Read Individual Measuring Values
Channel xx
10 - Adaptation
Channel xx
11 - Log-In Procedure
15 - Readiness Code

DISPLAY GROUP FORMAT

Display Group 000 (only)
xx xx xx xx xx xx xx xx xx xx

Display Group 001 (and higher)
xxxxx xxxxx xxxxx xxxxx

R32 Supplement

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GENERAL

The Rabbit GTI was the original "pocket rocket," mating a powerful selection of engines to a lightweight chassis. The current GTI remains a great sports car, with the R32 model taking the "more explosive power in a small package" theme up a notch with 20% more power and a host of luxury sports car features.

Engine Code

- BJS . . . . . 3.2L 6-cylinder gasoline

The 2004 R32 ("R" = Racing) is the most powerful Golf to date, thanks to a new and very responsive 240 hp 3.2-liter V6 engine which delivers 236 lb/ft of torque at 2800 to 3200 rpm. Volkswagen's 4Motion all-wheel drive system ensures complete and efficient use of all this power, with most of the R32's peak torque being delivered at less than 3000 rpm. A 6-speed manual transmission with overdrive is standard. The Volkswagen R32 was available for the 2004 model year in the North American market.

The publisher has developed this supplement with the R32 owner/enthusiast in mind. It is designed to provide some basic service information to help maintain your R32. For more detailed information consult the ***Volkswagen R32: 2004 Official Factory Repair Manual*** available on CD-ROM or via web subscription at www.bentleypublishers.com.



Engine

Volkswagen's 3.2L 15-degree VR6 four-valve engine is a an evolution of the compact and proven 2.8L VR6 engine. Horsepower was increased from 200 to 237 hp, while torque increased from 195 to 236 lb/ft at just 2800 to 3200 rpm. The increased engine capacity was achieved by extending piston stroke (81.0 to 84.0 mm) and increasing the size of the cylinder bore (90.3 to 95.9 mm). The compression ratio was also increased from 10.5:1 to 11.25:1. To make best use of this increased displacement, the entire intake system was redesigned to improve torque and power. This was done by altering the flow geometry of the plastic intake manifold and the ducts in the cylinder head.

The 3.2L VR6's valves are actuated by roller rocker fingers with hydraulic clearance compensation. Oil fed adjusters provide continuous adjustment of the inlet and exhaust camshafts, 52 degrees for the intake side and 22 degrees for the exhaust cam. Variable valve timing overcomes the limitations of static valve timing by altering the points in the four-stroke cycle when the valves open and close. This allows the engine to produce higher torque through a wider rpm range.

The 3.2L engine software was adapted to improve response characteristics and to take full advantage of the dual-pipe exhaust system with its two catalytic converters. There is also a vacuum operated exhaust flap in the rear silencer that produces a powerful engine sound in keeping with the performance qualities of the 3.2L VR6 engine.

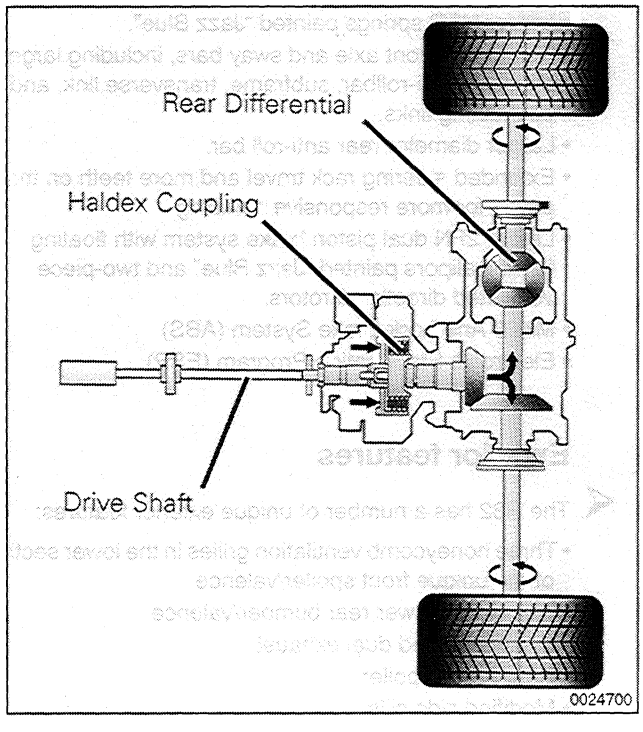
Technical Data - 3.2L Engine (code: BJS)

- Type . 6-cylinder compact inline V-arrangement (VR)
- Displacement . . . . . 3.2L (195 cubic inches)
- Bore . . . . . 84.0 mm
- Stroke . . . . . 95.9 mm
- V-angle . . . . . 15°
- Compression ratio 11.25:1
- Power . . . . . 177kW (240 hp) @6,200 rpm
- Torque . . . . . 320 Nm (236 lb-ft) @3,200 rpm
- Fuel requirement . . . . Gasoline, Premium Unleaded
- Engine management . . . . . Bosch Motronic ME 7.1

Transmission

The 6-speed all wheel drive (4Motion) 02Y manual transmission features closer spaced gear ratios, shorter shift travel, and a modified selector fork and selector rod. This combination ensures that the engine is always in its maximum torque curve while also ensuring quicker, more responsive shifts in every gear.

The transverse drivetrain R32 uses a different 4Motion system than that on other Volkswagen all wheel drive models. A high-performance Haldex clutch is used at the rear axle to allocate power as needed.



The Haldex coupling is mounted on the rear axle differential and is driven by the drive shaft. Engine torque is transmitted to the drive shaft through the gearbox, the front axle differential, and the front axle drive. The drive shaft is connected to the input shaft of the Haldex couplling. In the Haldex coupling, the input shaft is separated from the output shaft to the rear axle differential. Torque can only be transmitted to the rear axle differential when the Haldex coupling clutch plates are engaged.

With the Haldex coupling, slip is no longer the decisive factor in the distribution of drive forces. The car's dynamic state is also a factor. The Haldex control module monitors the ABS wheel speed sensors and the engine control module (accelerator pedal signal) via the CAN-bus. This data provides the engine control module with all the information it needs on road speed, cornering, coasting or traction mode, and can respond optimally to any driving situation.

Characteristics of the Haldex coupling:

- Permanent all-wheel drive with electronically controlled multi-plate clutch
- Front drive characteristic
- Quick response
- No strain on clutch when parking and maneuvering vehicle
- Compatible with different tires
- No restrictions on towing with the rear axle on the ground
- Fully integrated with systems such as:
  -Anti-Lock Brake System (ABS)
  -Electronic Differential Lock (EDL)
  -Anti-slip Regulation (ASR)
  -Electronic Brake Distribution system (EBD)
  -Electronic Stabilization Program (ESP)

Suspension and Brakes

Technical highlights

- MacPherson suspension struts and lower wishbones at the front.
- New independent 4-link rear suspension with forged dual-link trailing arms and Bilstein rubber vibration dampers that accommodate the 4Motion all-wheel drive system.
- Larger H&R springs painted "Jazz Blue".
- Reinforced front axle and sway bars, including large diameter anti-rollbar, subframe, transverse link, and connecting links.
- Larger diameter rear anti-roll bar.
- Extended steering rack travel and more teeth on the pinion for more responsive handling
- Larger 2FN dual piston brake system with floating frame calipers painted "Jazz Blue" and two-piece ventilated directional rotors.
- MK60 Anti-Lock Brake System (ABS)
- Electronic Stabilization Program (ESP)



Exterior features

The R32 has a number of unique exterior features:

- Three honeycomb ventilation grilles in the lower section of the unique front spoiler/valence
- Larger and lower rear bumper/valence
- Chrome tipped dual exhaust
- Rear hatch spoiler
- Modified side sills
- A ride height 20 mm lower than a standard Golf and 10 mm lower than the GTI VR6
- 15-spoke "OZ Aristo" racing-design 18-inch alloy wheels with wheel locks
- R32 badges on the radiator grille and tailgate



Vehicle Identification Number (VIN)

The vehicle year and model can be determined from the VIN or the identification plate. The VIN (Chassis number) (**arrow**) is located on the instrument panel on the driver's side and is visible from the outside through the windshield. See **Foreword** in the front of this manual for detailed VIN information.

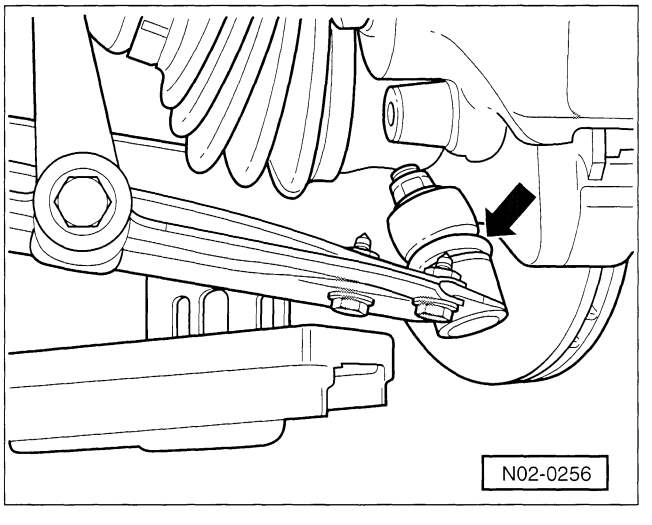
- Position #4 (4th digit from left) of the VIN will have a "K" for the R32 series designation.

MAINTENANCE

This section covers specific maintenance procedures that are relative for the R32 model special equipment. For overall vehicle maintenance, please see **0 Maintenance**.

WARNING —

- *Read all **Warnings** and **Cautions** in the beginning of this manual before starting any repair procedures.*
- *Disconnect battery ground (GND) strap from battery negative (–) terminal before doing any work on electrical components or wiring.*
- *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using a VAG 1551/1552 or equivalent scan tool.*



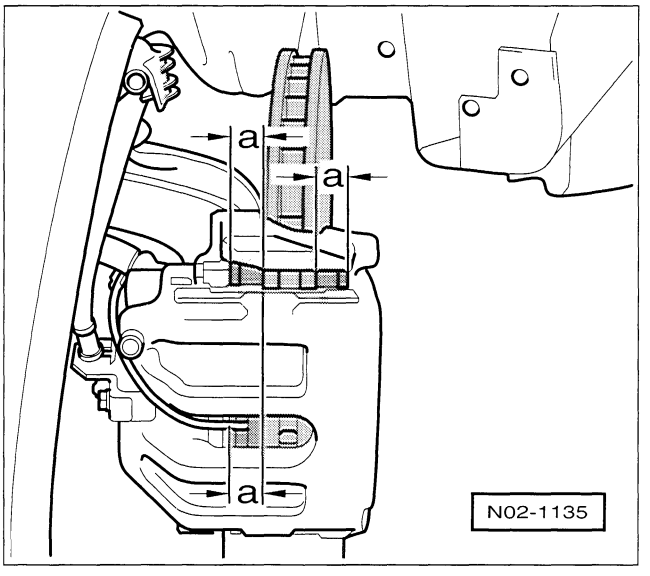
Ball joints, checking

Check ball joint boots (**arrow**) for leaks and damage.

– Check ball joints for axial play (vertical movement) and radial play (side-to-side movement).

NOTE —

- *There should be no perceptible play when checking ball joints.*
- *Take into account possible wheel bearing play or upper suspension bushing play when checking ball joints.*



Brake pads, checking

Front brakes

– Lift vehicle and remove front wheels. See **0 Maintenance**.

Measure inner and outer pad thickness (**a**). Replace before pad thickness reaches wear limit. See **Suspension and Brakes**, given later for front brake pad replacement procedure.

Specification

- Front brake pads, wear limit, (not including backing plate) . . . . . .2 mm (5/64 in.)

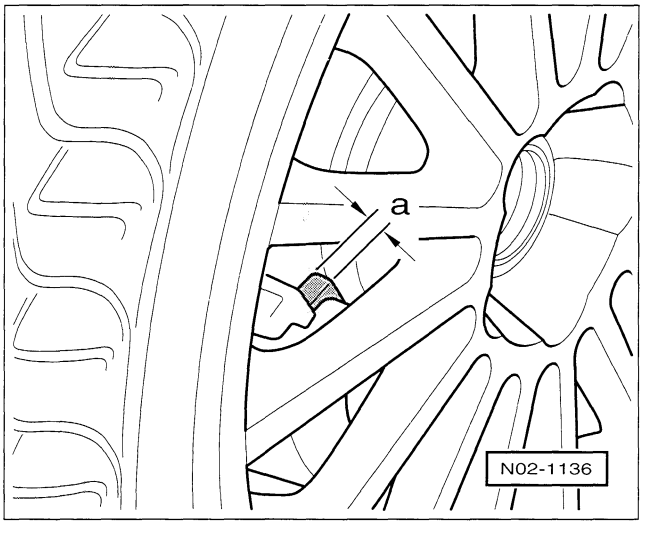
Rear brakes

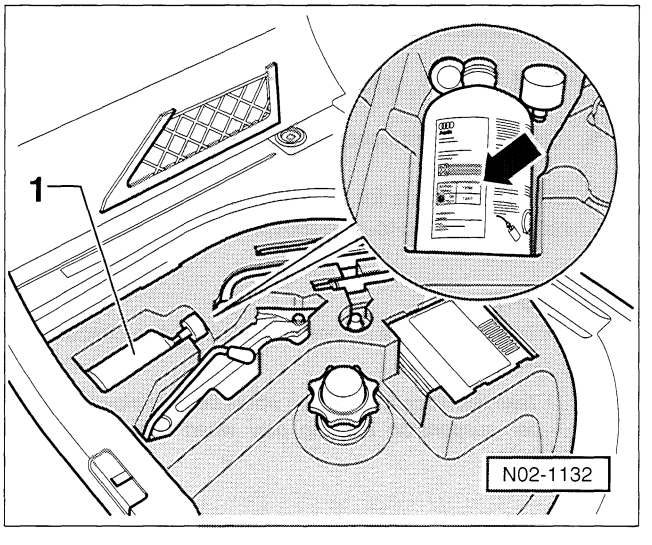
– Lift vehicle and remove rear wheels. See **0 Maintenance**.

Measure inner and outer pad thickness (**a**). Replace before pad thickness reaches wear limit. See **46 Brakes–Mechanical Components** for rear brake pad replacement procedure.

Specification

- Rear brake pads, wear limit, (not including backing plate) . . . . . .2 mm (5/64 in.)





Breakdown set, replacing tire sealant

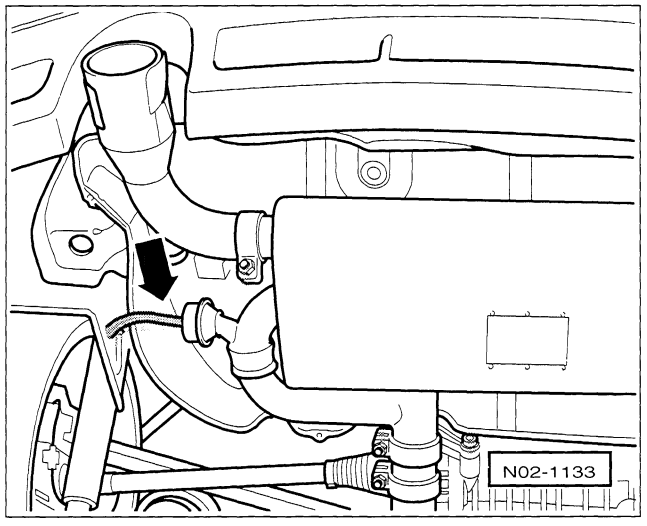
R32 models do not have a spare tire. There is a breakdown set in the luggage compartment with a spare tire sealant.

Replace spare tire sealant (**1**) if:

- Printed expiration date has passed
- Tire sealant is more than 3 years old
- Tire sealant has been used once

NOTE —

Observe waste disposal regulations for tire sealant.

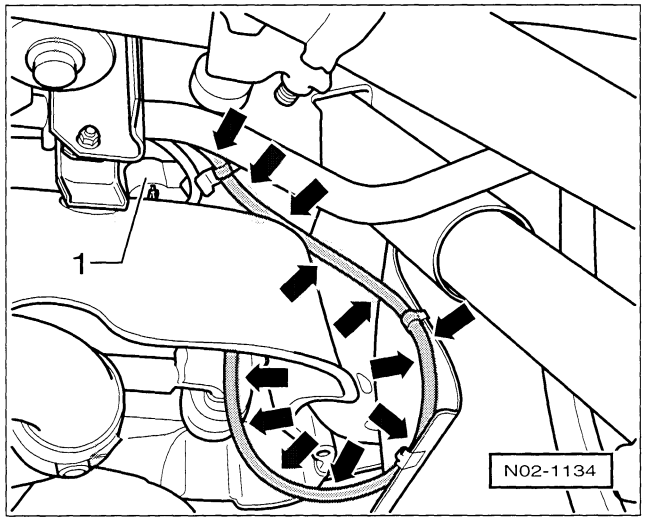


Exhaust system, checking

R32 models have an exhaust flap with a vacuum servo (**arrow**) attached to the rear muffler of the exhaust system. The exhaust flap is controlled by the exhaust flap valve 1 (N321).

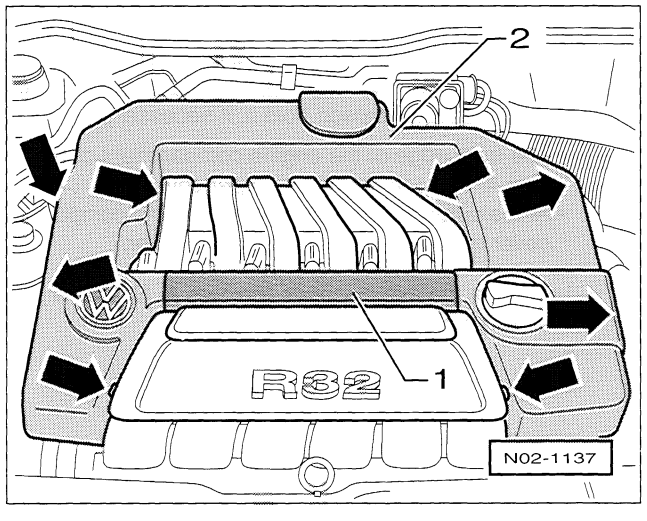
NOTE —

Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*



Check the vacuum line (**arrows**) at exhaust flap valve (**1**) for proper routing and damage (i.e. tears, abrasions, porosity). Replace vacuum line if damage is found.

– Inspect exhaust system for leaks or damage. Inspect exhaust system mounts. Replace missing, damaged or deteriorated components.

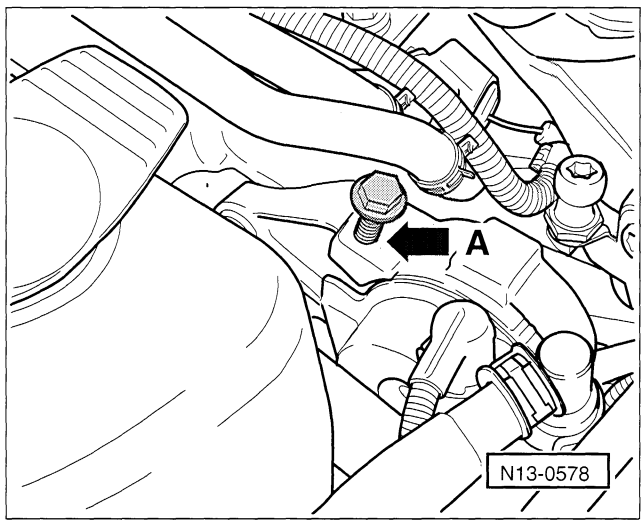


Ribbed V-belt, removing and installing

Unclip and remove cover (**1**) for wiring guides. Remove engine cover (**2**) by pulling upward at the indicated points (**arrows**).

– Remove right side lower sound insulation panel, see **0 Maintenance** if necessary.

– Mark running direction of ribbed V-belt if re-installing.



➤ Relieve tension from ribbed belt by threading an M8 x 50mm bolt into hole (**arrow A**) of ribbed belt tensioner.

NOTE —
Only thread bolt in far enough to relieve belt tension and remove belt, otherwise the tensioner housing unit can be damaged.

– Remove ribbed V-belt.

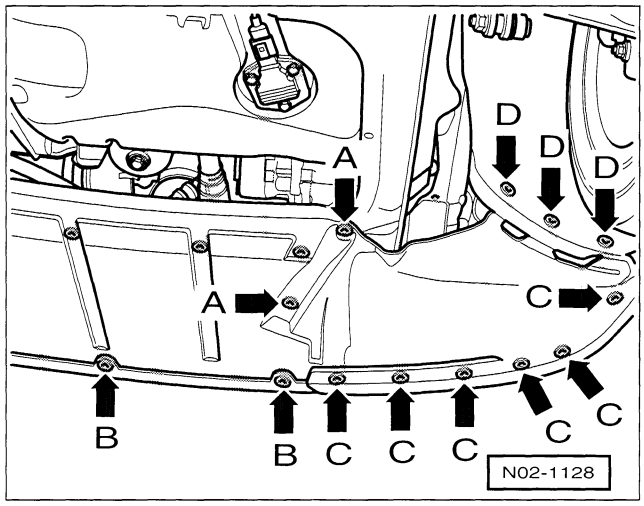
– Install in reverse order of removal, noting the following:

- Before installing belt, make sure that generator (alternator), air conditioning compressor and power steering pump are secured tightly.
- Make sure to install used belt in direction of rotation and that belt is seated correctly in pulleys.

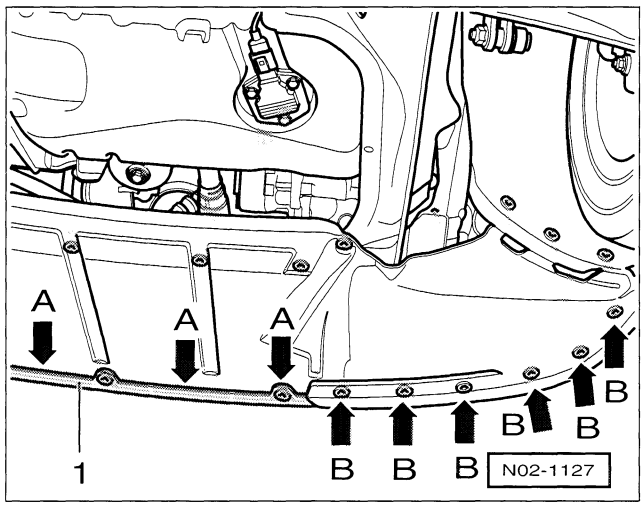
– Start engine and check belt running.

Sound absorber panels, removing

NOTE —
The following illustration shows the right side of the engine compartment cover. The fastening of the left side is the same but reversed.



➤ Remove screws (**arrows**) and remove center engine compartment cover.

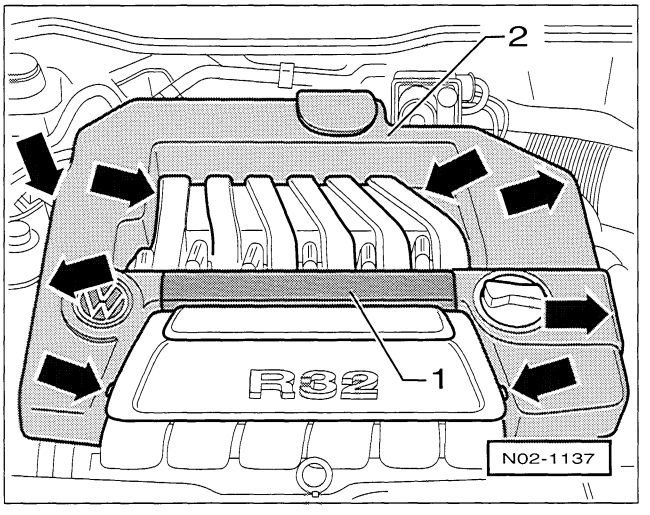


➤ To install, set the front edge of the engine compartment cover (**arrow A**) on the edge of the bumper cover (**1**) and push in. Then push the engine compartment cover up and let a second person hold it, if necessary.

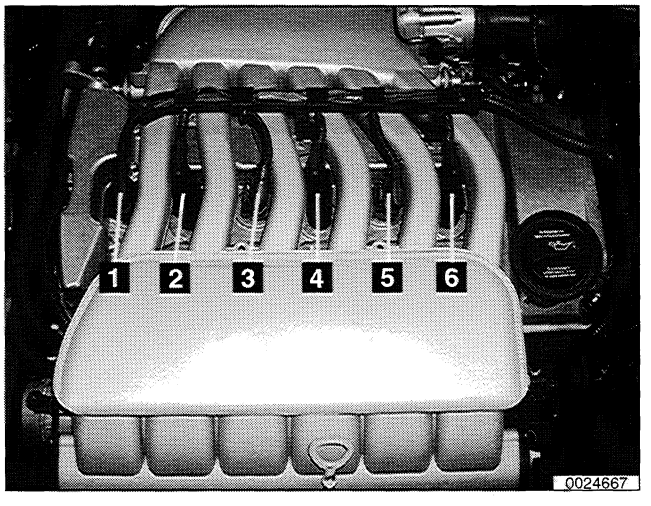
- The front edge of the engine compartment cover (**arrow A**) must rest on the bumper cover (**1**).
- At the outer edges (**arrow B**) the engine compartment cover must rest under the bumper cover.

– Install the mounting screws (**arrows A, B, C** and **D**), on the respective sides.

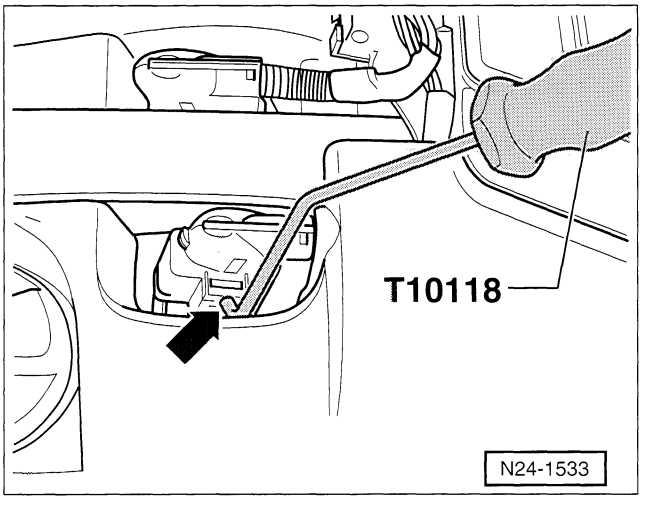
Spark plugs, replacing



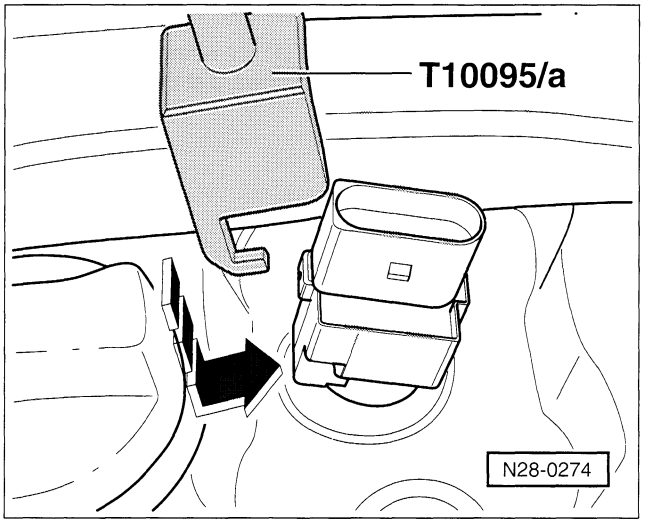
- Unclip and remove cover (**1**) for wiring guides. Remove engine cover (**2**) by pulling upward at the indicated points (**arrows**).



- Label connectors for ignition coils at each spark plug.

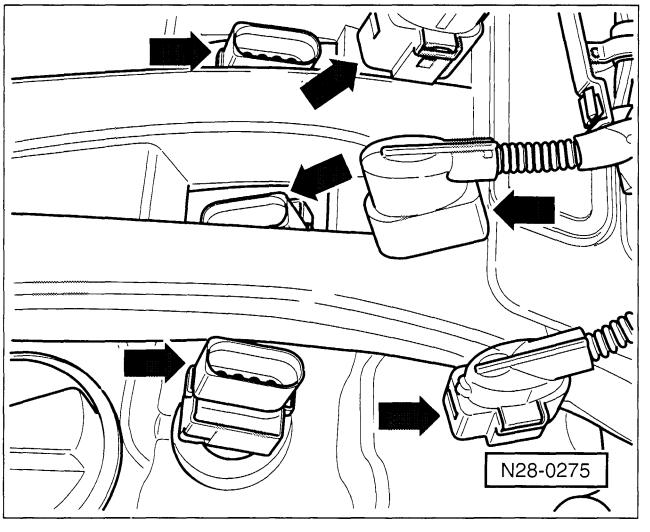


- Unlock each ignition coil connector using special tool T10118. Place tool on connector locating device (**arrow**) and carefully pull connector off.

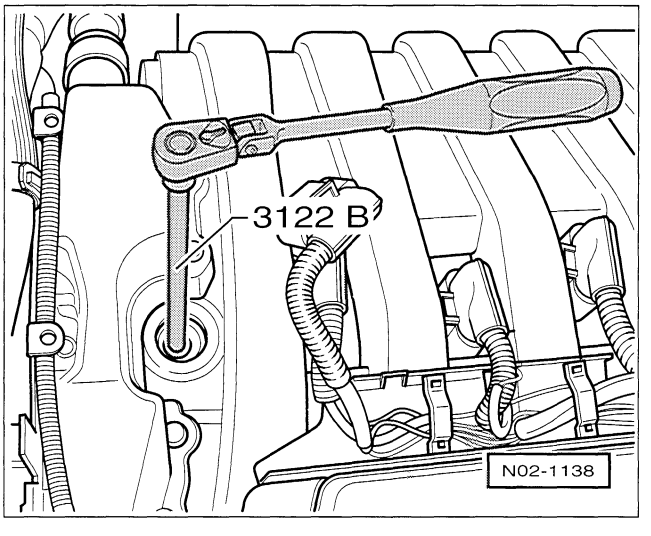


➤ Push ignition coil removal tool, T10095/a, onto coil from straight side of connector, in the direction of **arrow**.

– Pull the ignition coil up perpendicularly and remove.



➤ Before removing coils, observe the installed positions of the ignition coil connectors (**arrows**). The straight side of the connectors must fit to the straight side of the ignition coils.



➤ Remove spark plugs with VAS 3122B or 16mm spark plug socket and socket wrench with extension.

– Install new spark plugs in reverse order of removal.

Specification

- Spark plugs, 3.2L engine (R32 models)
  Volkswagen part number . . . . . 101 905 606 A
  Manufacturer designation. . . . . IZK R7B
  Electrode gap. . . . . max. 1.1.mm (0.043 in.)
- Tightening torque . . . . . 20 Nm (15 ft-lb)

Table a. 2004 m.y., 3.2L engine, maintenance schedule

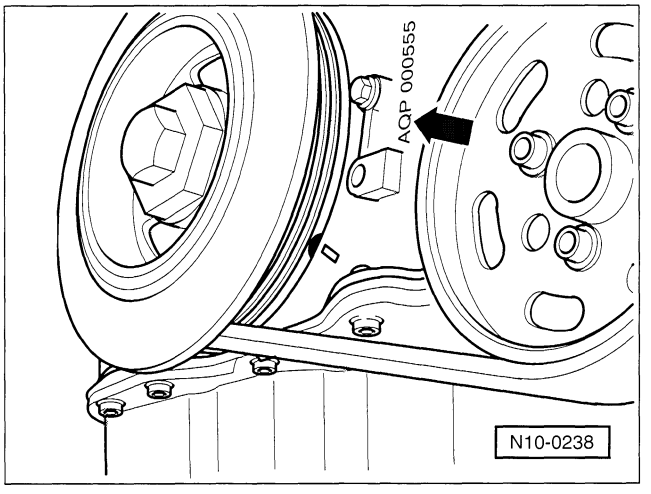
3.2 Liter VR6 Engine:

Miles (in thousands)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Kilometers (in thousands)	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168
Engine: change engine oil and oil filter	•	•		•		•		•		•		•		•		•		•		•	
Windshield washer fluid: check level; add if necessary		•		•		•		•		•		•		•		•		•		•	
Haldex clutch: Change oil.								•								•					
Brake system: check for damage/leaks, brake pad thickness, brake fluid level		•		•		•		•		•		•		•		•		•		•	
Wheels: rotate front to rear		•		•		•		•		•		•		•		•		•		•	
Engine: check for leaks				•				•				•				•				•	
Dust & pollen filter: replace (where applicable)				•				•				•				•				•	
Battery: check		•		•				•		•		•		•		•		•		•	
Cooling system: check coolant level; add if necessary				•				•				•				•				•	
Tires/spare wheel: check condition and pressure				•				•				•				•				•	
Manual transmission: check oil level; add if necessary; check for leaks				•				•				•				•				•	
Drive shafts: check boots				•				•				•				•				•	
On-Board Diagnostic system: check fault memory; erase if necessary				•				•				•				•				•	

Miles (in thousands)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Kilometers (in thousands)	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168
Door check straps: lubricate				•				•				•				•				•	
Exhaust system: check for damage & leaks				•				•				•				•				•	
Front axle: check dust seals on ball joints and tie rod ends; check tie rods				•				•				•				•				•	
Headlights: check & adjust if necessary				•				•				•				•				•	
Air cleaner: replace filter								•								•					
Sunroof frame: clean and lubricate				•				•				•				•				•	
Timing belt: check																•					
Timing belt: replace																					•
Timing belt tensioner: replace																					•
V-belt/ribbed belt: check								•								•					
Spark plugs: replace								•													
Power steering: check fluid level								•								•					
Road Test: check kickdown, braking, steering, heating and ventilation, air conditioning, power accessories and electrical systems				•				•				•				•				•	
Every 12 months, regardless of mileage (kilometers): Perform visual check on Airbag system.																					
Every 2 years, regardless of mileage (kilometers): Change brake fluid.																					

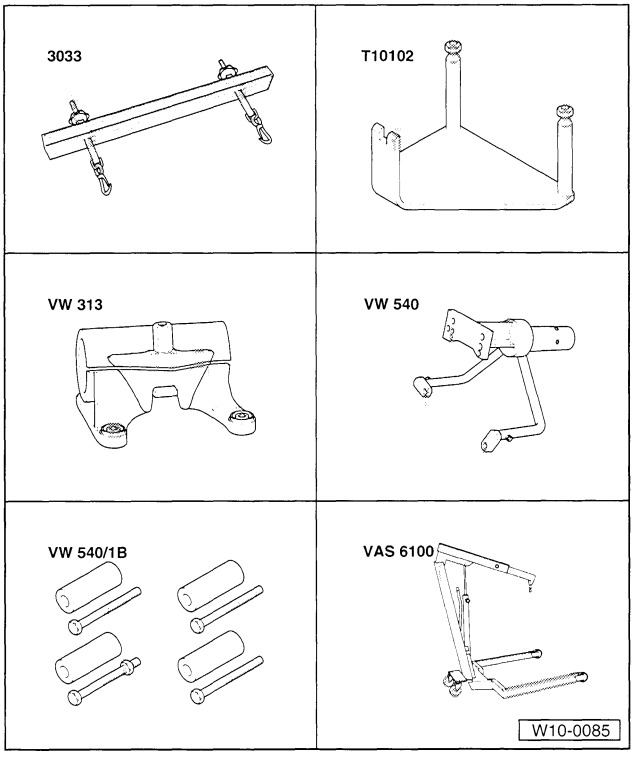
ENGINE

Engine number



The engine code and serial number (**arrow**) are located next to the vibration damper on the cylinder block under the coolant pump. There is also a sticker affixed to the intake manifold with the engine code and serial number. The engine code is also included on the vehicle data plate. See **0 Maintenance** for information on vehicle identification plates and labels.

Engine, removal and installation special tools



Removal of the 3.2L engine requires a number of special tools (some of them are shown at left). This procedure is best left to an authorized Volkswagen service facility.

For detailed engine removal and installation procedures please consult our Official Factory Repair manual for R32 models, available on CD-ROM or via web subscription at www.bentleypublishers.com or by contacting the publisher.

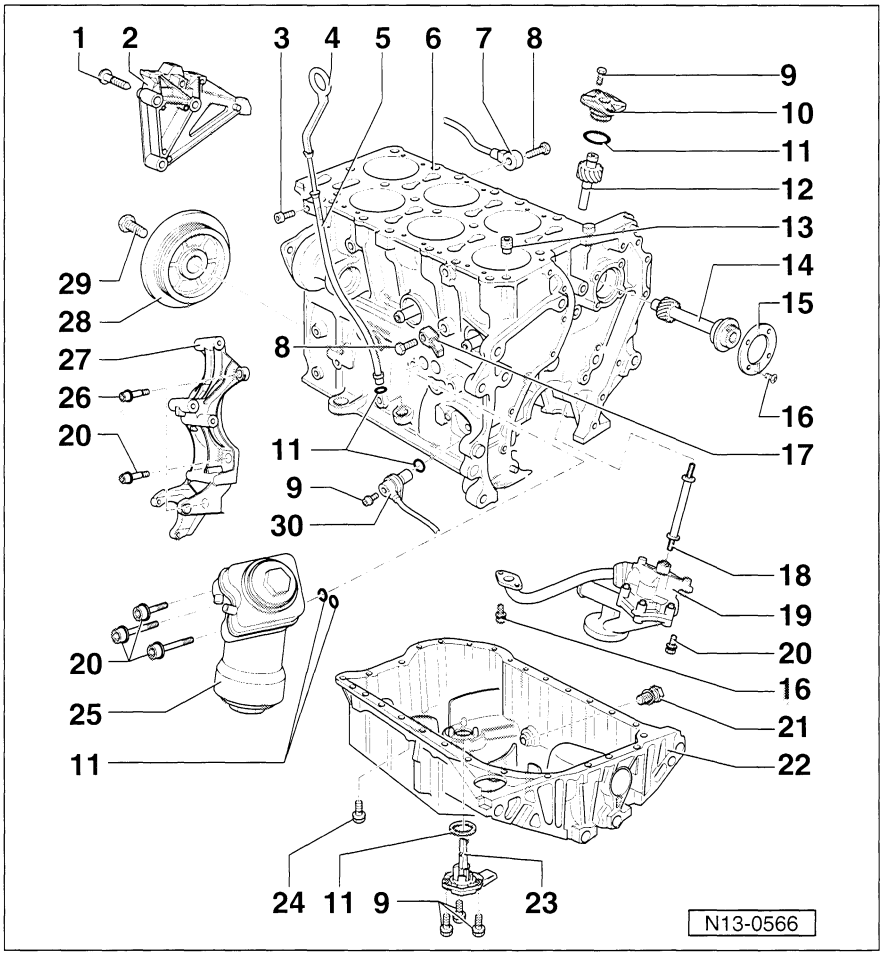
NOTE —

Many components of the 3.2L R32 engine are also common to the 2.8L (code: BDF) engine. Sections **13d Crankshaft/Cylinder Block (6-Cylinder)** *and* **15d Cylinder Head and Valvetrain (2.8L Engine)** *have more detailed information for cylinder block, head and valvetrain disassembly. However, the best resource for more information is the R32 Official Factory Repair manual available on CD-ROM or via web subscription at www.bentleypublishers.com.*

Cylinder block assembly

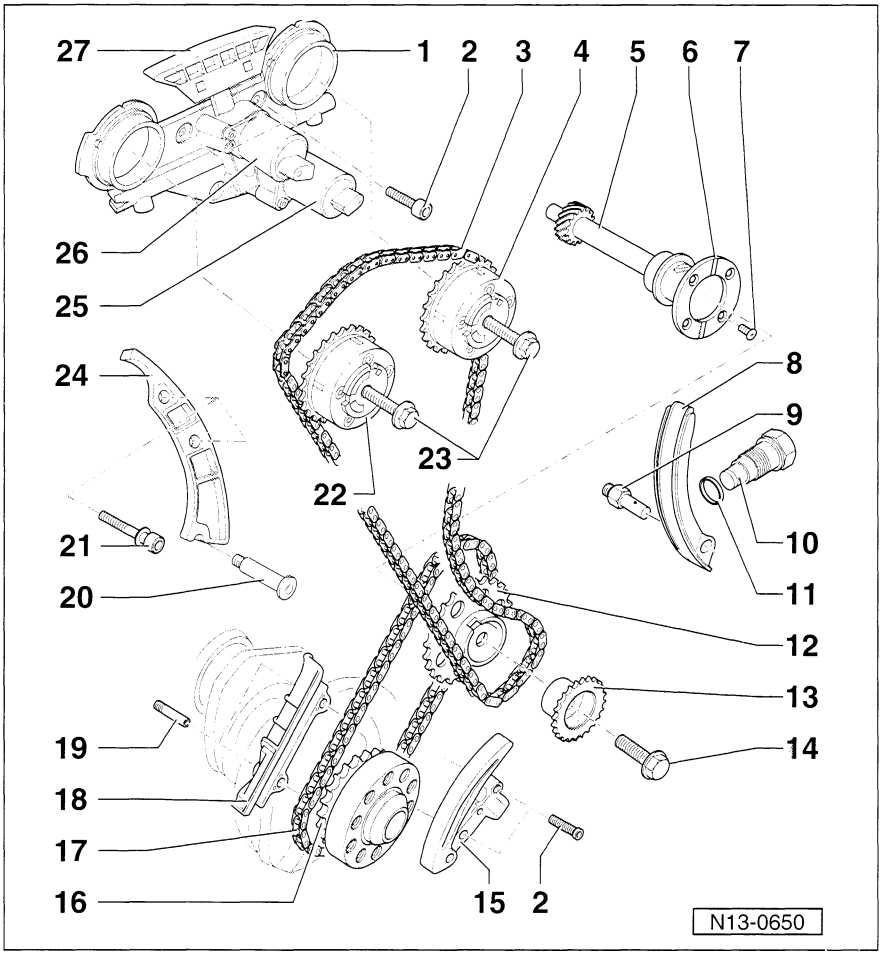
NOTE —

- *If during engine repairs, metal shavings or large quantities of small metal particles are found in the engine oil, the oil passages in the cylinder block must be thoroughly cleaned out and the oil cooler replaced.*
- *Volkswagen identifies electrical components by a letter and/or a number in the electrical schematics. See* **97 Wiring Diagrams, Fuses and Relays**. *These electrical identifiers are listed in parenthesis as an aid to electrical troubleshooting.*



1. **Bolt**
   - Tighten to 45 Nm (33 ft-lb)
2. **Engine bracket**
3. **Bolt**
   - Tighten to 5 Nm (44 in-lb)
   - Fastened to intake manifold
4. **Dipstick**
   - Oil level must not be above the max. mark!
5. **Guide tube**
   - For dipstick
   - Secured to intake manifold
6. **Cylinder block**
7. **Knock sensor 1 (KS1) (G61)**
   - Located between cylinders 1 and 3 on engine block
8. **Knock sensor mounting bolt**
   - Tighten to 20 Nm (15 ft-lb)
   - Torque setting influences the function of knock sensor
9. **Oil pump mounting bolt**
   - Tighten to 10 Nm (7 ft-lb)
10. **Oil pump drive cover**
11. **O-ring**
    - Always replace
    - Oil before assembling
12. **Oil pump drive**
13. **Oil non-return valve**
    - Tighten to 5 Nm (44 in-lb)
    - Note installation position
    - Clean if badly soiled
14. **Intermediate shaft**
15. **Thrust washer**
16. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
    - Install with locking fluid "D6"
17. **Knock sensor 2 (KS2) (G66)**
    - Located between cylinders 4 and 6 on engine block
18. **Oil pump drive shaft**
19. **Oil pump**
    - Coat oil pressure line at cylinder block and oil pump housing with sealing compound AMV 188 001 02
20. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
21. **Oil drain plug**
    - Tighten to 30 Nm (22 ft-lb)
    - Replace seal
22. **Oil pan**
23. **Oil level thermal sensor (G266)**
24. **Oil pan mounting bolt**
    - Tighten to 12 Nm (9 ft-lb)
25. **Oil filter housing**
26. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
27. **Compact bracket**
    - For generator (alternator), air conditioning compressor, and power steering pump
28. **Vibration damper**
29. **Vibration damper mounting bolt**
    - 100 Nm (74 ft-lb) + ¼ turn (90°)
    - Always replace
    - Use counter-holder T10069 to hold vibration damper while loosening and tightening bolt
30. **Engine speed (RPM) sensor (G28)**

Chain drive assembly

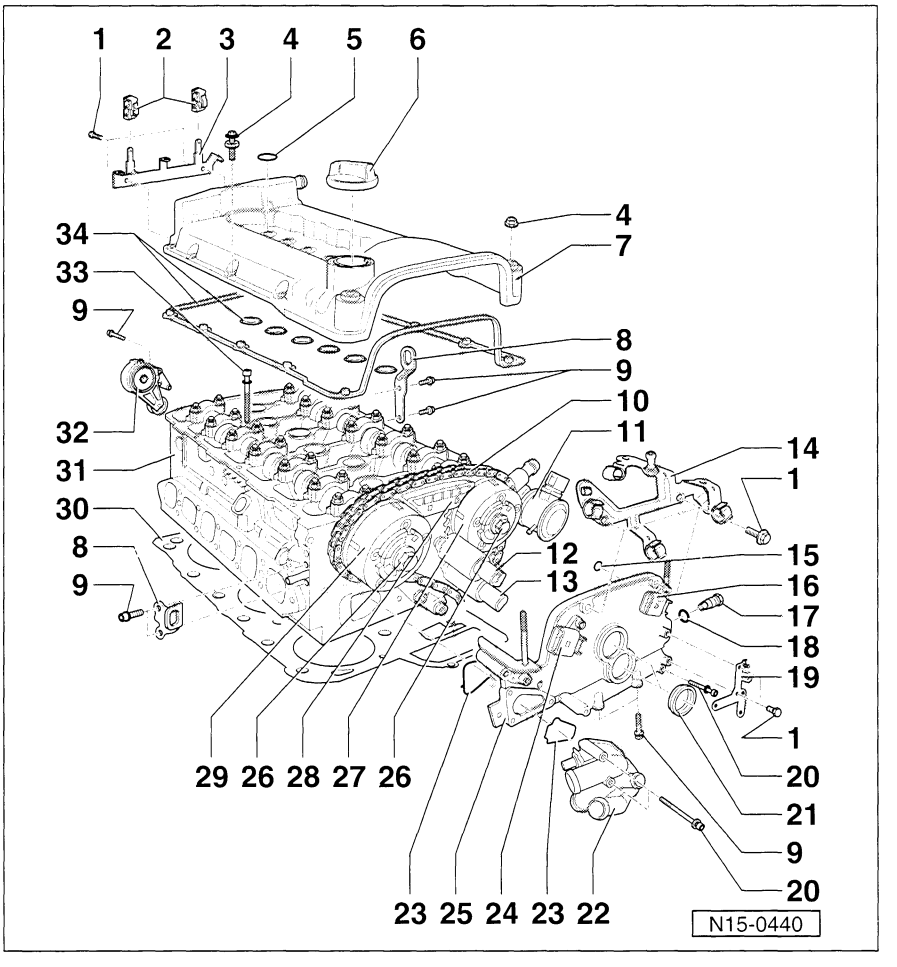


1. **Control housing**
   - Lightly lubricate contact surfaces of oil seals before installing
   - Before installing control housing strainer, check housing screen for contamination
2. **Bolt**
   - Tighten to 8 Nm (71 in-lb)
   - Always replace
3. **Camshaft roller chain**
   - Mark direction of rotation before removing
4. **Exhaust camshaft adjuster**
   - Identification: 32A
   - Only rotate engine with camshaft adjuster installed
5. **Intermediate shaft**
6. **Thrust washer**
7. **Screw**
   - Tighten to 8 Nm (71 in-lb)
   - Install with locking fluid D 000 600 A2
8. **Tensioning rail**
   - For camshaft roller chain
9. **Pivot pin,**
   - Tighten to 18 Nm (13 ft-lb)
10. **Chain tensioner**
    - Tighten to 40 Nm (30 ft-lb)
    - For camshaft roller chain
    - Only rotate engine with chain tensioner installed
11. **Oil seal**
    - Replace if damaged or leaking
12. **Chain sprocket**
    - For lower roller chain
13. **Chain sprocket**
    - For camshaft roller chain
14. **Bolt**
    - Tighten to 60 Nm (44 ft-lb) + ¼ turn (90°)
    - Always replace
    - Use counter-holder tool T10069 to hold sprocket while tightening and loosening bolt
15. **Chain tensioner and rail**
    - Before installation release locking device in chain tensioner with a small screwdriver and press tensioning plate against chain tensioner
    - Only rotate engine with chain tensioner installed
16. **Drive gear**
    - Integral part of crankshaft
    - Ground down tooth aligned with main bearing joint = TDC cyl. 1

    NOTE —

    See **15d Cylinder Head and Valvetrain (2.8L engine)** *for information on valve timing.*
17. **Roller chain (lower)**
    - Mark direction of rotation before removing
18. **Guide rail**
    - Remove and install together with roller chain
19. **Locating pin without collar**
    - Tighten to 10 Nm (7 ft-lb)
    - For guide rail
20. **Bolt**
    - Tighten to 18 Nm (13 ft-lb)
21. **Bolt**
    - Tighten to 23 Nm (17 ft-lb)
22. **Intake-camshaft adjuster**
    - Identification: 24E
    - Only rotate engine with camshaft adjuster installed
23. **Bolt**
    - Tighten to 60 Nm (44 ft-lb) + ¼ turn (90°)
    - Always replace
    - Contact surface of sender wheel must be dry around bolt head when assembling
    - To remove and install, counter-hold at camshaft using an open-end wrench (32 mm)
24. **Guide rail**
    - For camshaft roller chain
25. **Camshaft adjustment valve 1 (exhaust) (N318)**
    - Before disconnecting, mark connector and component
26. **Camshaft adjustment valve 1 (intake) N205**
    - Before disconnecting, mark connector and component
27. **Guide rail**
    - For camshaft roller chain
    - Clipped in at control housing

Cylinder head assembly



1. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
2. **Bracket for fuel lines**
3. **Mounting frame**
4. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
   - With spacer sleeve and seal
   - Replace seal if damaged
5. **O-ring**
   - Replace if damaged
   - Oil before assembling
   - For ignition coil with power output stage
6. **Sealing cap**
   - Replace gaskets if damaged
7. **Cylinder head cover**
   - Replace if damaged
8. **Lifting eye**
9. **Bolt**
   - Tighten to 23 Nm (17 ft-lb)
10. **Camshaft roller chain**
    - Mark direction of rotation
11. **Combi-valve**
12. **Camshaft adjustment valve 1 (intake) (N205)**
    - Before disconnecting, mark connector and component
13. **Camshaft adjustment valve 1 (exhaust) (N318)**
    - Before disconnecting, mark connector and component
14. **Bracket for wiring**
15. **O-ring**
    - For oil channel seal
    - Replace
    - Oil before assembling
16. **Camshaft position (CMP) sensor 2 (exhaust) (G163)**
    - Before disconnecting, mark connector and component
17. **Chain tensioner**
    - Tighten to 40 Nm (30 ft-lb)
    - For camshaft roller chain
    - Only rotate engine with chain tensioner installed
18. **Oil seal**
19. **Bracket for wiring**
20. **Bolt**
21. **Oil seal**
    - For N205
    - Replace if damaged or leaking
22. **Coolant thermostat housing**
23. **Oil seal**
    - Always replace
24. **Camshaft Position (CMP) sensor (intake) (G40)**
    - Before disconnecting, mark connector and component
25. **Cover**
    - Can be removed and installed with engine installed
26. **Bolt**
    - Tighten to 60 Nm (44 ft-lb) + ¼ turn (90°), always replace
    - Contact surface of sender wheel must be dry around bolt head when assembling
    - To remove and install, counterhold at camshaft using an open-end wrench (32 mm)
27. **Exhaust camshaft adjuster**
    - Identification: 32A
    - Only rotate engine with camshaft adjuster installed
28. **Guide rail**
    - For camshaft roller chain
    - Clipped in at control housing
29. **Intake-camshaft adjuster**
    - Identification: 24E
    - Only rotate engine with camshaft adjuster installed
30. **Cylinder head gasket**
    - Metal gasket
    - Always replace
31. **Cylinder head**
    - Check cylinder head for distortion
32. **Tensioning element**
    - For ribbed belt
33. **Cylinder head bolt**
    - Always replace
    - Observe installation instructions and sequence when loosening and tightening, see **15d Cylinder Head and Valvetrain (2.8L Engine)**
34. **Seal for cylinder head cover**
    - Replace if damaged or leaking
    - Note installation position

Engine lubrication system

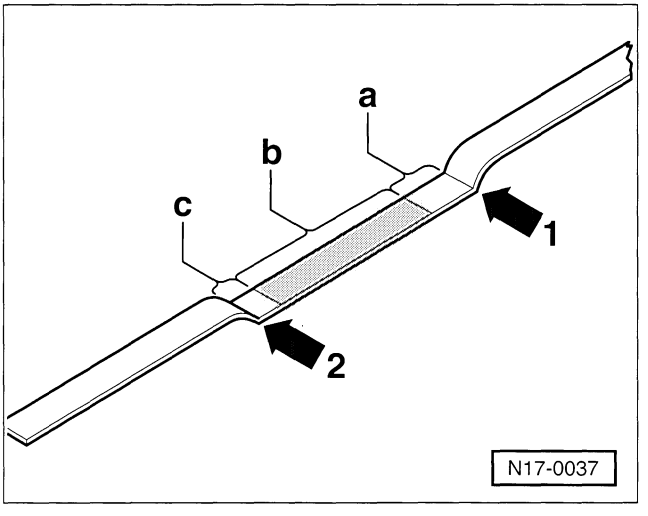
NOTE —

If when repairing an engine, metal shavings or a large quantity of small metal particles are found, this could indicate that the crankshaft and connecting rod bearings are damaged. To prevent consequential damage perform the following repairs:

- *Thoroughly clean oil passages*
- *Replace oil check valve*
- *Replace oil spray jets*
- *Replace oil cooler*
- *Replace oil filter*

NOTE —

The various components of the engine lubrication system can be found earlier in this section, see **Cylinder block assembly**.



The oil level must not be above the max. mark on the engine oil dipstick. Damage to the catalytic converter could result from too much oil.

- **1** - Max. mark
- **2** - Min. mark
- **a** - Area above hatched field up to Max. mark: Do not top up with engine oil!
- **b** - Oil level within hatched field: Can be topped up with engine oil
- **c** - Area from Min. mark up to hatched field: Top up with max. 0.5 Liter of engine oil!

Use "long life" engine oil in compliance with VW standard 503 00. See **0 Maintenance** for more information on oil and oil change procedures.

Specification

- Oil system capacity (with filter). 5.5 liters (5.8 quarts)

Oil pressure specifications

NOTE —

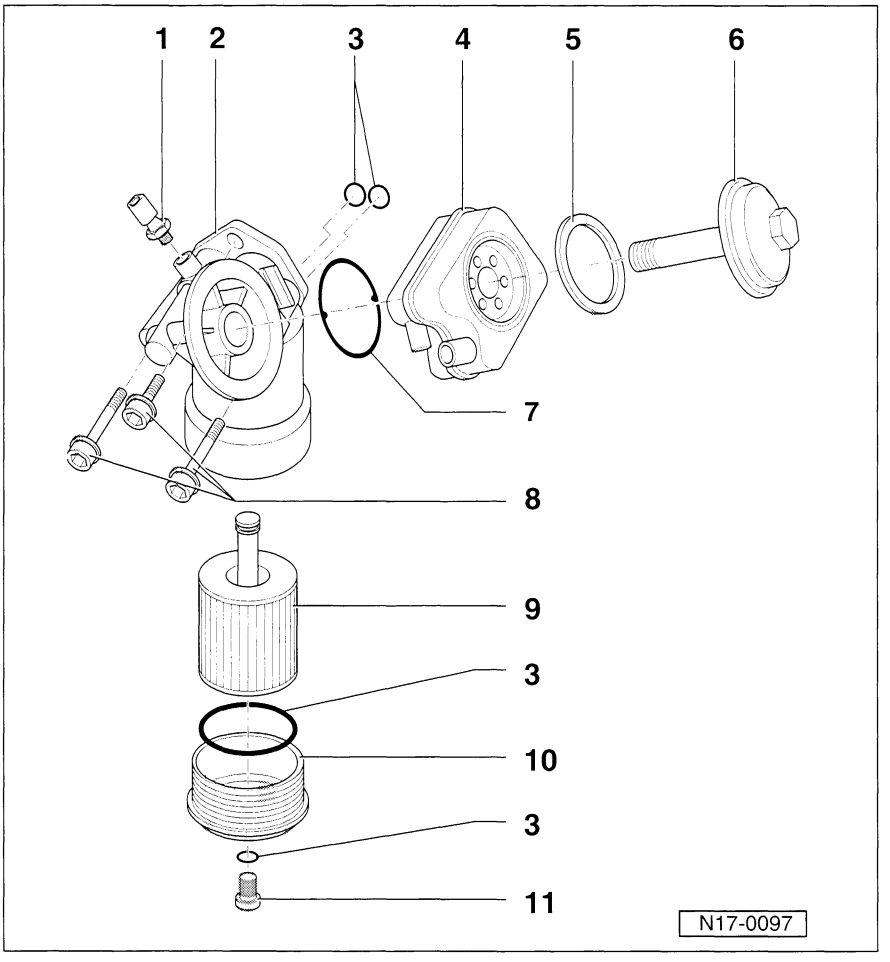
See **17 Engine–Lubrication System** *for engine oil pressure system and switch testing procedures.*

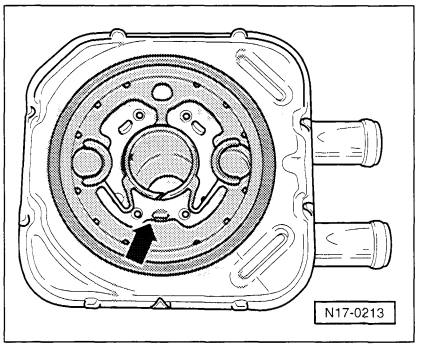
Oil pressure specifications

- **Oil pressure at 80°C (176°F):**
  1500 rpm . . . . . .1.7 bar (25 psi)
  2000 rpm . . . . . 3.0 to 5.5 bar (43 to 80 psi)
- **Oil pressure maximum:**
  3.2L R32 engine. . . . . .7.0 bar (102 psi)

Oil filter assembly

1. **1.4 bar oil pressure switch (F1)**
   - Tighten to 20 Nm (15 ft-lb)
   - Black
   - If sealing ring is leaking cut open and replace.
2. **Oil filter housing**
   - With check valve, opening pressure: 0.05 bar (0.7 psi)
3. **O-ring**
   - Always replace
   - Oil before assembling
4. **Oil cooler**
   - Ensure sufficient clearance to surrounding components
   - Coat all contact surfaces outside of the oil seal with sealing compound AMV 188 001 02
5. **Oil seal**
   - Always replace
   - Oil before assembling
6. **Oil cooler cover**
   - Tighten to 25 Nm (18 ft-lb)
7. **O-ring**
   - Insert into oil cooler before installing, see **Oil cooler gasket, installing** below
   - Always replace
   - Oil before assembling
8. **Mounting bolts**
   - Tighten to 23 Nm (17 ft-lb)
9. **Oil filter element**
   - Observe change intervals
10. **Oil filter lower part**
    - Tighten to 25 Nm (18 ft-lb)
    - Drain before removing
    - With bypass valve, opening pressure: 2.5 bar (36 psi)
11. **Oil drain plug**
    - Tighten to 10 Nm (7 ft-lb)





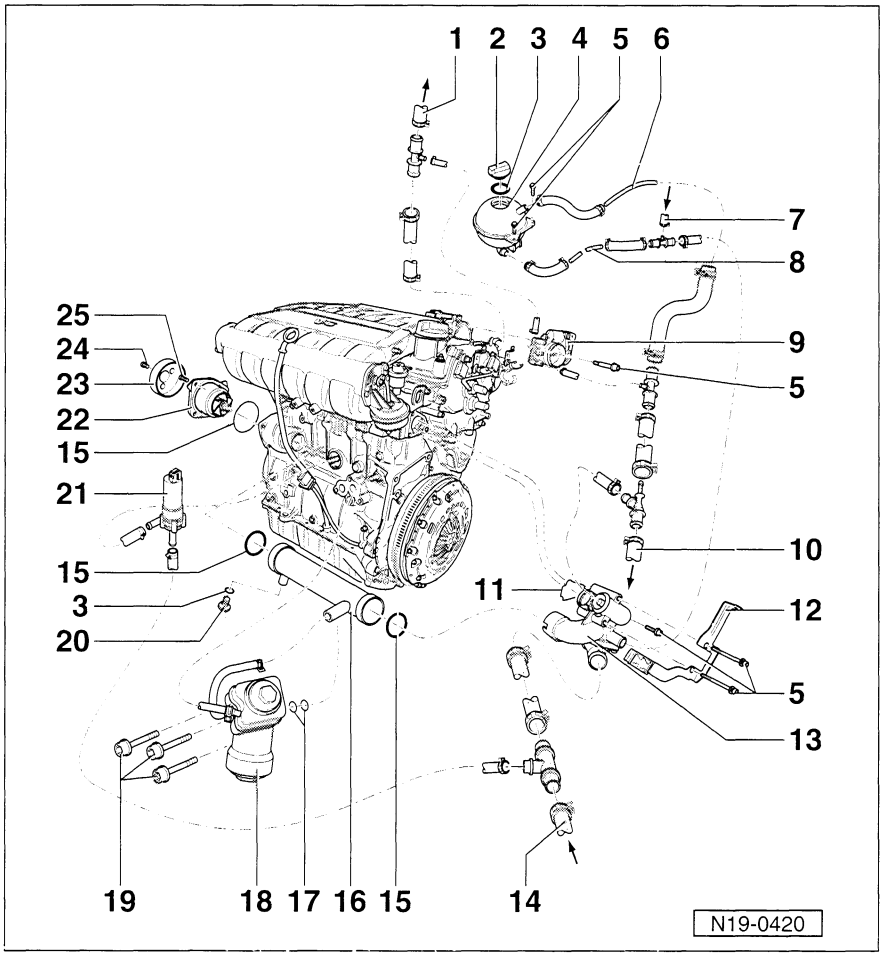
Oil cooler gasket, installing

- Before installing moisten O-ring with clean engine oil. Press valve into channel by hand.
- Install oil-soaked gasket in oil cooler as illustrated. Observe installation location (**arrow**).

Cooling system components

NOTE —

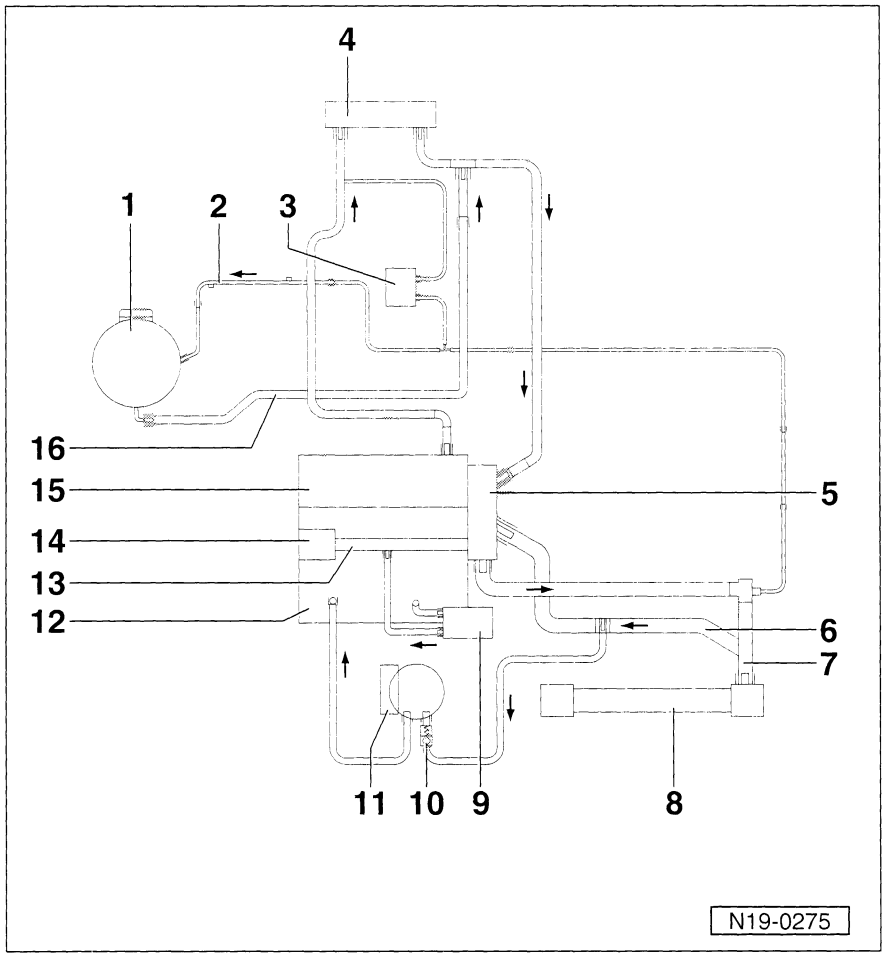
- *When the engine is warm the cooling system is under pressure. If necessary release pressure before commencing repair work.*
- *Hoses are secured with spring-type clamps. Replace only with spring-type clamps.*
- *The pliers VAS5024A or VAG 1921 are recommended for installing spring-type clips.*
- *When installing coolant hoses route stress-free, so that they do not come into contact with other components (observe markings on coolant connection and hose).*
- *Perform cooling system leakage test with cooling system tester VAG1274 and the adapters VAG1274/8 and VAG1274/9.*
- *See* **19 Engine–Cooling System** *for 6-cylinder cooling system components, testing and procedures not covered here.*



1. **To heat exchanger**
2. **Sealing cap**
   - Check with cooling system tester V.A.G1274 and adapter V.A.G1274/9
   - Pressure relief valve must open at a pressure of 1.4 - 1.6 bar (20 - 23 psi)
3. **O-ring**
   - Replace if damaged
4. **Reservoir**
5. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
6. **Upper coolant line**
   - Clipped to bulkhead
7. **From heat exchanger**
8. **Lower coolant line**
   - Fastened at intake manifold support and shield
9. **Throttle valve control module**
   - Coolant heated
10. **To upper radiator**
11. **Oil seal**
    - Always replace
12. **Bracket**
13. **Coolant thermostat housing**
    - Same as 2.8L VR6 housing
14. **From lower radiator**
15. **O-ring**
    - Always replace
16. **Coolant line**
17. **O-ring**
    - Always replace
    - Oil before assembling
18. **Oil filter housing**
    - With oil cooler
19. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
20. **Sealing plug**
21. **After-run coolant pump (V51)**
    - Fastened to cylinder block with bracket
22. **Coolant pump**
    - Note installed position
    - Check for ease of movement
    - If damaged or leaking replace completely
23. **Pulley**
    - For coolant pump
24. **Bolt**
    - Tighten to 20 Nm (15 ft-lb)
    - Use water pump wrench VAG1590 to loosen and tighten
25. **Bolt**
    - Tighten to 8 Nm (71 in-lb)

Coolant hose diagram

1. Reservoir
2. Upper coolant line
3. Throttle valve control module
4. Heater unit heat exchanger
5. Coolant thermostat housing
6. Lower coolant hose
7. Upper coolant hose
8. Radiator
9. Oil cooler
10. Non-return valve
11. After-run coolant pump (V51)
12. Cylinder block
13. Coolant line
    - Between coolant pump and thermostat housing
14. Coolant pump
15. Cylinder head
16. Lower coolant line



FUEL SUPPLY, INJECTION, IGNITION AND EXHAUST

WARNING —

- *For safety reasons, fuse No. 28 must be removed from fuse holder before opening fuel system as fuel pump can be activated by door contact switch in driver's door.*
- *Fuel supply lines are under pressure! Before opening the system place a cloth around the connection. Then release pressure by carefully pulling hose off connection.*
- *Always observe the following when removing and installing the sender for fuel gauge or the Fuel Pump (FP) from full or partially filled fuel tanks: Before starting work, switch on an exhaust extraction system and place the extraction hose close to the sensor installation opening of the fuel tank to extract escaping fuel fumes. If no exhaust extraction system is available, a radial fan (as long as the motor is not in the air flow) with a displacement greater than 15m^3/h can be used.*
- *Prevent fuel from contacting skin! Wear fuel-resistant gloves!*

NOTE —

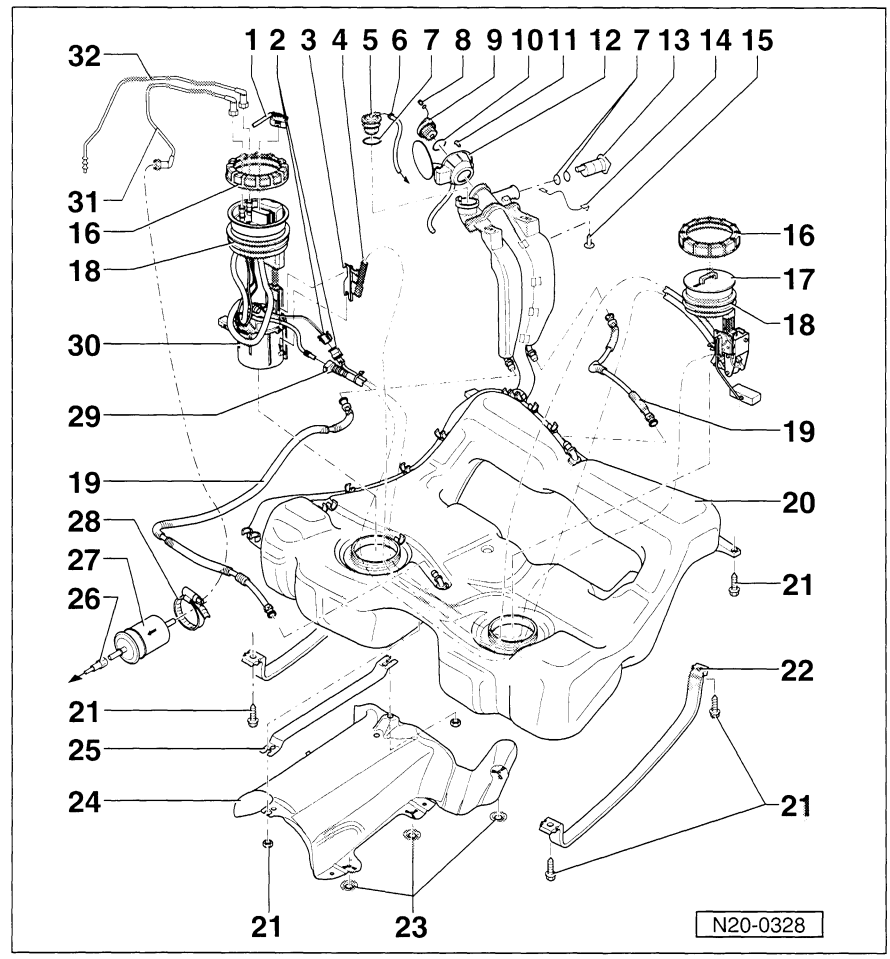
- *Fuel lines are secured with spring-type clamps. Replace only with spring-type clamps.*
- *The pliers VAS5024A or VAG 1921 are recommended for installing spring-type clips.*

Rules for cleanliness

When working on the fuel supply/injection system, pay careful attention to the following 5 rules:

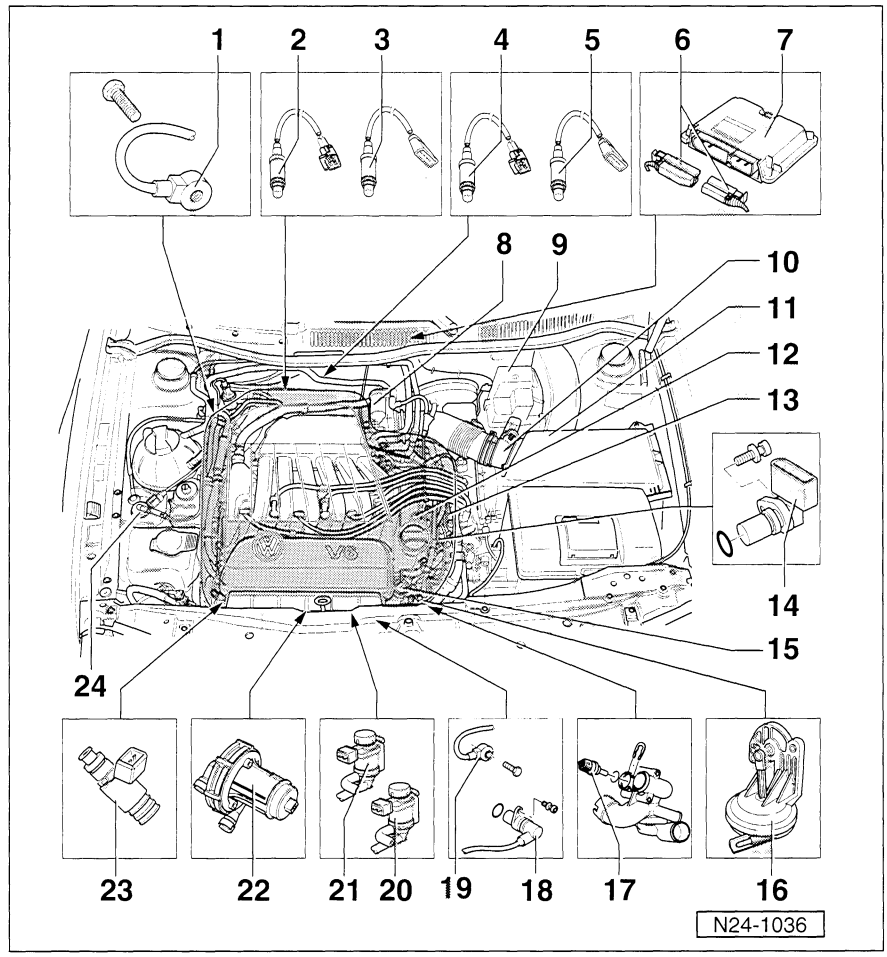
- Thoroughly clean all connections and the surrounding area before disconnecting.
- Place parts that have been removed on a clean surface and cover them. Do not use fluffy cloths!
- Carefully cover opened components or seal them if repairs are not performed immediately.
- Only install clean components: Only unpack replacement parts immediately prior to installation. Do not use parts that have been stored loose (i.e. in tool boxes).
- When the system is open, avoid working with compressed air if possible. Do not move the vehicle unless absolutely necessary.

Fuel supply components



1. **Connector**
   - Black, 4-pin
   - For Sender for fuel gauge (G) and Fuel Pump (G6)
2. **Connector**
   - Black, 2-pin
3. **Bracket for return line**
   - Clipped to side of fuel delivery unit
4. **Return line**
5. **Gravity/expansion valve**
   - To remove valve unclip upward out of support
   - Check valve for through-flow valve vertical: open valve tilted 45°: closed
6. **Vent line**
   - Ensure seated tightly
   - Secure with spring-type clips
7. **O-ring**
   - Replace if damaged
8. **Securing clip**
9. **Sealing cap**
10. **Oil seal**
    - Replace if damaged
11. **Mounting bolt**
12. **Tank flap unit**
    - With rubber cup
13. **Breather valve**
    - To remove valve unclip sideways out of support
    - Before installing remove sealing cap (item **9**)
14. **Ground connection**
    - Ensure seated tightly
15. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
16. **Union nut,**
    - Tighten to 80 Nm (59 ft-lb)
    - Use ring nut wrench 3217 for removing and installing
17. **Fuel level sensor 2 (G169)**
    - Note installed position on fuel tank
18. **Oil seal**
    - To install, place into opening of fuel tank dry
    - Replace if damaged
    - Moisten with fuel only when installing flange
19. **Vent line**
    - Ensure seated tightly
20. **Fuel tank**
    - Support with engine/transmission jack V.A.G1383A when removing
21. **Bolt**
    - Tighten to 25 Nm (18 ft-lb)
22. **Securing strap**
    - Note installed position
23. **Lock washer**
24. **Heat shield**
25. **Support brace**
26. **Supply line**
    - Black
    - Ensure seated tightly
    - Secure with spring-type clips
    - To fuel supply line at fuel rail
27. **Fuel filter**
    - Installed position: Arrow points in direction of flow
28. **Screw clamp**
29. **Supply line**
30. **Fuel delivery unit**
    - With sender for fuel gauge (G)
    - Clean strainer if soiled
31. **Supply line**
    - Ensure seated tightly
    - Black
    - Clipped to side of fuel tank
32. **Return line**
    - Blue or with blue marking
    - Ensure seated tightly
    - Secure with spring-type clips
    - To fuel supply line at fuel rail

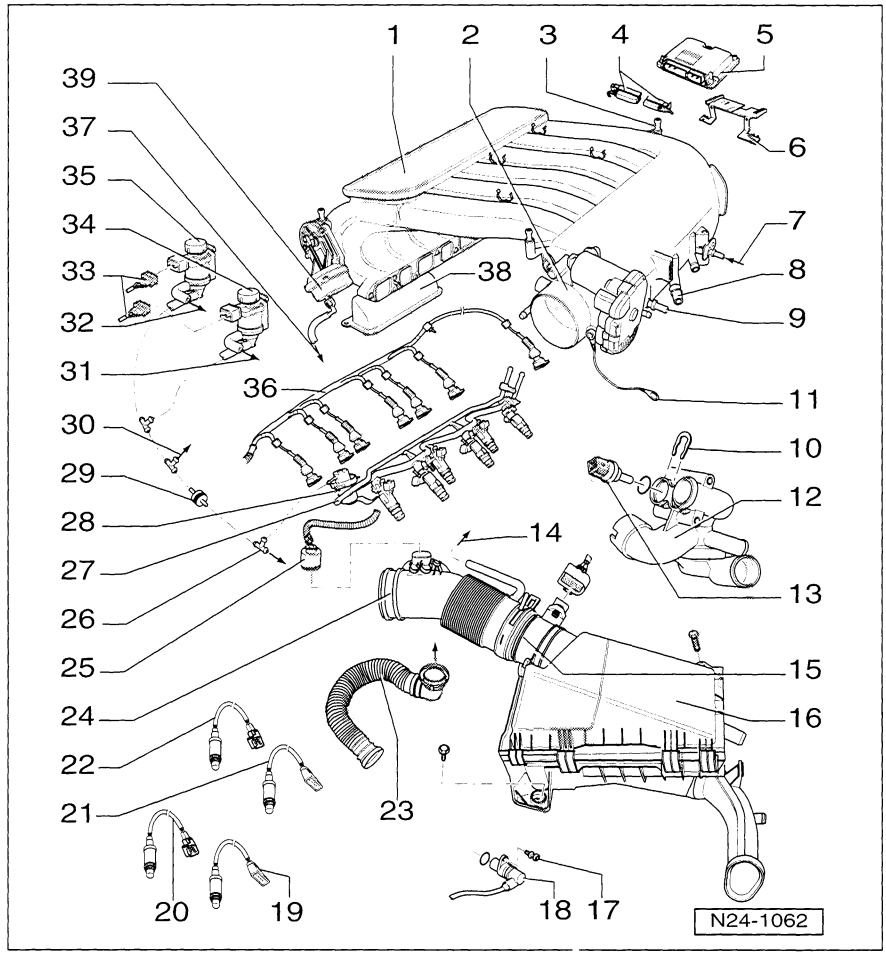
Fuel injection system components



1. **Knock sensor 1 (KS1) (G61)**
   - Location: Cylinder block, exhaust side
2. **Heated Oxygen Sensor (HO2S) (G39)**
   - Tighten to 50 Nm (37 ft-lb)
   - Location: in front exhaust pipe for cylinders 1, 2 and 3
3. **Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) (G130)**
   - Tighten to 50 Nm (37 ft-lb)
   - Location: in rear catalytic converter
4. **Heated Oxygen Sensor (HO2S) 2 (G108)**
   - Tighten to 50 Nm (37 ft-lb)
   - Location: in front exhaust pipe for cylinders 4, 5 and 6
5. **Oxygen Sensor (O2S) 2 behind Three Way Catalytic Converter (TWC) (G131)**
   - Tighten to 50 Nm (37 ft-lb)
   - Location: in rear catalytic converter
6. **Connector**
   - For engine control module
   - Only disconnect and connect with ignition switched off
   - Release to disconnect
7. **Motronic Engine Control Module (ECM) (J220)**
   - Location: in plenum chamber
8. **Throttle valve control module (J338)**
   - Coolant heated
9. **Protective housing**
   - For Secondary Air Injection (AIR) pump relay (J299)
10. **Mass Air Flow (MAF) sensor (G70) with Intake Air Temperature (IAT) sensor (G42)**
11. **Air filter housing**
12. **Valves for camshaft adjustment**
13. **Ignition coil (N152)**
    - Not for engine code BJS
    - On engine codes BJS, one ignition coil with power output stage is installed per cylinder
14. **Camshaft Position (CMP) sensor (G40)**
15. **Fuel pressure regulator**
16. **Vacuum actuator**
    - For variable intake manifold
17. **Engine coolant temperature (ECT) sensor (G62)**
    - Blue
    - For engine control module
    - With Engine Coolant Temperature (ECT) Sensor (G2)
    - Release pressure in cooling system before removing
18. **Engine speed (RPM) sensor (G28)**
19. **Knock sensor 2 (KS2) (G66)**
    - Location: Cylinder block, intake side
20. **Secondary Air Injection (AIR) solenoid valve (N112)**
21. **Intake manifold change-over valve (N156)**
    - For variable intake manifold
22. **Secondary Air Injection (AIR) pump motor (V101)**
23. **Fuel injectors (N30, N31, N32, N33, N83, N84)**
24. **Evaporative emission (EVAP) canister purge regulator valve (N80)**

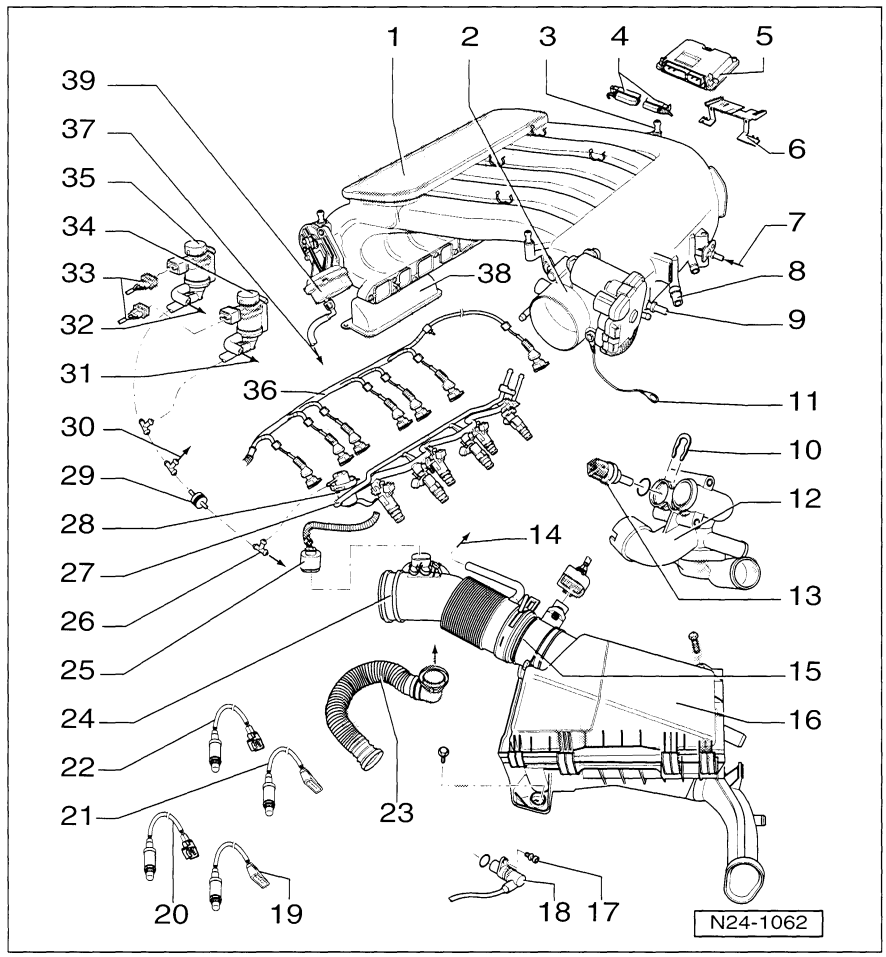
Fuel injection system components, upper

1. **Intake manifold**
2. **Throttle valve control module (J338)**
3. **Mounting pin**
   - For engine cover
4. **Connector**
   - For engine control module
   - Only disconnect and connect with ignition switched off
5. **Motronic engine control module (ECM) (J220)**
   - In plenum chamber
   - When replacing, J220 must be adapted to immobilizer
6. **Mounting frame**
7. **Vacuum connection from fuel pressure regulator**
8. **Vacuum connection for brake booster**
9. **Connection for EVAP canister**
10. **Retaining clip**
    - Check for secure connection
11. **Ground wire**
    - Check for secure connection
12. **Coolant thermostat housing**
13. **Engine Coolant Temperature (ECT) sensor (G62)**
    - Blue identification
    - With Engine Coolant Temperature (ECT) sensor (G2)
    - Release pressure in cooling system before removing
    - Terminals 3 and 4 for (G62)
    - Contacts gold plated
14. **To connections on cylinder head**
    - For air shrouded fuel injectors
15. **Mass Air Flow (MAF) sensor (G70) with Intake Air Temperature (IAT) sensor (G42)**
    - Sensor contacts and connector contacts gold plated
16. **Air filter housing**
17. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
18. **Engine speed (RPM) sensor (G28)**



19. **Oxygen Sensor (O2S) 2 behind Three Way Catalytic Converter (TWC) (G131)**
    - Tighten to 50 Nm (37 ft-lb)
    - Location: in left rear side of catalytic converter
    - Grease threads-only with G 052 112 A3
    - Grease must not get into slots on sensor body
    - Use 3337 to remove and install
    - With 4-pin connector
    - Voltage supply for sensor heater via Fuel Pump relay (J17)
20. **Heated Oxygen Sensor (HO2S) 2 (G108)**
    - Tighten to 50 Nm (37 ft-lb)
    - Location: in left front side of exhaust pipe
    - Grease threads-only with G 052 112 A3
    - Grease must not get into slots on sensor body
    - Use 3337 to remove and install
    - With 6-pin connector
    - Voltage supply for sensor heater via fuel pump relay (J17)
21. **Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) (G130)**
    - Tighten to 50 Nm (37 ft-lb)
    - Location: in right rear side of catalytic converter
    - Grease threads-only with G 052 112 A3
    - Grease must not get into slots on sensor body
    - Use 3337 to remove and install
    - With 4-pin connector
    - Voltage supply for sensor heater via fuel pump relay (J17)
22. **Heated Oxygen Sensor (HO2S) (G39)**
    - Tighten to 50 Nm (37 ft-lb)
    - Location: in right front side of exhaust pipe
    - Grease threads-only with G 052 112 A3
    - Grease must not get into slots on sensor body
    - Use 3337 to remove and install
    - With 6-pin connector
    - Voltage supply for sensor heater via Fuel Pump relay (J17)

Fuel injection system components, removing and installing (continued)



23. Connecting hose
- For crankcase ventilation
- From breather housing on cylinder head cover

24. Positive Crankcase Ventilation (PCV) heating element (N79)
- For crankcase ventilation
- Not for engine code BJS

25. Connector
- Black, 2-pin
- For Positive Crankcase Ventilation heating element (N79)
- Check specified value of voltage supply for PCV heating element between contacts 1 and 2 with engine running: min. 11.5 V

26. Vacuum connection
- To item **7**

27. Fuel rail

28. Fuel pressure regulator

29. Non-return valve
- Black side of valve faces junction piece of fuel pressure regulator

30. To vacuum reservoir

31. To vacuum actuator

32. To combi-valve

33. Connector

34. Intake manifold change-over valve (IMT) (N156)

35. Secondary Air Injection (AIR) solenoid valve (N112)

36. Wiring harness
- With harness connectors for fuel injectors

37. To intake manifold change-over valve (N156)

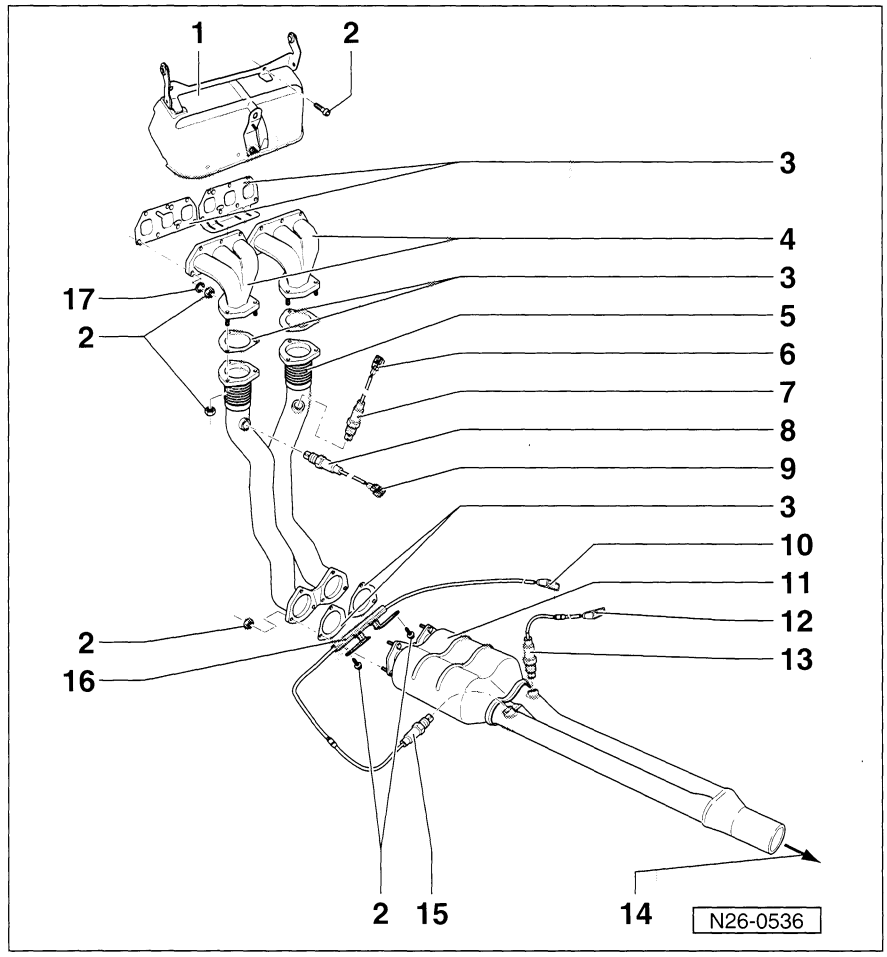
38. To vacuum reservoir

39. Vacuum actuator
- For variable intake manifold

Exhaust system components, front

NOTE —

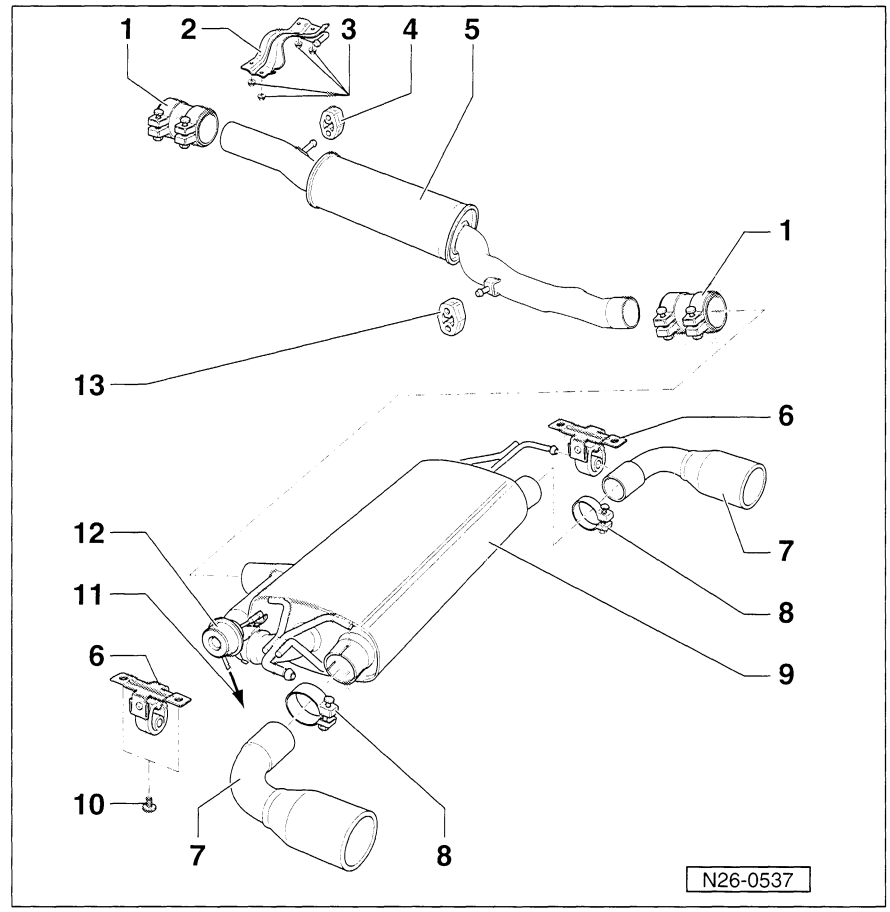
- *After working on the exhaust system ensure that the system is not under stress, and that it has sufficient clearance from body and frame. If necessary, loosen the double clamps and align the exhaust pipe so that sufficient clearance is maintained and the mounts carry uniform loads.*
- *Replace all self-locking nuts.*

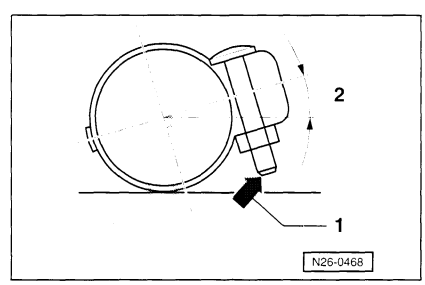


1. **Heat shield**
2. **Mounting bolts**
   - M6 = 10 Nm (7 ft-lb)
   - M8 = 25 Nm (18 ft-lb)
   - M10 = 40 Nm (30 ft-lb)
3. **Seal**
   - Always replace
4. **Exhaust manifold**
5. **Front exhaust pipe**
   - Remove front driveshaft tube before removing pipe
6. **Connector**
   - Black, 6-pin
7. **Heated Oxygen Sensor (HO2S) (G39)**
   - Tighten to 50 Nm (37 ft-lb)
   - Grease threads-only with G 052 112 A3
   - Grease must not get into slots on sensor body
   - Use body repair saw VAG 1523 for removal and installation
8. **Heated Oxygen Sensor (HO2S) 2 (G108)**
   - Tighten to 50 Nm (37 ft-lb)
   - Grease threads-only with G 052 112 A3
   - Grease must not get into slots on sensor body
   - Use body repair saw VAG 1523 for removal and installation
9. **Connector**
   - Brown, 6-pin
10. **Connector**
    - Brown, 4-pin
11. **Double catalytic converter**
    - Behind pipe connection guide with limit stop for double clamps
12. **Connector**
    - Black, 4-pin
13. **Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) (G130)**
    - Tighten to 50 Nm (37 ft-lb)
    - Grease threads-only with G 052 112 A3
    - Grease must not get into slots on sensor body
    - Use body repair saw VAG 1523 for removal and installation
14. **To front muffler**
15. **Oxygen sensor (O2S) 2 behind Three Way Catalytic Converter (TWC) (G131)**
    - Tighten to 50 Nm (37 ft-lb)
    - Grease threads-only with G 052 112 A3
    - Grease must not get into slots on sensor body
    - Use body repair saw VAG 1523 for removal and installation
16. **Wiring router**
    - Fastened to subframe
17. **Washer**

Exhaust system components, rear

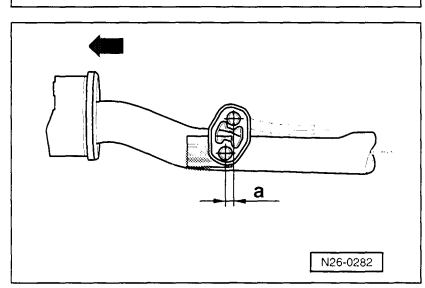
1. **Double clamp**
   - Tighten to 40 Nm (30 ft-lb)
   - See **Double clamp, installation detail**
2. **Connection support**
3. **Mounting bolts**
   - M6 = 10 Nm (7 ft-lb)
   - M8 = 25 Nm (18 ft-lb)
   - M10 = 40 Nm (30 ft-lb)
4. **Retaining ring**
   - Color identification: gray
   - Replace if damaged
5. **Front muffler**
   - See **Aligning exhaust system**
6. **Suspended mount**
   - With retaining ring
   - Replace if damaged
7. **Exhaust tailpipe**
8. **Clamp**
   - Tighten to 40 Nm (30 ft-lb)
9. **Rear muffler**
   - Install muffler free of tension
10. **Mounting bolts**
    - M6 = 10 Nm (7 ft-lb)
    - M8 = 25 Nm (18 ft-lb)
    - M10 = 40 Nm (30 ft-lb)
11. **To vacuum control module**
    - Location: behind left rear wheel housing
    - See **Vacuum control module, installation detail**
12. **Vacuum actuator**
    - Use hand vacuum pump VAG 1390 to check operation
13. **Retaining ring**
    - Color identification: red
    - Replace if damaged
    - See **Aligning exhaust system**





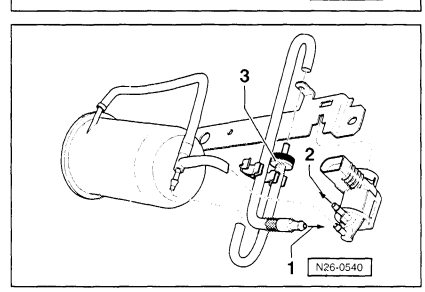
Double clamp, installation detail

- **1** - End of bolt must not project beyond lower edge of clamp
- **2** - Angle = 10° + 5°



Aligning exhaust system

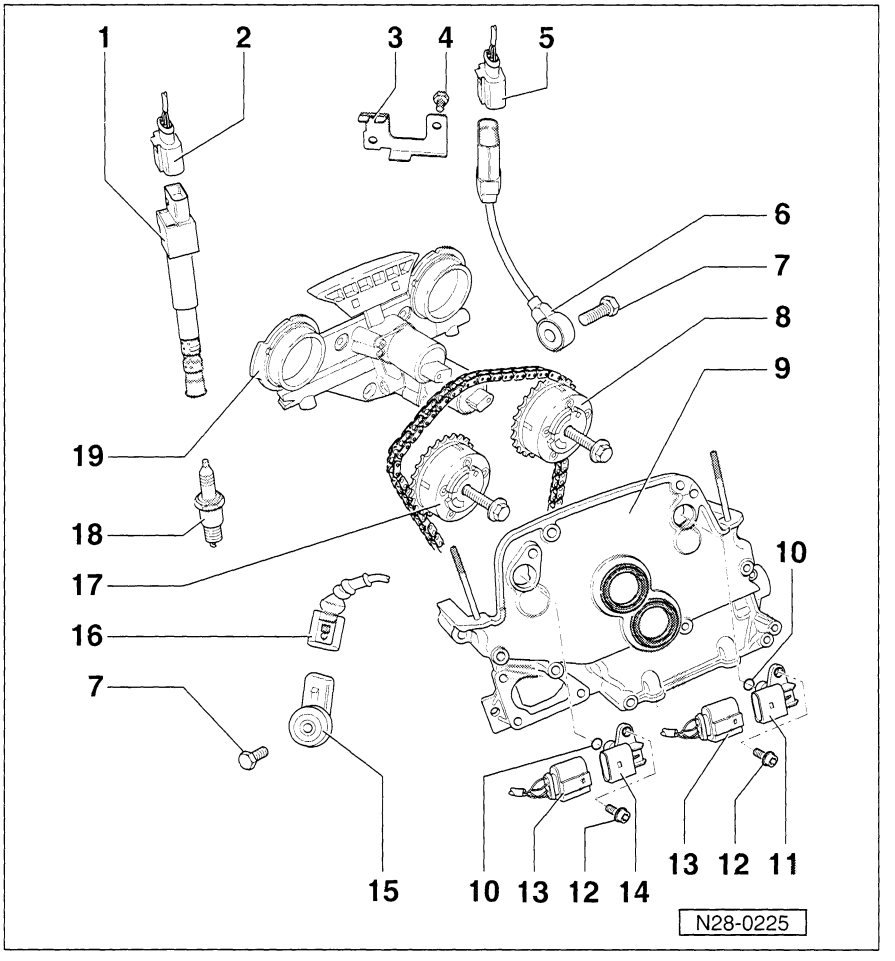
- Engine must be cold
- Align exhaust system so that dimension (**a**) = 10 ± 2 mm
- **Arrow** points in driving direction



Vacuum control module, installation detail

- **1** - From check valve to intake manifold
- **2** - From Exhaust flap valve 1 (N321) to vacuum actuator
- **3** - Check valve (white side faces vacuum reservoir)

Ignition system components



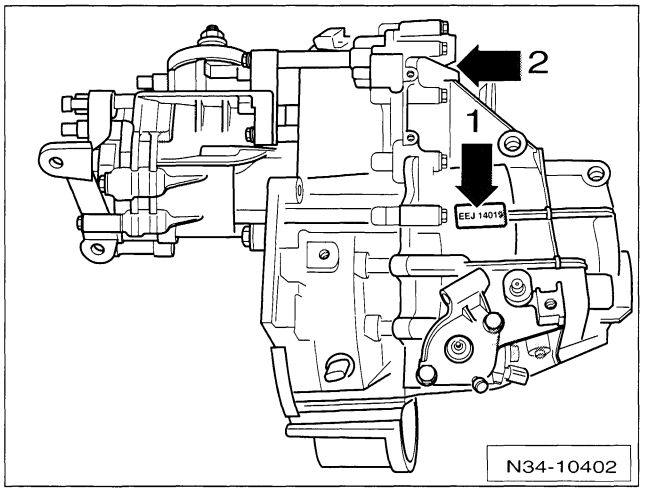
1. **Ignition coil with power output stage (N70, N127, N291, N292, N323 and N324)**
   - Use puller T10095A to remove
2. **Connector**
   - 4-pin
3. **Bracket**
   - For Knock Sensor (KS) 1 (G61) connector
4. **Bolt**
   - Tighten to 10 Nm (7 ft-lb)
5. **Connector**
   - Black, 3-pin
   - Sensor contacts and connector contacts gold plated
6. **Knock Sensor 1 (KS1) (G61)**
   - Sensor contacts and connector contacts gold plated
   - Location: Cylinder block, exhaust side
7. **Bolt**
   - Tighten to 20 Nm (15 ft-lb)
   - Torque setting influences function of knock sensor
8. **Exhaust camshaft adjuster**
   - With CMP sensor 2 (G163)
   - If camshaft adjuster has been removed, adjust timing after installation
9. **Cover**
10. **Oil seal**
    - Always replace
11. **Camshaft Position (CMP) sensor 2 (G163)**
    - For exhaust camshaft
    - Sensor contacts and connector contacts gold plated
12. **Bolt**
    - Tighten to 10 Nm (7 ft-lb)
13. **Connector**
    - Black, 3-pin
    - Sensor contacts and connector contacts gold plated
    - Mark connector before removing
14. **Camshaft Position (CMP) sensor (G40)**
    - For intake camshaft
    - Sensor contacts and connector contacts gold plated
15. **Knock sensor 2 (KS2) (G66)**
    - Sensor contacts and connector contacts gold plated
    - Location: Cylinder block, intake side
16. **Connector**
    - Black, 2-pin
    - Sensor contacts and connector contacts gold plated
17. **Intake camshaft adjuster**
    - With CMP sensor (G40)
    - If camshaft adjuster has been removed, adjust timing after installation
18. **Spark plug**
    - Remove and install with spark plug removal tool 3122B
    - See **Spark plugs, replacing** given earlier in this section
19. **Control housing**
    - For camshaft adjustment

TRANSMISSION

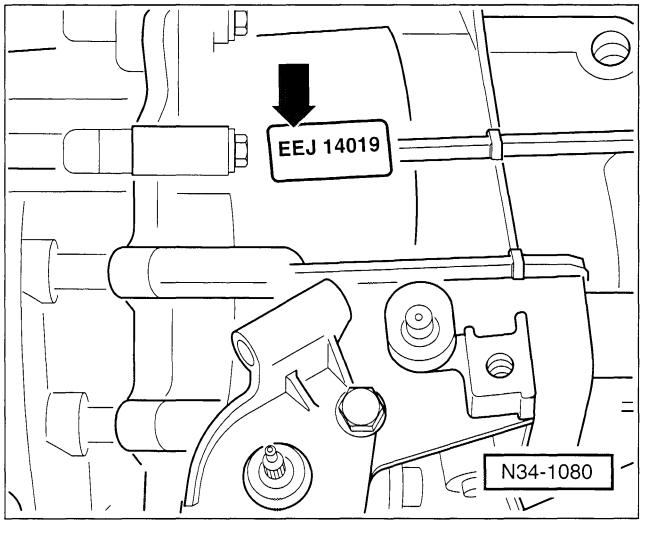
WARNING —

- *Before working on the transmission or gear selector lever mechanism disconnect the negative (–) battery cable.*
- *Disconnecting the negative (–) battery cable may erase fault codes and basic settings in the engine management and automatic transmission control modules. Some driveability problems may be noticed until the system re-adapts to operating conditions. OBD II readiness codes, which may be required for emissions testing, may also be erased. Convenience electronics (alarm system, interior light control, power locks, mirrors, and windows) may need to be re-set using a VAG 1551/1552 or equivalent scan tool.*
- *Be sure to have the anti-theft radio code on hand before disconnecting the battery.*

Transmission identification



Transmission code letters and date of manufacture for the 02Y 6-speed manual transmission are stamped into machined area on transmission housing (**1**). Transmission type designation (**2**) is cast into transmission housing.



Transmission code letters and date of manufacture are stamped on transmission (**arrow**). Example is a code **EEJ**, manufactured on the **14**th day of the **01**st month in 199**9**.

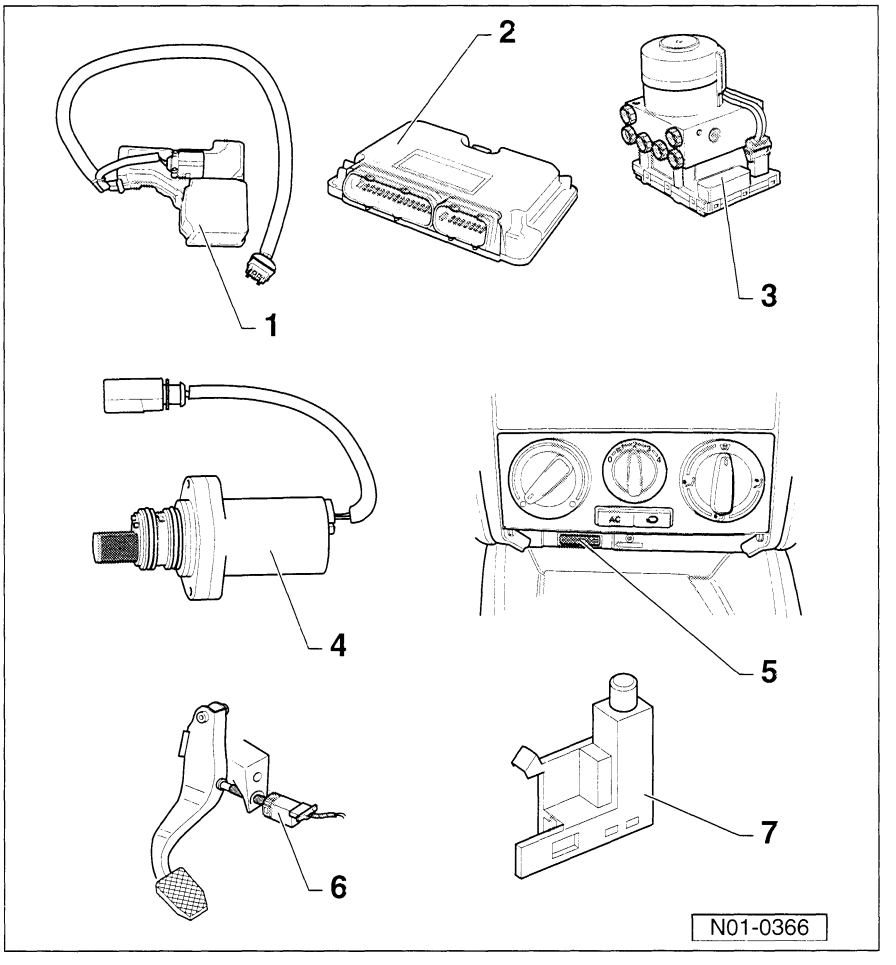
Table b lists the gear ratios and other data for the different versions of the 02Y 6-speed manual transmission.

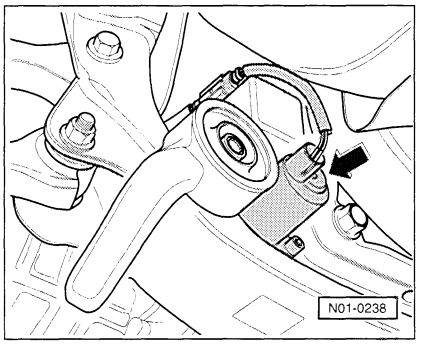
Table b. 02Y manual transmission specifications

Code letters	FMP	GQT, GQV
Engine application, horsepower	3.2L, 240hp	3.2L, 240hp
Ratio: Z_2:Z_1		
Final drive	72:22 = 3.273	72:22 = 3.273
1st gear	47:14 = 3.357	47:14 = 3.357
2nd gear	48:23 = 2.087	48:23 = 2.087
3rd gear	47:32 = 1.469	47:32 = 1.469
4th gear	45:41 = 1.098	37:34 = 1.088
5th gear	41:37 = 1.108	41:37 = 1.108
6th gear	38:41 = 0.927	31:34 = 0.912
Reverse gear	23:14 x 34:14 = 3.990	23:14 x 34:14 = 3.990
Speedometer drive	electronic	electronic
Lubricant		
Capacity	2.6 liters (2.7 qt.)	
Specification	G50 synthetic oil, SAE 75W90	G50 synthetic oil, SAE 75W90
Clutch control	hydraulic	
Driveshaft flange diameter	108 mm	108 mm
Ratio, overall in top gear	3.034	2.985

Transmission electrical components

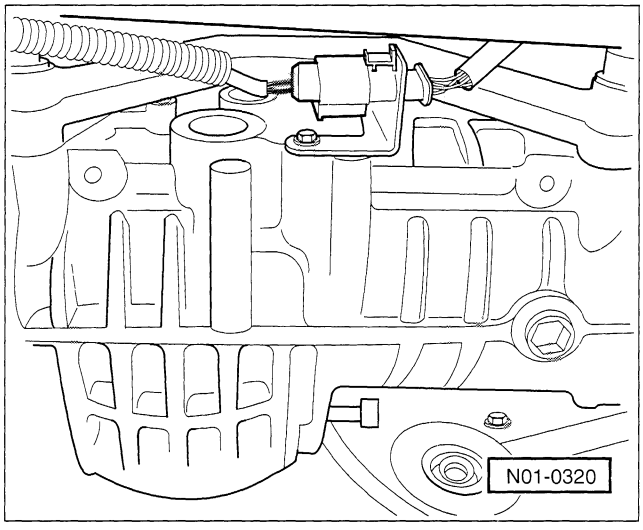
1. **All-Wheel Drive Control Module (J492)**
   - Forms a unit together with Oil Pressure Actuator (V184) and Hydraulic Temperature Sensor (G271).
2. **Engine Control Module (ECM)**
   - Component location 34-2, Engine Control Module (ECM)
   - The following signals are transmitted to All-Wheel Drive Control Module (J492) via data-BUS:
     - Engine speed (RPM)
     - Accelerator pedal position
     - Engine torque
3. **ABS Control Module (w/EDL) (J104)**
   - Location: at hydraulic unit on left side of engine compartment
   - The following signals are transmitted to All-Wheel Drive Control Module (J492) via data-BUS:
     - Wheel speeds
     - Longitudinal acceleration
     - Brake operation
4. **Haldex Clutch Pump (V181)**
   - See **Haldex pump, location detail**
   - Can be tested in "Guided Fault Finding" using Vehicle Diagnosis, Testing and Information system VAS 5051
5. **Data Link Connector (DLC)**
   - Location: under instrument panel to left of steering column
6. **Brake light switch (F)**
   - Location: at brake pedal
   - Can be tested in "Guided Fault Finding" using Vehicle Diagnosis, Testing and Information system VAS 5051
   - Removing and installing, see **45 Anti-Lock Brakes (ABS)**
7. **Parking brake warning light switch (F9)**
   - Can be tested in "Guided Fault Finding" using Vehicle Diagnosis, Testing and Information system VAS 5051





Haldex pump, location detail

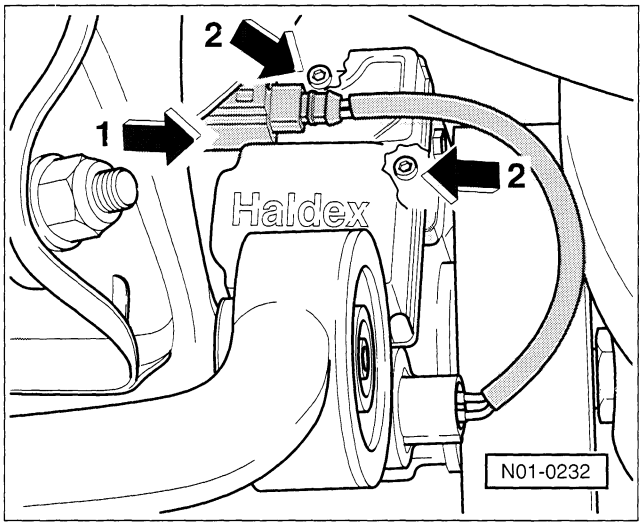
- Haldex clutch pump (**arrow**) is located just below the all-wheel drive control module at rear final drive.



All-wheel drive control module, removing and installing

– Switch ignition off.

➢ Disconnect control module harness connector on rear final drive and pull connector out of retaining bracket.

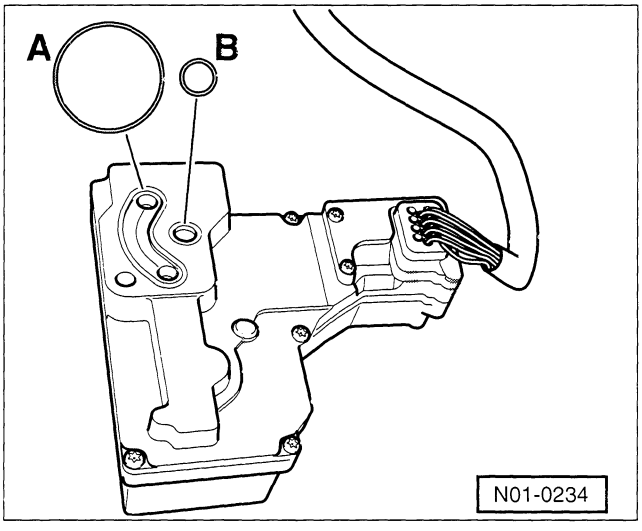


➢ Disconnect connector for Haldex clutch pump (**arrow 1**).

– Place appropriate fluid receptacle underneath final drive.

– Remove mounting bolts (**arrows 2**).

– Remove control module.

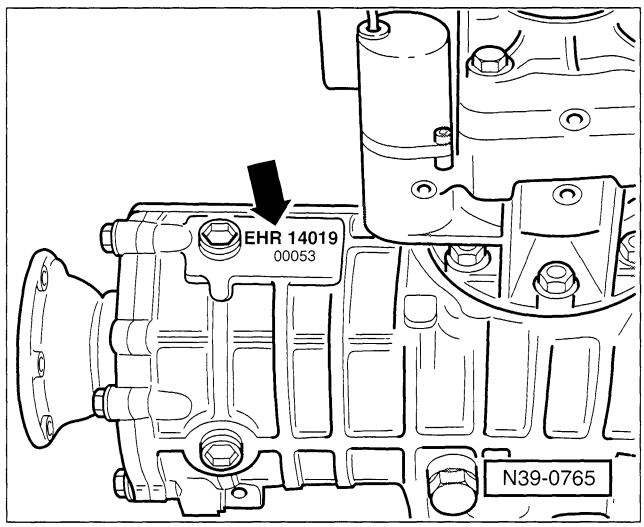


➢ Install in reverse of removal, noting the following:

- If installed, replace O-rings (**A** and **B**).
- If a seal is installed, replace it
- Tighten mounting bolts to tightening torque
- Check oil level in Haldex clutch as described later

Tightening torque

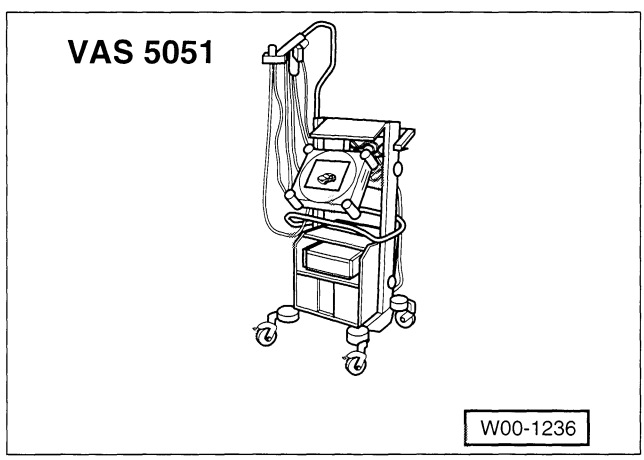
- All-wheel drive control module to transmission . . . . . 6 Nm (53 in-lb)



Rear final drive, identification

Final drive 02D is allocated to the 6-speed all-wheel drive 02Y manual transmission.

Rear final drive code letters and date of manufacture are the stamped on machined area (**arrow**) of final drive. Example is a code **EHR**, manufactured on the **14**th day of the **01**st month in 199**9**.



Haldex clutch oil and filter, servicing

Checking oil level

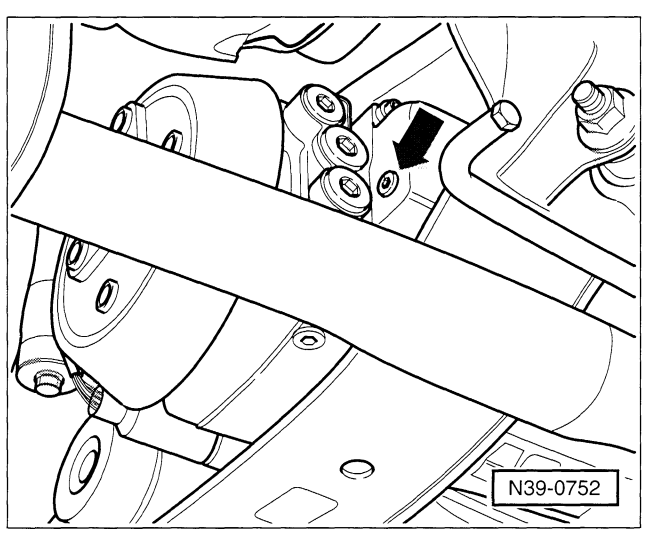
Connect Vehicle Diagnostic, Testing and Information System VAS 5051.

– Select "Suspension (Rep. - Gr. 01; 40 to 49)" on display.
Select "All Wheel Drive with Haldex clutch" on display.
Select "01 - On Board Diagnostic capable systems" on display. Select "All Wheel Drive Haldex" on display.
Select "Electrical components" on the display.
Select "Oil temperature" on the display.

- Oil temperature must be 20° to 40°C (68° to 104° F)

NOTE —
Use of VAS 5051 may not be necessary if transmission oil temperature can be measured with other means.

– Oil temperature can be obtained by driving vehicle to warm it.



Remove oil checking plug (**arrow**).

- Oil level is correct when Haldex clutch is filled up to lower edge of checking hole or up to a minimum of approx. 3 mm below lower edge of checking hole.

– Tighten checking plug to specified torque.

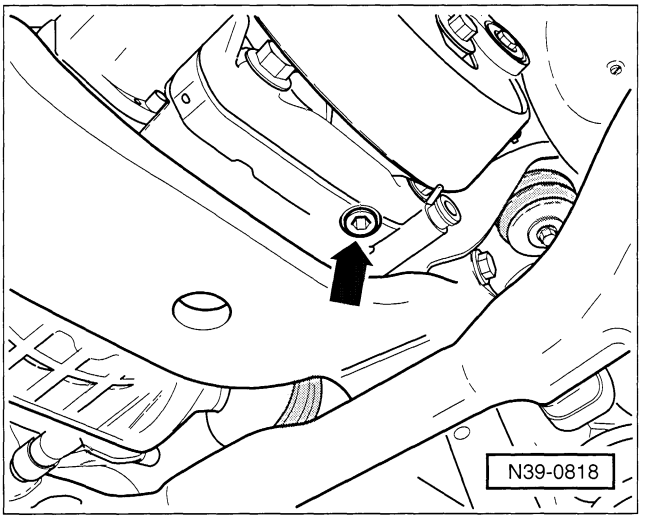
Tightening torque

- Haldex clutch oil checking plug to transmission . . . . . 25 Nm (18 ft-lb)

– If oil level is not correct, top off or change oil in Haldex clutch as described below.

Specification

- Haldex high performance clutch oil 0.25L
  Volkswagen part number . . . . . G 052 175 A1



Haldex clutch oil, changing

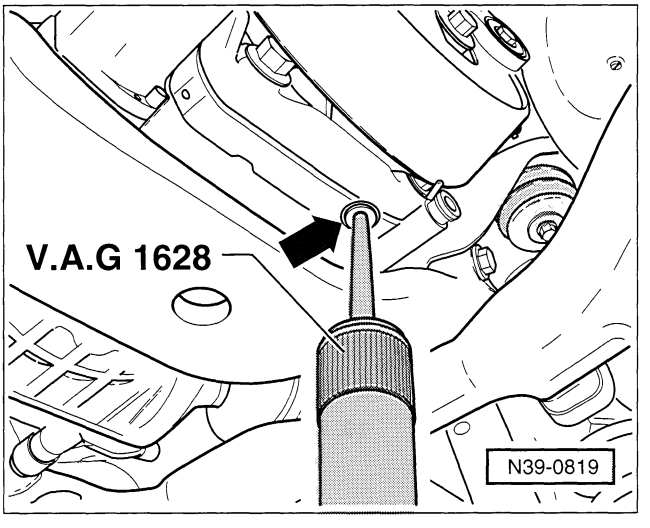
– Place drain pan underneath Haldex coupling.

➤ Remove drain plug (**arrow**) and drain oil completely.

– Insert 0.25 liter oil cartridge into cartridge gun. Have drain plug with new seal ready to install.

Specification

- Haldex high performance clutch oil 0.25L
  Volkswagen part number . . . . . .G 052 175 A1



➤ Guide cartridge gun V.A.G 1628, or equivalent, vertically into drain hole (**arrow**).

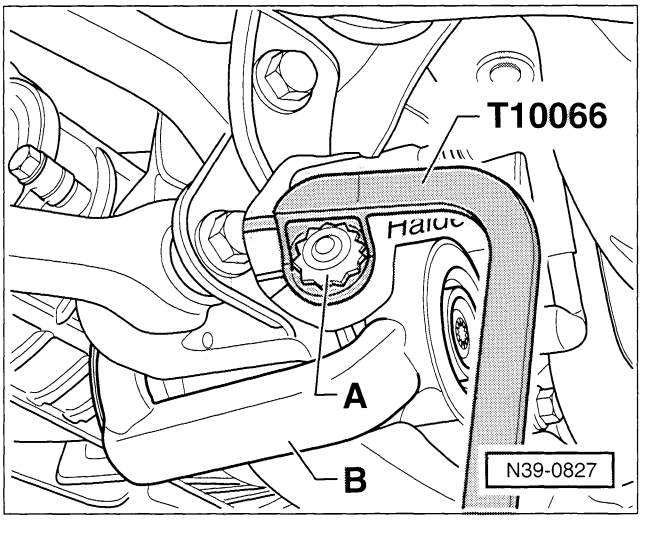
– Pump complete contents of oil cartridge into Haldex clutch.

– Withdraw cartridge gun and immediately thread in drain plug with new seal and tighten to specified torque.

Tightening torque

- Haldex clutch drain plug
  to transmission. . . . . 25 Nm (18 ft-lb)

– Check oil level in Haldex clutch as previously described.



Haldex clutch oil filter, replacing

– Place drain pan underneath Haldex coupling.

➤ Use special tool T10066 filter wrench to loosen and unscrew oil filter.

- Installed position: Oil filter (**A**) is located on right side of vehicle, concealed by subframe near front mounting bracket (**B**).

– Lightly coat O-ring of new oil filter with Haldex clutch oil and install filter.

Tightening torque

- Haldex oil filter to transmission. . . . . 35 Nm (26 ft-lb)

– Check oil level in Haldex clutch as previously described.

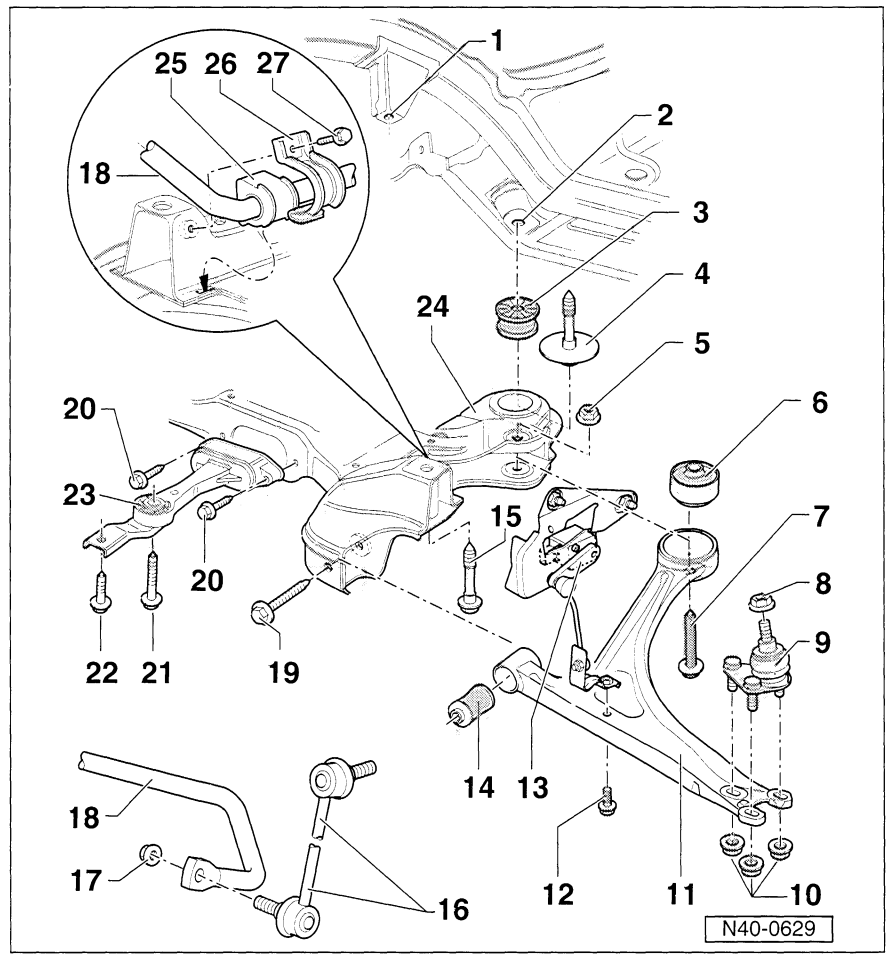
– Check for any oil leaks around filter or drain plug.

SUSPENSION AND BRAKES

Front suspension assembly

NOTE —

- *If a vehicle that has a drive axle removed needs to be moved, an outer CV joint must be installed in place of the drive axle and be tightened to 50 Nm (37 ft-lb). Otherwise, the wheel bearing will be damaged.*
- *Welding and straightening operations are not permitted on load-bearing or wheel-controlling components.*
- *Always replace self-locking nuts.*
- *Always replaced corroded nuts/bolts.*

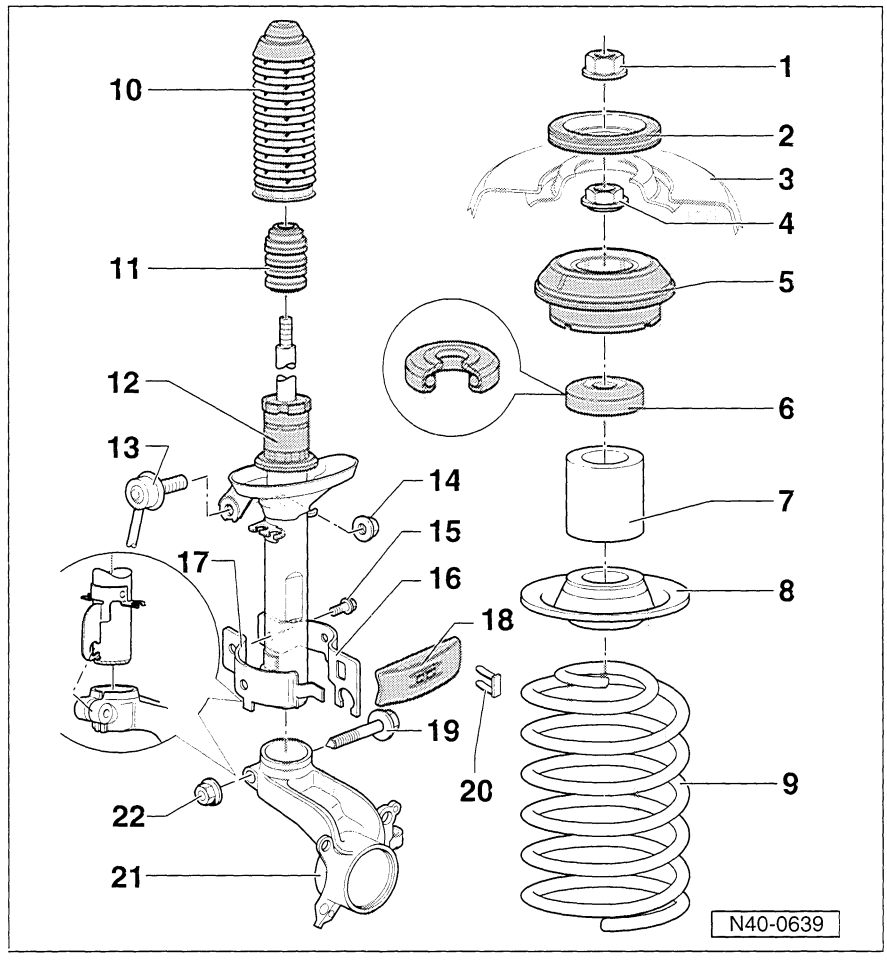


1. **Subframe retaining bracket**
   - The captive nut cannot be reworked. If the nut is damaged, replace complete mounting bracket.
2. **Welded nut in body**
   - If weld nut threads are damaged, threads can be repaired using Heli-Coil thread inserts.
3. **Bonded rubber bushing**
4. **Hex bolt**
   - M 14 x 1.5 x 63
   - Tighten to 100 Nm (74 ft-lb) + ¼ turn (90°)
   - Always replace
5. **Self-locking nut**
   - Always replace
6. **Rear control arm bushing**
7. **Hex bolt**
   - M 12 x 1.5 x 70
   - Tighten to 70 Nm (52 ft-lb) + ¼ turn (90°)
   - Always replace
8. **Self-locking hex nut**
   - Tighten to 45 Nm (33 ft-lb)
   - Always replace
9. **Ball joint**
   - See **Ball joint, checking** earlier in this section
10. **Hex nut**
    - Tighten to 75 Nm (55 ft-lb)
    - Always replace
11. **Control arm**
12. **Hex bolt**
    - Tighten to 25 Nm (18 ft-lb)
13. **Left Front Level Control System Sensor (G78)**
14. **Front control arm bushing**
15. **Hex bolt**
    - M 14 x 1.5 x 95
    - Tighten to 100 Nm (74 ft-lb) + ¼ turn (90°)
    - Always replace
16. **Connecting link**
17. **Hex nut,**
    - Tighten to 90 Nm (66 ft-lb)
    - Always replace
18. **Stabilizer bar**
    - The subframe must be lowered to remove and install
19. **Hex bolt**
    - M 12 x 1.5 x 78
    - Tighten to 70 Nm (52 ft-lb) + ¼ turn (90°)
    - Always replace
20. **Hex bolt**
    - M8 x 45
    - Tighten to 25 Nm (18 ft-lb)
21. **Hex bolt**
    - M10 x 70
    - Tighten to 50 Nm (37 ft-lb)
22. **Hex bolt**
    - M10 x 30
    - Tighten to 50 Nm (37 ft-lb)
23. **Pendulum support**
24. **Subframe**
    - If damaged, do not repair threads in subframe for front control arm bolt
25. **Rubber bushing**
26. **Clamp**
27. **Hex bolt**
    - Tighten to 25 Nm (18 ft-lb)

Front strut assembly

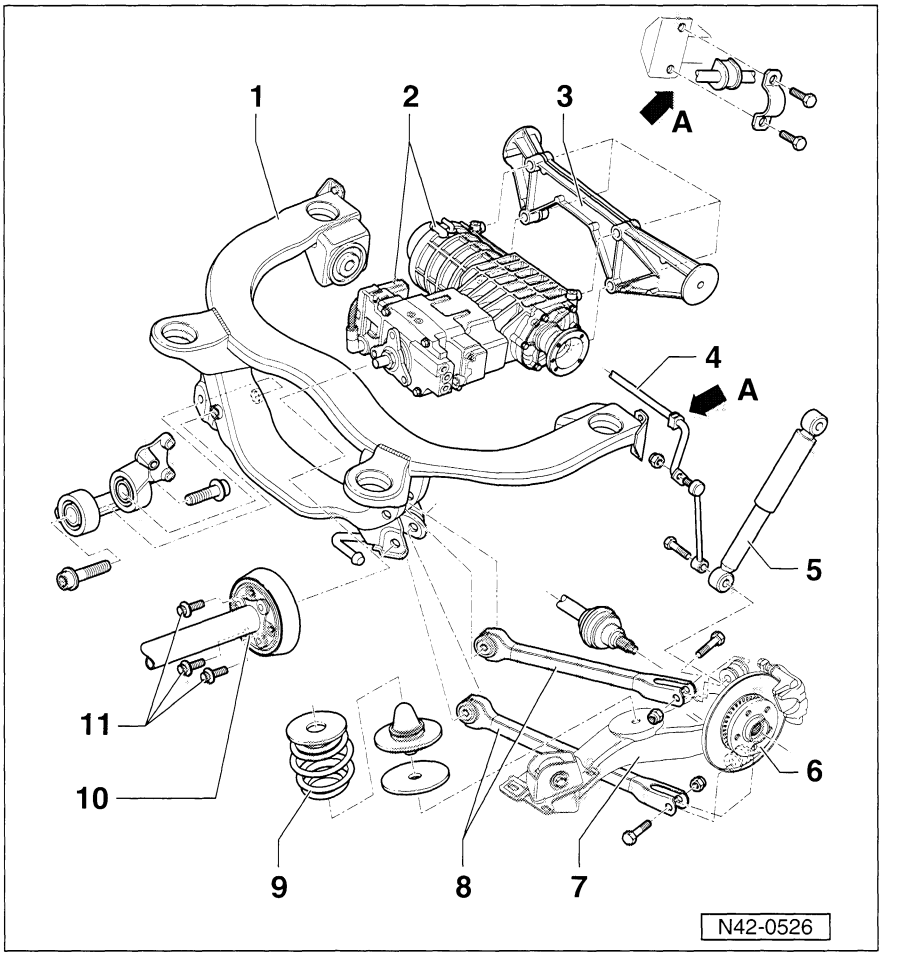
NOTE —
For front suspension strut removal and installation, see **40 Front Suspension and Drive Axles**.

1. **Self-locking hex nut**
   - Tighten to 60 Nm (44 ft-lb)
   - Always replace
2. **Stop**
3. **Suspension strut turret**
4. **Hex nut**
   - Tighten to 60 Nm (44 ft-lb)
5. **Strut mount**
6. **Axial ball bearing**
7. **Bushing**
8. **Spring plate**
9. **Coil spring**
   - Observe color coding
   - Surface of spring must not be damaged
10. **Protective sleeve**
11. **Buffer stop**
12. **Damper**
    - Can be replaced individually
13. **Connecting Link**
14. **Hex nut**
    - Tighten to 90 Nm (66 ft-lb)
    - Always replace
15. **Hex bolt**
    - Tighten to 10 Nm (7 ft-lb)
16. **Bracket**
17. **Clamp**
18. **Heat shield**
19. **Hex bolt**
    - Always replace
    - Arrow on the hex bolt must point in normal direction of travel
20. **Clip**
21. **Wheel bearing housing**



22. **Self-locking nut**
    - Tighten to 60 Nm (44 ft-lb) + ¼ turn (90°)
    - Never less than 90°
    - Turning angle tolerance 90° to 120°
    - Always replace

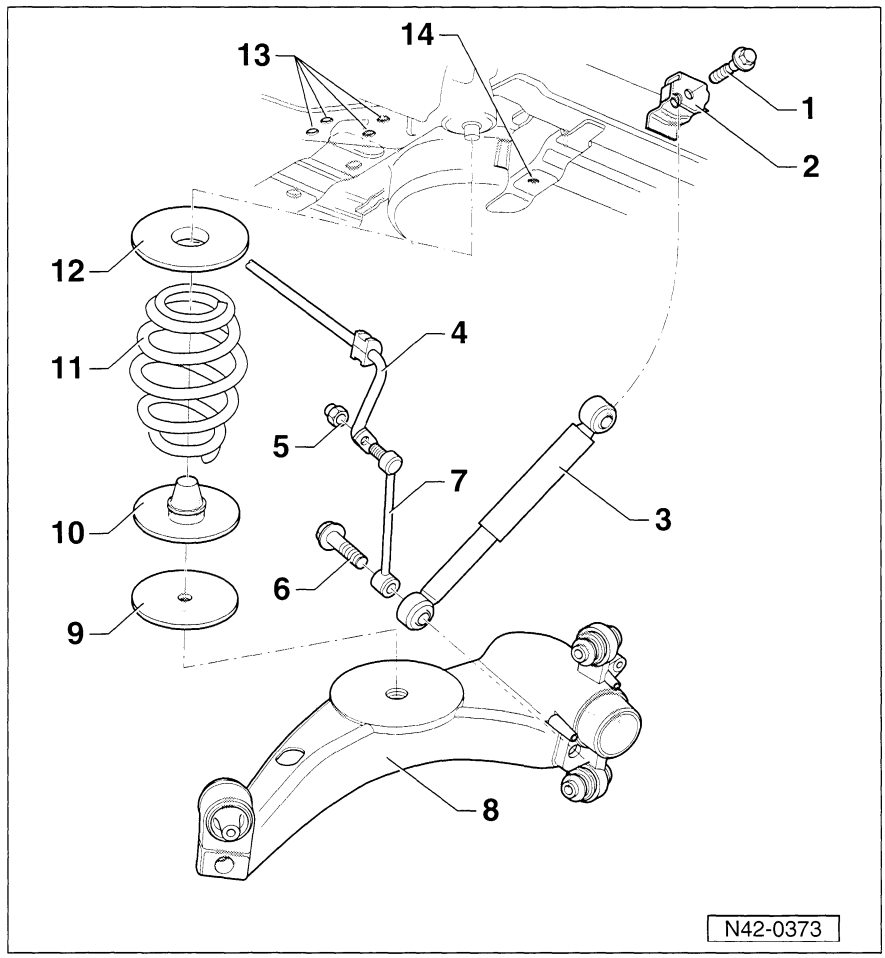
Rear suspension assembly



1. **Subframe**
2. **Final drive**
3. **Cross member**
4. **Stabilizer bar**
   - Repair damaged paint and protect against corrosion
5. **Gas filled shock absorber**
6. **Wheel bearing**
7. **Trailing arm**
8. **Transverse link**
9. **Coil spring**
   - Remove using VAG 1752/1 spring compressor and VAG 1752/15 spring holder with appropriate attachments:
     VAG 1752/15 L.U.
     VAG 1752/15 L.O.
     VAG 1752/15 R.O.
     VAG 1752/15 R.U.
   - Additional special tools required for removal and installation:
     VAG 1383A transmission jack
     VAG 1752/7 spring retainer
     T10038 tensioning strap
     T10149 wheel hub support
   - Left and right springs are not interchangeable
10. **Drive shaft**
11. **Twelve point bolt**

Rear shock and spring assembly

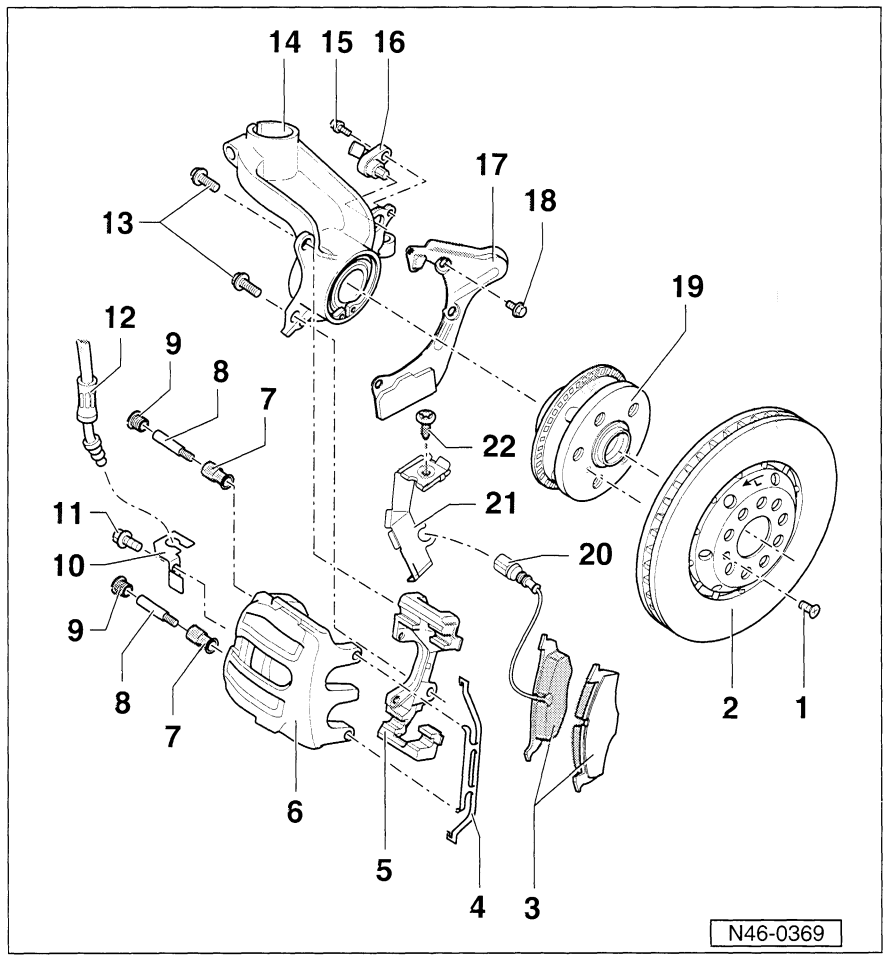
1. **Hex bolt**
   - Tighten to 60 Nm (44 ft-lb)
   - Always replace
2. **Shock absorber mounting bracket**
3. **Gas filled shock absorber**
   - Rear spring must be removed before removing shock
   - Can be replaced individually
4. **Stabilizer bar**
5. **Self-locking nut**
   - Tighten to 25 Nm (18 ft-lb)
   - Always replace
6. **Hex bolt**
   - Tighten to 110 Nm (81 ft-lb)
   - M 14 x 1.5 x 90
   - Always replace
   - Used to mount shock and lower part of connecting link
7. **Connecting Link**
   - Disconnect upper mount from stabilizer bar for rear shock installation
8. **Trailing arm**
9. **Spacer**
   - Installed to vehicles with heavy-duty suspension only
10. **Bump stop**
11. **Coil spring**
    - Examine for paint damage and repair paint damage if necessary
    - Observe color coding
    - Different versions
    - Application, see VW parts department or VW parts specialist
12. **Washer**
13. **Threads in longitudinal member**
    - If weld nut threads are damaged, threads can be repaired using Heli-Coil thread inserts.
14. **Thread in cross-member**
    - If welded nut threads in the cross member are damaged, threads can be repaired using Heli-Coil thread inserts.



Front brake assembly

NOTE —

- *After replacing brake pads, depress brake pedal firmly several times with vehicle stationary so that the brake pads are properly seated in their normal operating position.*
- *To draw off brake fluid from the reservoir, use brake charge and bleed unit VAS 5234 or extraction unit VAG 1869/4.*
- *Install brake pedal depressor VAG 1869/2 before removing a brake caliper or disconnecting a brake hose.*

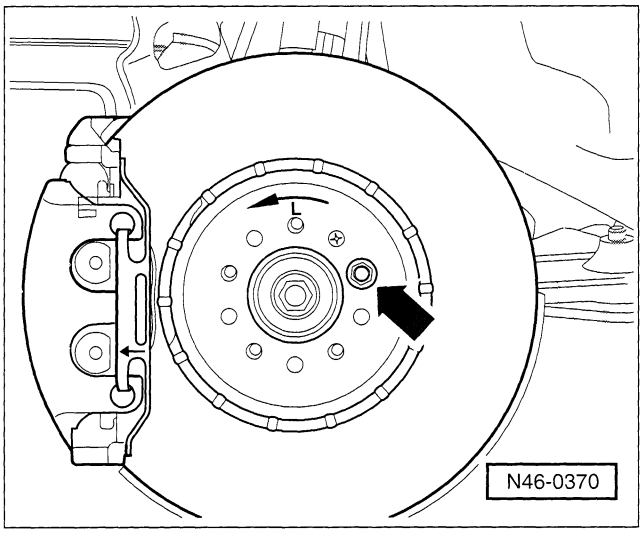


1. **Hex bolt**
   - Tighten to 4 Nm (35 in-lb)
2. **Brake disc**
   - Ventilated brake disc: diameter 334 mm (13.1 in.)
   - Brake disc thickness: 32 mm (1.26 in)
   - Wear limit: 30 mm (1.18 in.)
   - Always replace both sides
   - Left is different from right. Arrow points in direction of normal travel
   - Remove brake caliper before removing disc
3. **Brake pads**
   - With wear indicator
   - Warning lamp lights up on instrument panel when wear limit is reached (limit: 2 mm (5/64 in)
   - Thickness 19.7 mm (0.78 in.) including backing plate
   - See **Brake pads, checking** given earlier in this section
   - Always replace both sides
   - Wear limit: 7 mm (0.28 in.) including backing plate
4. **Retaining spring**
   - Insert in both brake caliper housing holes
   - The retaining spring must be pushed under the brake carrier after inserting into both holes. Faulty installation will not allow compensation of outer pad wear and therefore the pedal travel increases.
5. **Brake carrier**
   - Bolt to wheel bearing housing
6. **Brake caliper housing**
   - Do not disconnect brake hose when changing brake pads
7. **Bearing bushing**
8. **Guide pins**
   - Tighten to 25 Nm (18 ft-lb)
9. **Protective cap**
   - Upper protective cap has cable holder for brake pad wear indicator
10. **Retainer**
    - Bolted to brake caliper housing
11. **Hex bolt**
    - Tighten to 8 Nm (71 in-lb)
12. **Brake hose/line**
    - Do not disconnect brake hose when changing brake pads
13. **Ribbed combi-bolt**
    - Tighten to 125 Nm (92 ft-lb)
    - Clean if reusing
14. **Wheel bearing housing**
15. **Hex socket head bolt,**
    - Tighten to 8 Nm (71 in-lb)
16. **ABS speed sensor**
    - Before inserting sensor, clean mounting hole inner surface and coat with lubricating paste G 000 650
17. **Splash plate**
18. **Hex bolt**
    - Tighten to 10 Nm (7 ft-lb)
19. **Wheel hub with rotor**
20. **Connector**
21. **Bracket**
22. **Bolt**

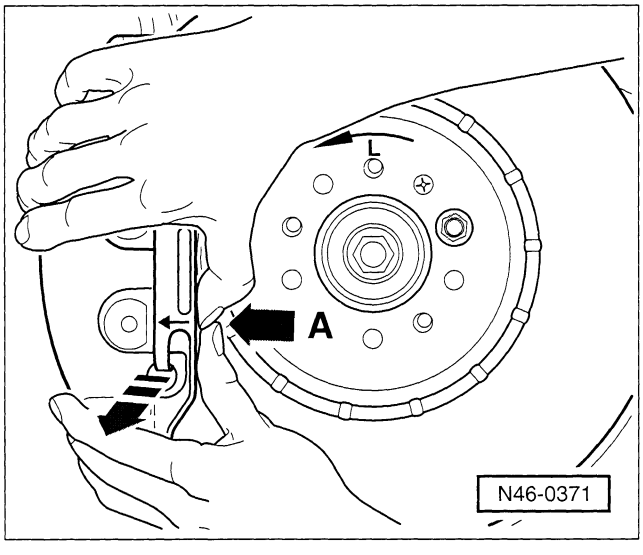
Front brake pads, removing and installing

NOTE —
If reusing brake pads mark location and install in same position when installing otherwise uneven braking will occur!

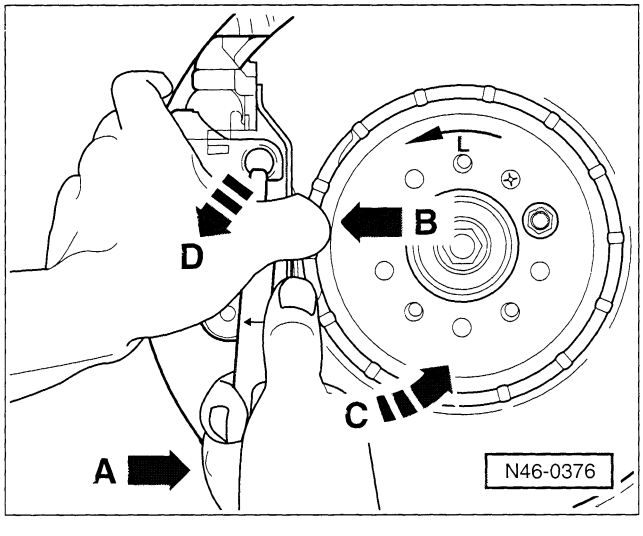
– Safely position vehicle on lift or jackstands designed to hold the weight of the vehicle. Remove wheels. See **0 Maintenance** for proper lifting procedures.



➤ Secure brake disc using a wheel bolt (**arrow**).

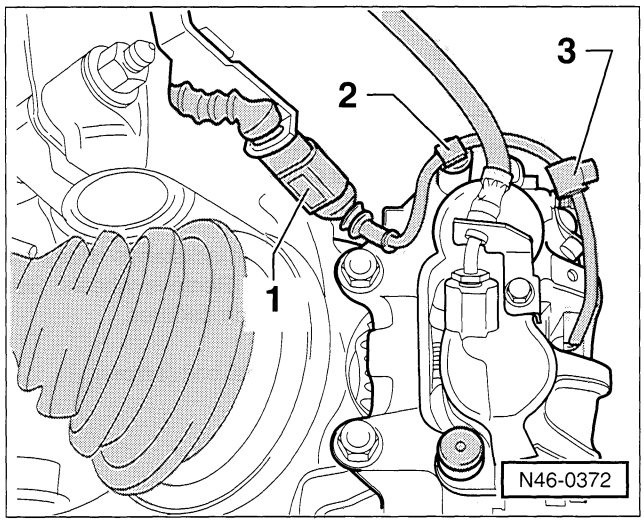


➤ Press retaining spring so far in direction of (**arrow A**) until it can be pressed out of the bore of the brake caliper.



➤ Then, pull bottom of retaining spring in direction of (**arrow A**) and hold this position.

– Press top of retaining spring in direction of (**arrow B**). At the same time, the retaining spring must be turned slightly counter-clockwise and be pulled out of the bore of the brake caliper (**arrow D**).

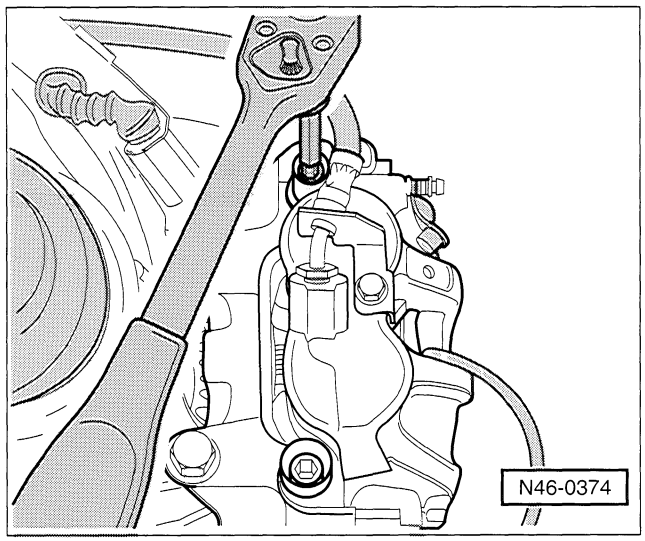


➤ Separate connector (**1**) from brake pad wear indicator.

– Remove harness for brake lining wear indicator from retainer (**2**) of the upper cap and out of retainer (**3**) of the protective cap.

– Remove protective caps for caliper mounting bolts.

NOTE —
Upper protective cover with cable holder for brake pad wear indicator



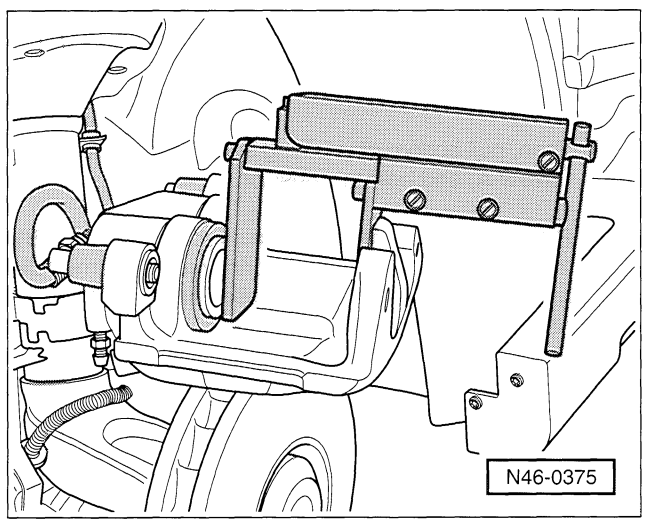
➤ Remove both guide pins from brake caliper.

– Take off brake caliper housing and lay to one side so that the weight of the brake caliper does not stress or damage brake hose. Use large zip ties or wire to support caliper as necessary.

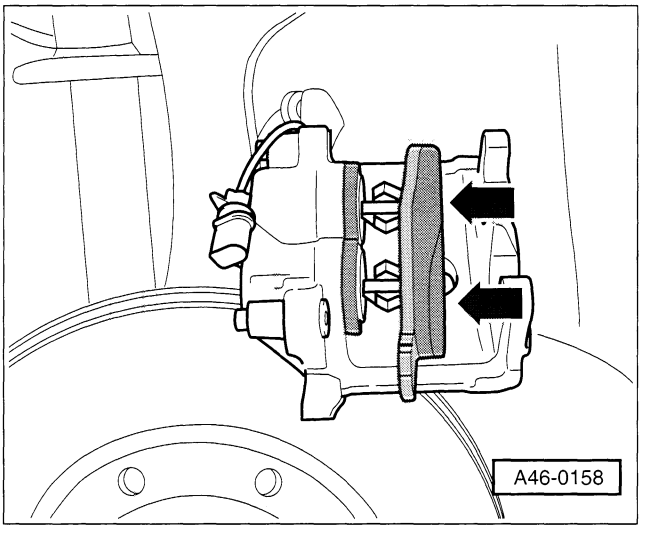
– Take brake pads out of brake caliper housing or from brake carrier.

Brake pads, installing

NOTE —
Before inserting new brake pads, press piston back into the cylinder with resetting tool. Before pressing the piston back, draw off brake fluid from the reservoir with a bleeder bottle. Otherwise particularly if reservoir has been topped off, fluid will overflow and cause damage.



➤ Press piston back using brake piston resetting tool.



➢ Insert brake pad with retaining spring in brake caliper housing (piston).

– Install outer brake pad to brake carrier.

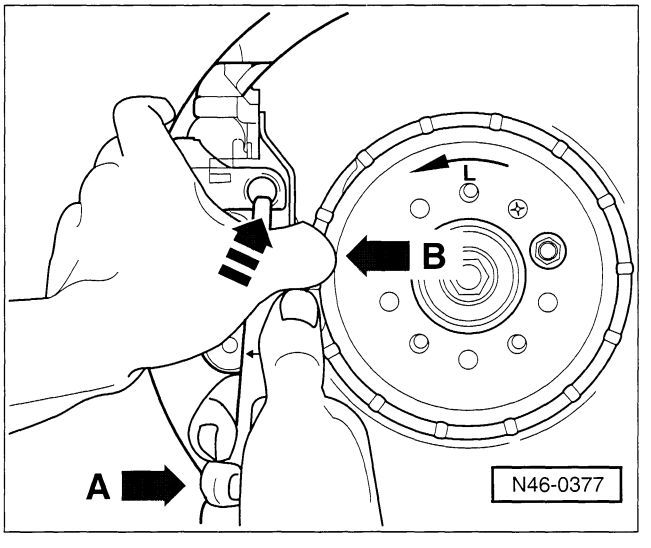
– Bolt brake caliper housing to brake carrier with both guide pins.

– Install both protective caps.

NOTE —
Upper protective cover with cable holder for brake pad wear indicator.

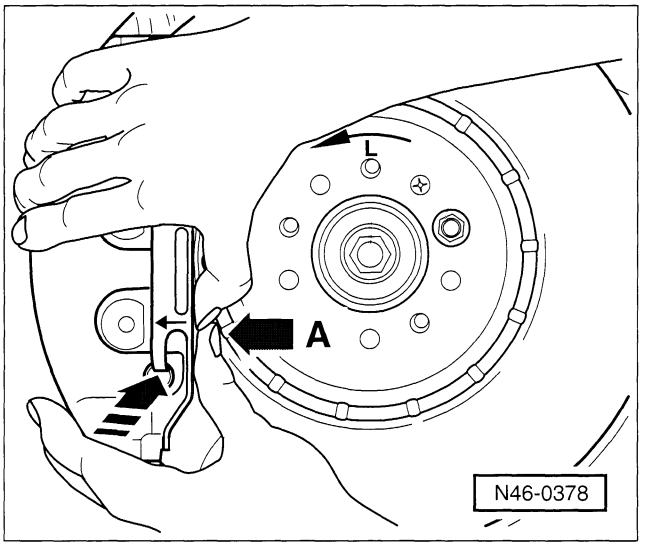
– Insert brake pad wear indicator connector under dust cap of bleeder valve, in upper protective cap and in bracket on brake caliper.

– Join connector for brake wear indicator.



➢ Place top of retaining spring against brake caliper carrier. Then, press the top of retaining spring in direction of (**arrow B**) and simultaneously hold the bottom in opposite direction of (**arrow A**).

– Press the retaining spring into the bore of the brake caliper.



➢ Place the bottom of retaining spring against brake caliper carrier. Then, press retaining spring in direction of **(arrow A**) first, and then simultaneously into the bore of the brake caliper.

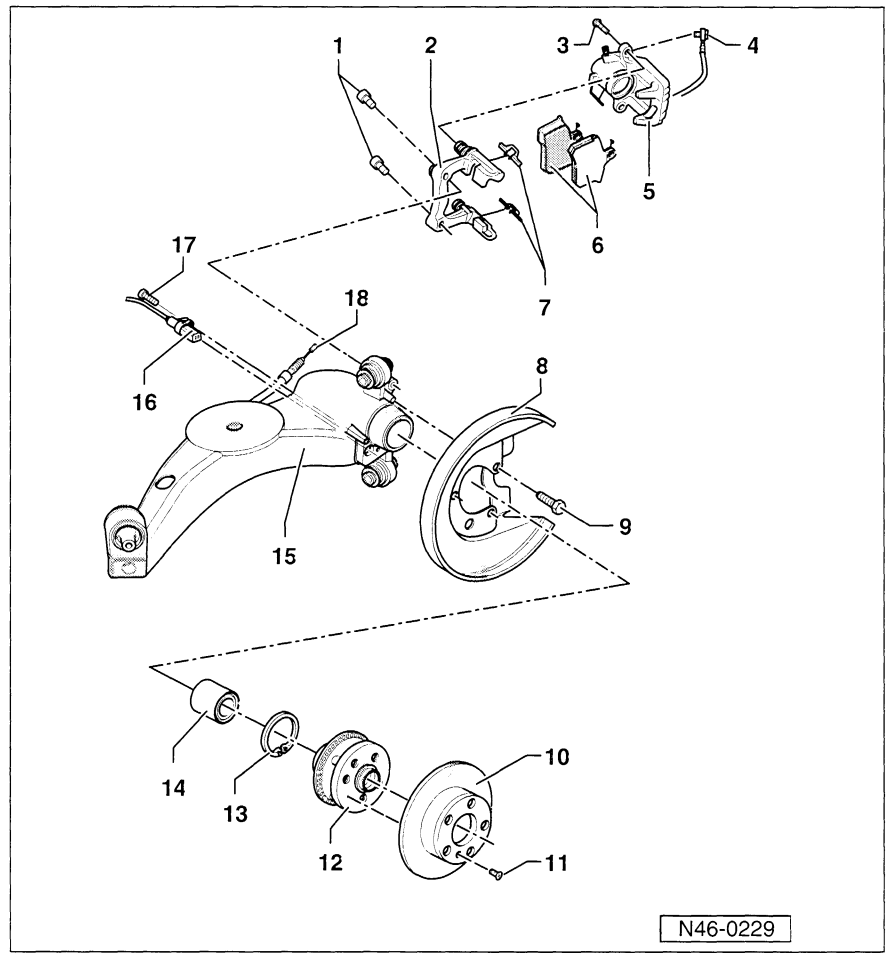
– Install wheels and check brake fluid level.

NOTE —
After each brake pad change firmly depress brake pedal several times with vehicle stationary, so that the brake pads are properly seated in their normal operating position.

Rear brake assembly

NOTE —

- *After replacing brake pads, depress brake pedal firmly several times with vehicle stationary so that the brake pads are properly seated in their normal operating position.*
- *To draw off brake fluid from the reservoir, use brake charge and bleed unit VAS 5234 or extraction unit VAG 1869/4.*
- *Install brake pedal depressor VAG 1869/2 before removing a brake caliper or disconnecting a brake hose.*
- *For removal and installation of rear brake pads, see* **46 Brakes–Mechanical Components**.



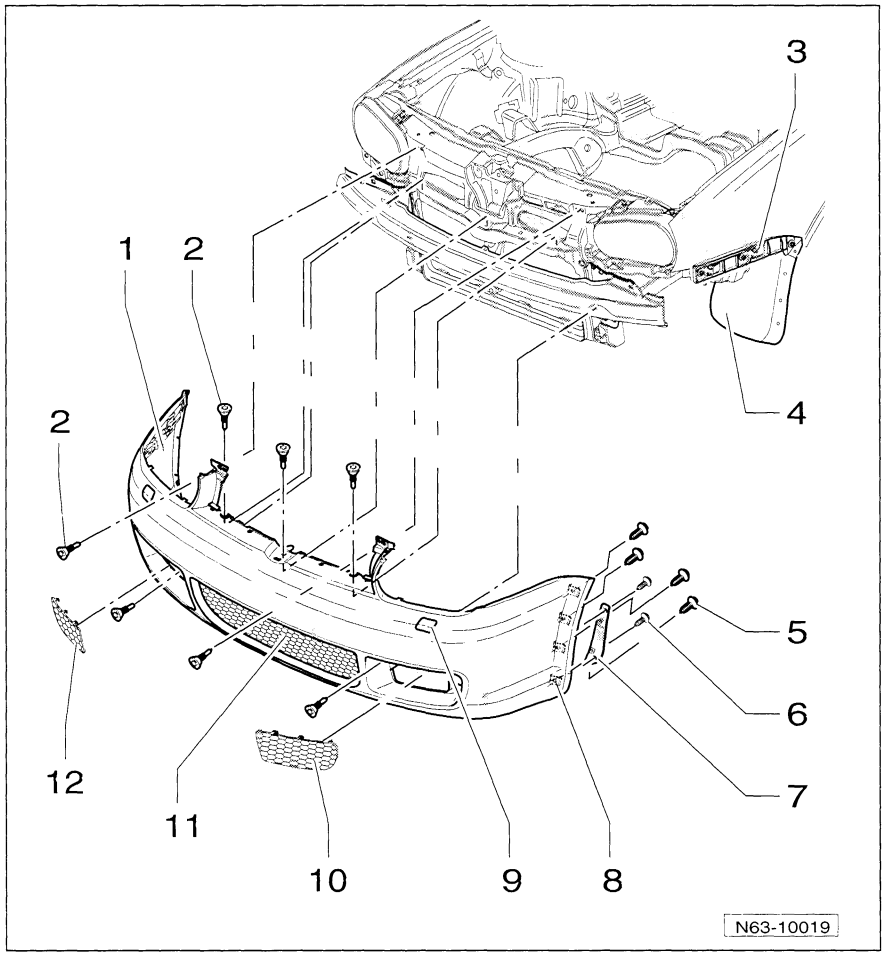
1. **Hex socket head bolt**
   - Tighten to 80 Nm (59 ft-lb)
2. **Brake carrier with guide pins and protective cap**
   - Supplied as replacement part assembled with sufficient grease on guide pins
   - If protective caps or guide pins are damaged, use repair kit. Use grease packet supplied to lubricate guide pins
3. **Self-locking hex bolt**
   - Tighten to 35 Nm (26 ft-lb)
   - Always replace
4. **Brake hose/line**
   - With banjo bolt and seals
   - Banjo bolt to brake caliper tightening torque: 38 Nm (28 ft-lb)
   - Do not disconnect brake hose when changing brake pads
5. **Brake caliper**
   - Do not disconnect brake hose when changing brake pads
   - Removing:
     Remove brake pads
     Install brake pedal depressor
     Unscrew brake hose (item **4**) from brake caliper
   - Installing:
     Install brake pads
     Install brake hose
     Remove brake pedal depressor VAG 1869/2
     Bleed brake system
6. **Brake pads**
   - Thickness: 16.9 mm (0.665 in.) including backing plate
   - Always replace on both wheels of axle
   - Removing and installing, see **46 Brakes–Mechanical Components**
   - Wear limit: 7.5 mm (0.295 in.) including back plate
7. **Pad retaining springs**
   - Always replace when changing pads
8. **Splash plate**
9. **Hex bolt**
   - Tighten to 10 Nm (7 ft-lb)
10. **Brake disc**
    - Thickness: 9 mm (0.35 in.)
    - Wear limit: 7 mm (0.27 in.)
    - Thickness: 22 mm (0.87 in.)
    - Wear limit: 20 mm (0.78 in.)
    - When worn, always replace both sides
11. **Phillips-head screw**
    - Tighten to 4 Nm (35 in-lb)
12. **Wheel hub with rotor**
13. **Circlip**
14. **Wheel bearing**
    - Replace each time after removing
15. **Trailing arm**
16. **ABS speed sensor**
    - Before inserting sensor, clean mounting hole inner surface and coat with lubricating paste G 000 650
17. **Hex socket head bolt**
    - Tighten to 8 Nm (71 in-lb)
18. **Parking brake cable**
    - Adjusting, see **46 Brakes–Mechanical Components**

BODY COMPONENTS

Front bumper cover assembly

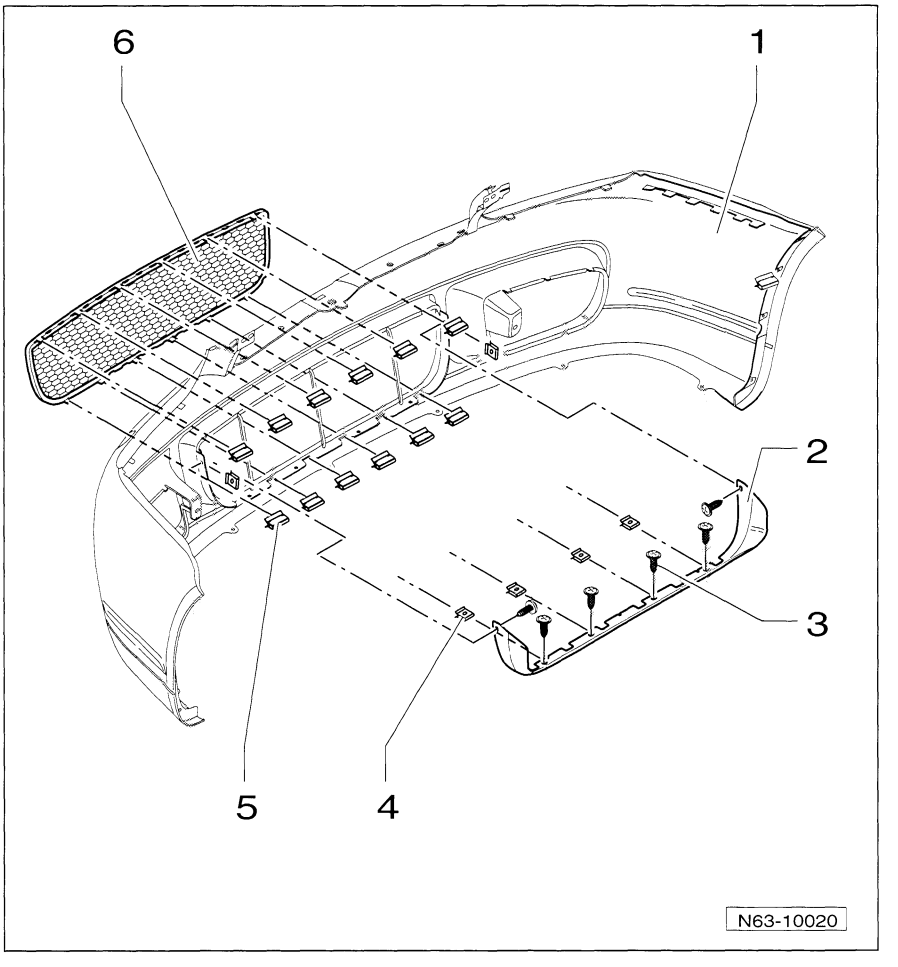
NOTE —
Slight changes may have to be made to removal and installation procedures, depending upon equipment installed in vehicle.

1. **Bumper cover**
   - Material - PP/EPDM
2. **Bolt**
   - Qty. 7
3. **Guide piece**
   - To remove and install, pull out/slide in bumper cover parallel out of guide pieces (left and right sides)
4. **Wheel housing liner**
5. **Bolt**
   - Qty. 8
6. **Bolt**
   - Qty. 2
7. **Adapter part**
   - With 2 speed nuts
   - Remove wheel housing liner before removing adapter part
8. **Speed nut**
   - Qty. 8
9. **Cover for headlight cleaning system**
   - Cover is clipped in at nozzle holder of headlight cleaning system
10. **Left ventilation grid**
    - Clipped in on bumper cover
11. **Center ventilation grid**
    - Secured to bumper cover with clamps
    - Remove bumper cover before removing grid
12. **Right ventilation grid**
    - Clipped in on bumper cover



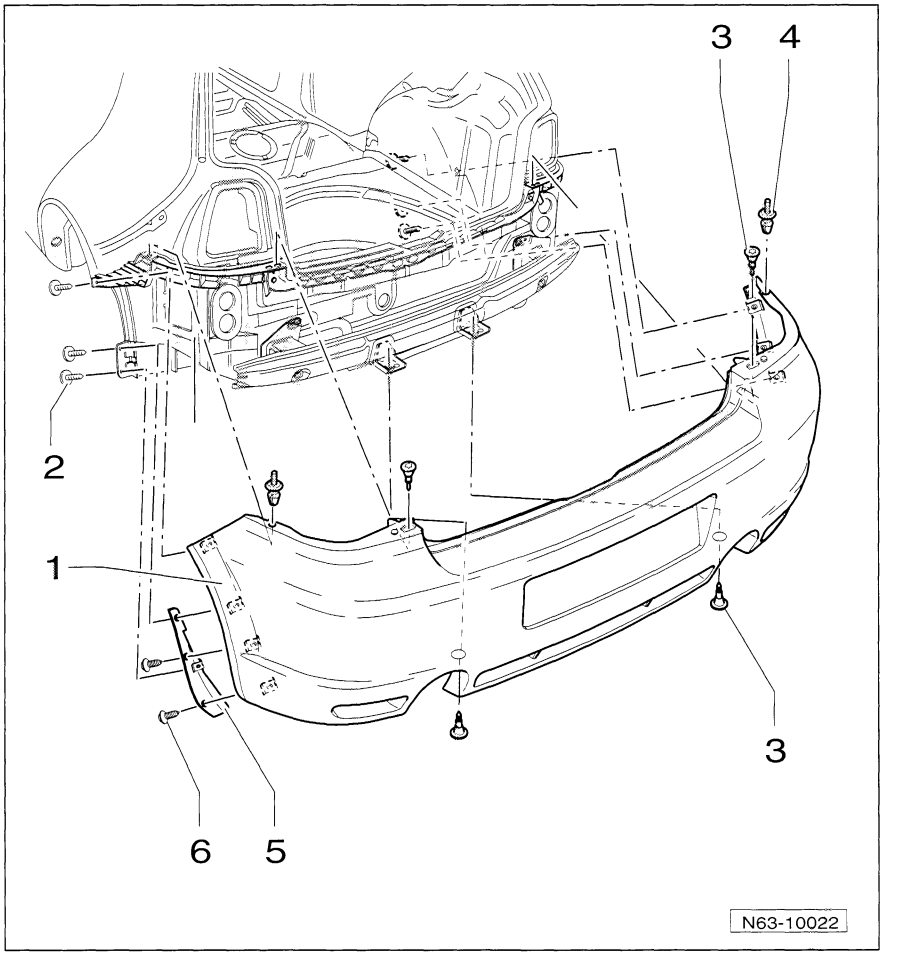
Center ventilation grid assembly

1. **Bumper cover**
   - Material - PP/EPDM
2. **Air duct**
   - Remove bumper cover before removing duct
3. **Bolt**
   - Qty. 6
4. **Speed nut**
   - Qty. 6
5. **Clip**
   - Qty. 12
6. **Center ventilation grid**
   - Remove bumper cover before removing grid
   - Damaged clips (item **5**) must be replaced upon installation



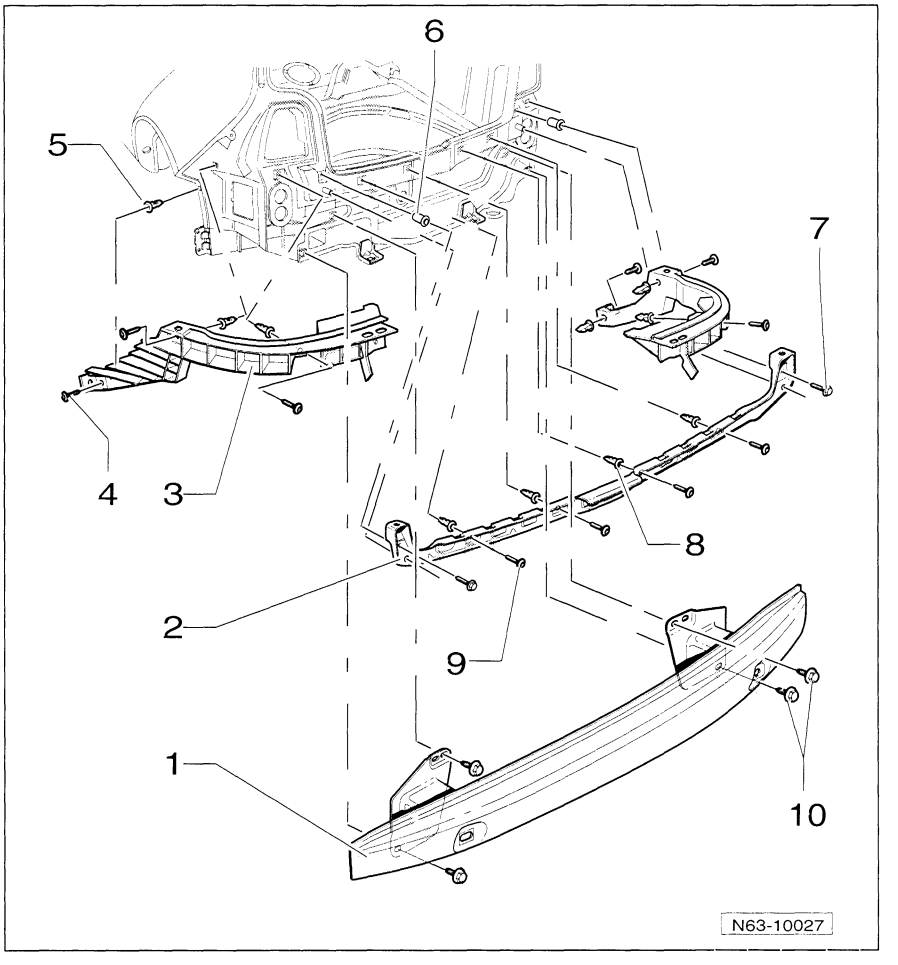
Rear bumper cover assembly

1. **Bumper cover**
   - Material - PP/EPDM
   - Removal:
     Loosen wheel housing bolts (**2**) and adapter bolts (**6**)
     Remove tail light assembly, see **94 Lights, Accessories–Exterior**
     Disconnect harness connector for license plate light (located below left tail light assembly) on Golf models
     Remove bolts (**3**)
     Remove expanding rivet (**4**)
   - Remove bumper cover (**1**)
2. **Bolt**
   - Qty. 6
3. **Bolt**
   - Qty. 4
4. **Expanding rivet**
   - Qty. 2
5. **Adapter part**
   - Remove bumper cover before removing duct
6. **Bolt**
   - Qty. 2



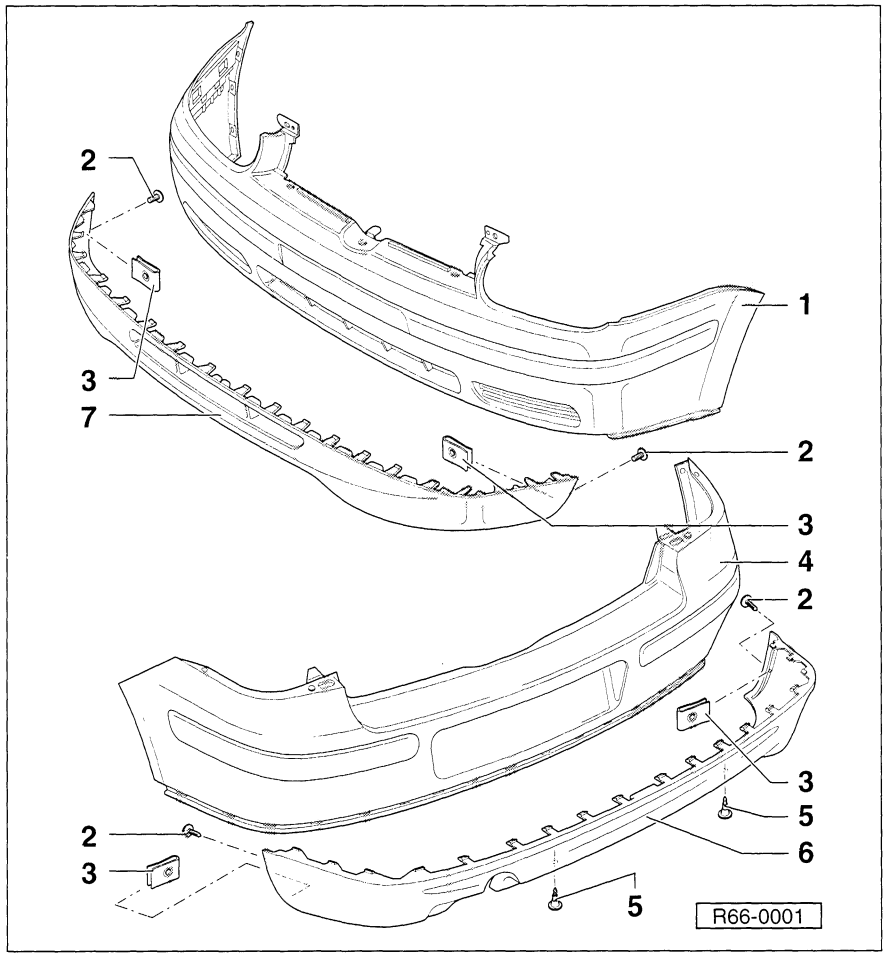
Rear bumper carrier assembly

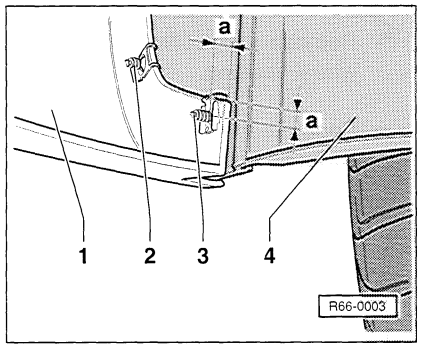
1. **Bumper carrier**
2. **Attachment rail**
3. **Guide piece**
4. **Bolt**
   - Qty. 3
5. **Expanding nut**
   - Qty. 3
6. **Internally threaded pop rivet**
   - Qty. 2
7. **Bolt**
   - Qty. 2
8. **Expanding nut**
   - Qty. 4
9. **Bolt**
   - Qty. 4
10. **Bolt**
    - Qty. 4
    - Tighten to 20 Nm (15 ft-lb)



Front and rear valence spoilers

1. **Front cover**
   - Removing and installing, see **63 Bumpers**
2. **Screw (4)**
3. **Speed nut (4)**
4. **Rear cover**
   - Removing and installing, see **63 Bumpers**
5. **Bolt (2)**
   - Tighten to 15 Nm (11 ft-lb)
6. **Rear valence spoiler**
   - Made of PUR-RIM
   - Clipped to cover and 4 screws
7. **Front valence spoiler**
   - Made of PUR-RIM
   - Clipped to cover and 4 screws





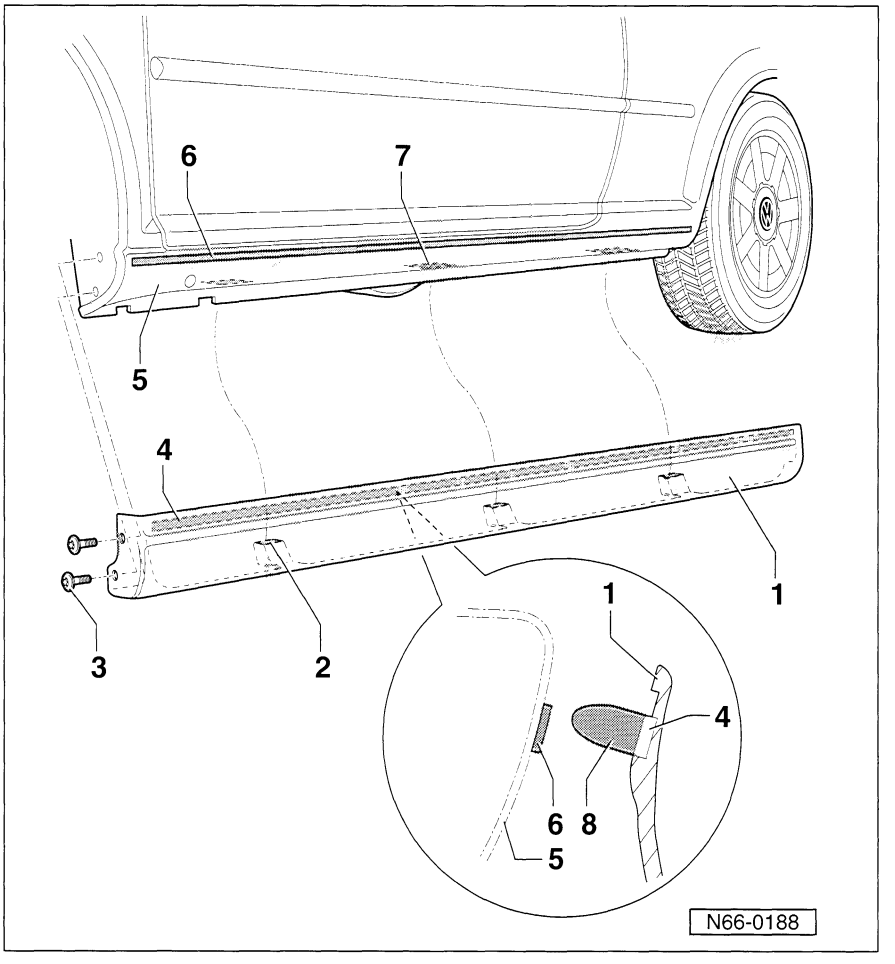
Front valence spoiler, additional mounting bolts

- Dimension (**a**) = 10mm (0.4 in)

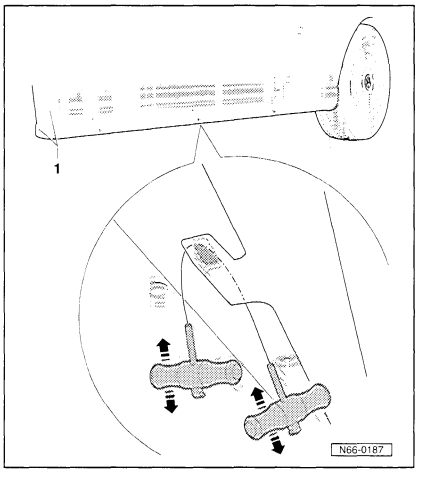
1. **Front valence spoiler**
2. **Screw and speed nut**
3. **Screw and speed nut**
4. **Front wheelhouse liner**

Sill panel extension

1. **Sill panel extension**
   - See **Sill panel extension, removing**
   - Made of PUR-RIM
2. **Lower adhesive surface on sill panel**
3. **Bolt (2)**
4. **Upper adhesive surfaces on sill panel extension**
5. **Sill panel**
6. **Upper primer surfaces on sill panel extension**
7. **Lower primer surface on sill panel**
8. **PUR adhesive sealing material**

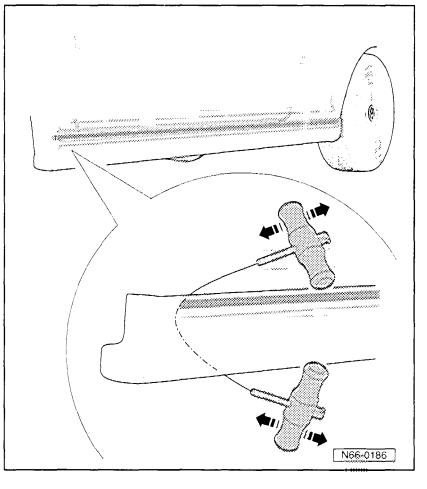


Sill panel extension, removing



➤ Remove two bolts (**1**) in front of wheel housing.

– Separate three lower adhesive surfaces of sill panel extension using pulling handles and cutting cord.



➤ Separate the upper sealing bead using pulling handles and cutting cord.

– Remove sill panel extension.

WARNING

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Volkswagen

Battle for the Beetle: The Story of the Battle for the Giant VW Factory and the Car that Became an Icon Around the Globe
Karl Ludvigsen ISBN 08376-0071-5

Volkswagen Model Documentation
Joachim Kuch ISBN 0-8376-0078-2

Volkswagen Sport Tuning for Street and Competition
Per Schroeder ISBN 0-8376-0161-4

Volkswagen Jetta Service Manual: 2005, 2006 1.9L TDI, 2.0L FSI, 2.5L
Bentley Publishers ISBN 0-8376-1335-3

Golf, GTI, Jetta: 1999-2005, Jetta Wagon 2001-2005 Official Factory Repair Manual on CD-ROM
Volkswagen of America ISBN 0-8376-1264-0
VWoA Lit No.: W42 VA45 V030 CD

Jetta, Golf, GTI Service Manual: 1999-2005 1.8L turbo, 1.9L TDI diesel, PD diesel, 2.0L gasoline, 2.8L VR6
Bentley Publishers ISBN 0-8376-1251-9
Volkswagen Part No. LPV 800 120

Passat, Passat Wagon: 1998-2005 Official Factory Repair Manual on CD-ROM
Volkswagen of America ISBN 0-8376-1267-5
VWoA Lit No.: W42 VB55 V030 CD

Passat: 1998-2004 Service Manual
Bentley Publishers ISBN 0-8376-0369-2
Volkswagen Part No. LPV 800 209

New Beetle: 1998-2005, New Beetle Convertible 2003-2005 Official Factory Repair Manual on CD-ROM
Volkswagen of America ISBN 0-8376-1265-9
VWoA Lit No.: W42 VNB5 V030 CD

New Beetle Service Manual: 1998-2002 1.8L turbo, 1.9L TDI diesel, 2.0L gasoline
Bentley Publishers ISBN 0-8376-0385-4
Volkswagen Part No. LPV 800 402

Golf, GTI, Jetta: 1993-1999, Cabrio: 1995-2002 Official Factory Repair Manual on CD-ROM
Volkswagen of America ISBN 0-8376-1263-2
VWoA Lit No.: W42 VA35 V030 CD

Jetta, Golf, GTI: 1993-1999 Cabrio: 1995-2002 Service Manual
Bentley Publishers ISBN 0-8376-0366-8
Volkswagen Part No. LPV 800 116

EuroVan: 1992-2003 Official Factory Repair Manual on CD-ROM
Volkswagen of America ISBN 0-8376-1262-4
VWoA Lit No.: W42 VT45 V030 CD

EuroVan Official Factory Repair Manual: 1992-1999
Volkswagen of America ISBN 0-8376-0335-8
Volkswagen Part No. LPV 800 149

Passat, Passat Wagon: 1995-1997 Official Factory Repair Manual on CD-ROM
Volkswagen of America ISBN 0-8376-1266-7
VWoA Lit No.: W42 VB45 V030 CD

Passat Official Factory Repair Manual 1995-1997
Volkswagen of America ISBN 0-8376-0380-3
Volkswagen Part No. LPV 800 207

GTI/Golf/Jetta Service Manual: 1985-1992 Gasoline, Diesel, and Turbo Diesel, including 16V
Bentley Publishers ISBN 0-8376-0342-0
Volkswagen Part No. LPV 800 112

Corrado Official Factory Repair Manual: 1990-1994
Volkswagen of America ISBN 0-8376-0387-0
Volkswagen Part No. LPV 800 300

Passat Service Manual: 1990-1993 4-cylinder gasoline models, including GL and Wagon
Bentley Publishers ISBN 0-8376-0378-1
Volkswagen Part No. LPV 800 205

Cabriolet and Scirocco Service Manual: 1985-1993, including 16V
Bentley Publishers ISBN 0-8376-0362-5
Volkswagen Part No. LPV 800 113

Vanagon Official Factory Repair Manual: 1980-1991 including Diesel, Syncro, and Camper
Volkswagen of America ISBN 0-8376-0336-6
Volkswagen Part No. LPV 800 148

Rabbit, Scirocco, Jetta Service Manual: 1980-1984 Gasoline Models, Including Pickup Truck, Convertible, and GTI
Bentley Publishers ISBN 0-8376-0183-5
Volkswagen Part No. LPV 800 104

Rabbit, Jetta Service Manual: 1977-1984 Diesel Models, Including Pickup Truck and Turbo Diesel
Bentley Publishers ISBN 0-8376-0184-3
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